

A practical text-book on infectious diseases / by R.W. Marsden ; with a chapter on puerperal septic disease by A. Knyvett Gordon.

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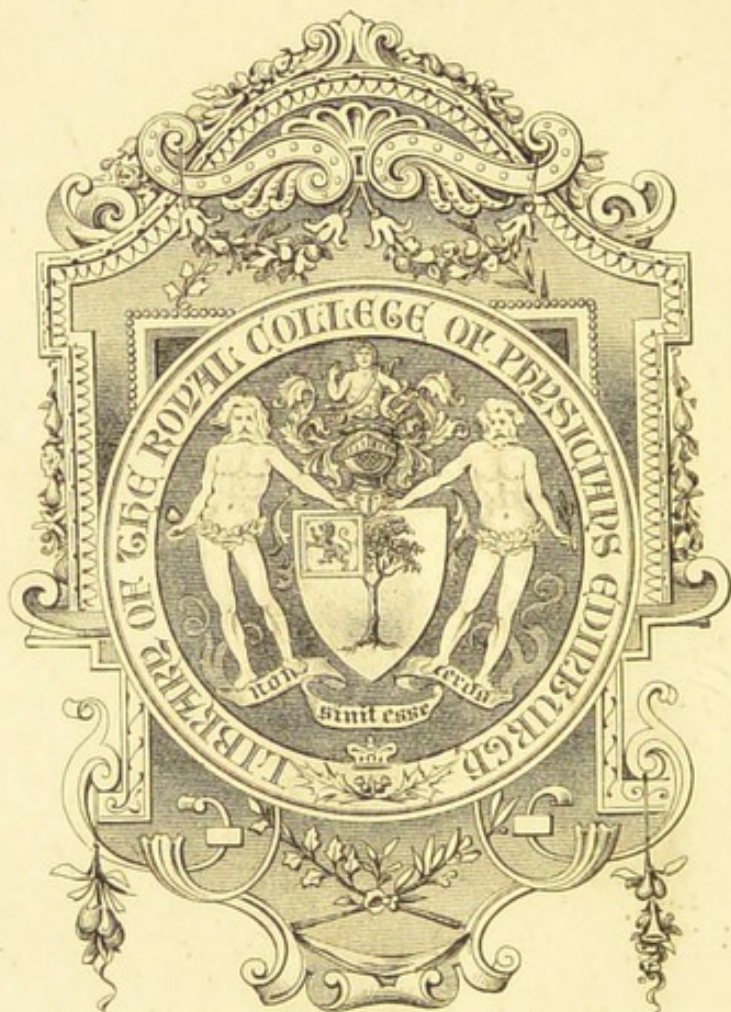
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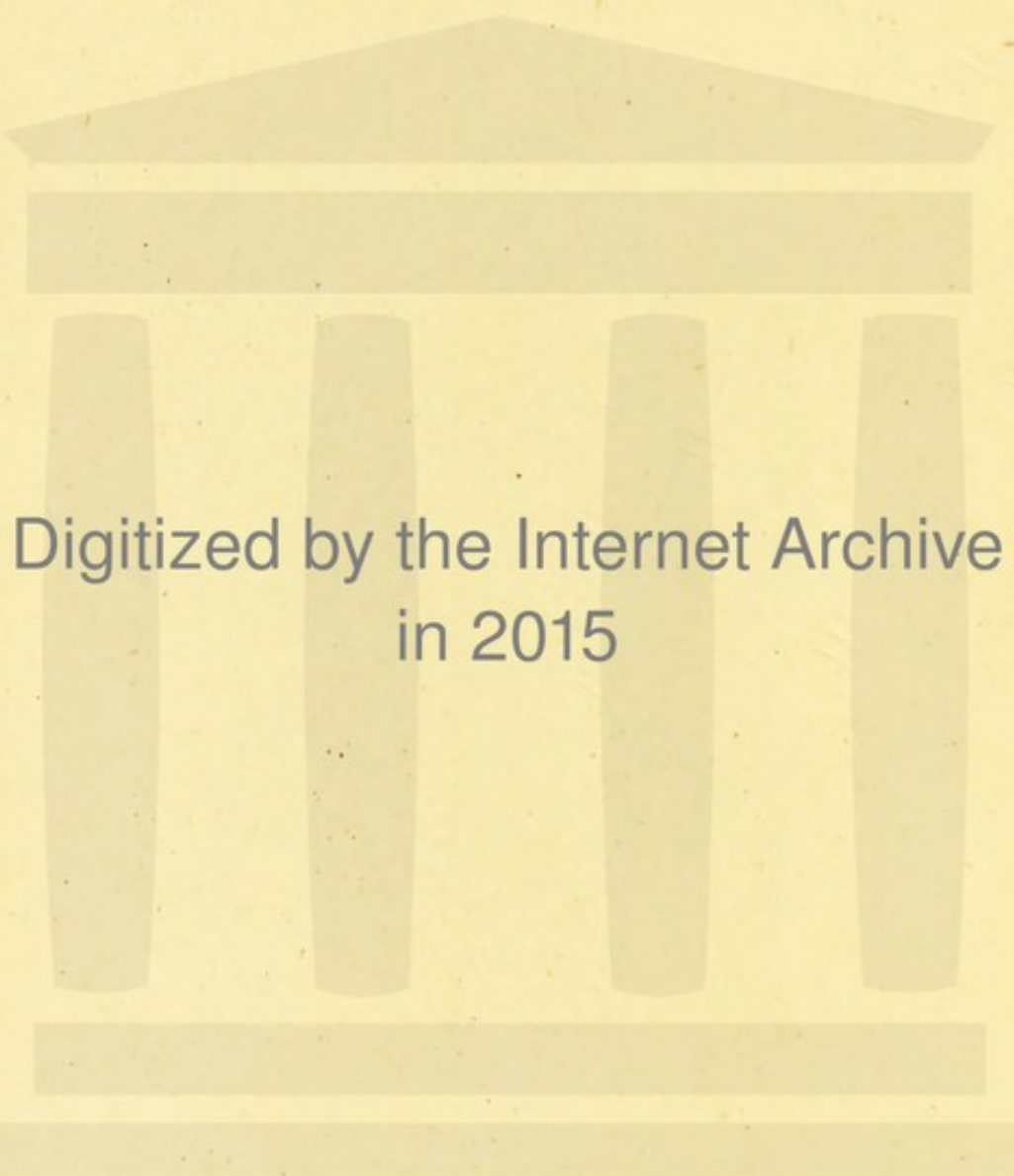
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A Practical Text-Book

ON

Infectious Diseases

BY
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WITH A CHAPTER ON
Puerperal Septic Disease

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PREFACE.

WITHIN recent years a large amount of attention has been devoted to infectious diseases, and great advances in our knowledge of them have been made. This progress has been signified by the appearance of several excellent works, either as sectional contributions, or as parts of a general system of medicine.

The enormous amount of detail contained in such books, whilst making them of the greatest service for purposes of reference, forbids the practitioner or student from attempting to imbibe all their contents.

There seemed to me, therefore, a need for a small text-book endeavouring to briefly outline our newer conceptions of these diseases.

Since the practitioner is most deeply concerned with the questions of diagnosis and treatment, I have throughout laid special emphasis on these points, even at the expense of some recapitulation at times. Etiology and symptomatology are also considered in a degree necessary for the elucidation of prophylaxis or diagnosis, but the pathology of the various diseases is only incidentally mentioned.

I have consequently adopted as the title of the

work a "Practical Text-Book on Infectious Diseases," and trust that both the practitioner and student will find help from its perusal.

I must here express my general indebtedness to the larger works referred to above, but my special thanks are due to Dr. Knyvett Gordon, who has written the article on Puerperal Fever, not only for reading the proofs, but for numerous suggestions, and to Dr. Lloyd Smith, of the Crossley Sanatorium, Delamere, for his criticism of the article on the Sanatorium treatment of Pulmonary Tuberculosis.

R. W. MARSDEN.

MANCHESTER,

JUNE, 1908.

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Infectious Diseases.

SCARLET FEVER.

Scarlet Fever is an acute infectious disease which commences suddenly. At an early period of the attack there is sore throat of varying degrees of severity, as well as an eruption on the skin having a characteristic appearance, and distribution. Desquamation of the skin occurs subsequently, and there is great liability to the supervention of a specific acute inflammation of the kidneys and implication of the middle ear, as complications or sequelæ.

ETIOLOGY.

The micro-organism causing the disease is not known with certainty. The majority of investigators have described a streptococcus, but it must be remembered that septic complications are very prone to follow an attack of Scarlet Fever, and that the cocci found may be the result of a "secondary" infection.

The invasion of the body by septic microbes takes place in all cases from the throat, the primary effects being manifested in that region. The severity of the symptoms and signs arising from the septic process is as variable as that resulting from the toxæmia due to the specific micro-organism.

The disease is endemic in this country, but the number of individuals attacked shews a

seasonal and cyclical increase, over which isolation and efforts at quarantine do not seem to exert any decided influence. It is generally most prevalent towards the end of each year, with a still further augmentation every five years.

An attack confers a very marked immunity, though second invasions have been reported even within a short period after the completion of convalescence from the primary illness.

Relapses, which may be due to a re-infection from without, or to a dissemination of microbes or toxins stored in some organ in the body, are most likely to occur during the second or third week of the disease. In them all the symptoms of the primary attack may be repeated. Though usually milder the relapse may be more severe than the primary attack. In its diagnosis great care must be used to exclude septic complications.

The predisposition to the disease, or the virulence of the micro-organism shews the greatest variability. One person may suffer from a malignant attack, whereas in another the disease is so mild as to escape observation. A tendency to one or other type may be noticed as a family predisposition. In still other instances the same individual, after undergoing repeated exposure with impunity, may contract the disease at a subsequent date.

No age is exempt, but attacks are very rare in infants under six months. Predisposition increases after the first year and may be increased by the presence of enlarged tonsils and adenoid vegetations or as the result of overcrowding and malnutrition.

The majority of the patients are between 3 and 10 years old, girls being always slightly in

excess. In the quinquennial period, 10 to 15 years, the rate of morbidity still remains high, but after that time it undergoes a marked diminution.

The disease is most fatal to children of 2 and 3 years of age. The mortality is lowest between 10 and 15 years. Very severe attacks are not infrequent in adult unprotected individuals. The average mortality for cases admitted to hospital may be stated to be about 5 per cent.

The presence of an open wound, and more especially of a burn or scald seems to favour the occurrence of an attack. In these cases the onset of the disease is often ill-defined save for a sudden exacerbation of temperature, the rash is not so uniformly distributed, and the inflammatory changes in the throat are frequently only of a mild or moderate degree. The surface of the wound often shews no change as the result of the infection, though some writers have described unhealthy alterations, *e.g.*, sloughs.

The micro-organism can be conveyed in milk. Epidemics have even been attributed to a specific disease in cows which is associated with an eruption on the udder and teats. Such an experience must be a very great rarity, and it is much more probable in any instance that the milk has been infected secondarily either in collection, distribution, or storage, through a person suffering from the disease.

The microbe seems to have great vitality, under adverse circumstances, cases having been reported of infection occurring through clothing and other articles which, subsequent to exposure, had been placed aside for long periods.

Pillows, sheets, clothing, furniture, etc., in-

fectured by discharges, or even long exposed to the infected atmosphere may be expected to contain the active microbe in dangerous amount in all cases, and the same may be said of the uncleansed hands of those attending on the patients, or of instruments or utensils used by them or in their treatment. Nevertheless a practical acquaintance with the disease makes it impossible to prevent the suspicion that, on the strength of some historical occurrences, too much value is often attached to its conveyance by fomites.

There can be little doubt that the disease is in almost all instances conveyed by close proximity to a person suffering, or recently recovered, from an attack. As exhibiting the improbability of intermediate transmission, it is sufficient to draw attention to the rarity with which a resident in a fever hospital, which does not limit its admissions to this disease only, has been able to suspect the conveyance of infection in this manner, despite the fact that he may not even take any further precaution than washing his hands before proceeding from one ward to another. Under these circumstances it is surprising how, in an enquiry as to the source of infection, the greatest importance is not infrequently attached to the question whether any particular article failed to receive adequate disinfection after the barest possible exposure, to the exclusion or detracting of a more probable origin.

PERIOD OF INCUBATION.

From the reception of the micro-organism to the manifestation of symptoms may only be a question of hours, but usually a period of 3 to

5 days elapses. Longer times have also been described, but unless following a single exposure anything over 7 days should be received with scepticism, since as already mentioned, the earlier exposures may not have been instrumental factors in its contraction, or an intermediate case may have been overlooked.

The onset of the disease usually takes place suddenly. There is headache, malaise, chilliness (on rare occasions even rigors and convulsions), soreness of the throat, and a rapid rise in the temperature of the body, a pyrexia of 102°F. to 104°F. when first examined being quite common. In young patients it is important to note the relative frequency with which vomiting occurs at the onset.

SYMPTOMS AND COURSE.

The skin is hot and dry, and the face, more particularly the cheeks, flushed. In association, however, with the early nausea and vomiting there may be distinct pallor. The pulse is unusually rapid especially in children, the tongue is frequently covered with a fur through which the enlarged red papillæ may be seen disseminated over the dorsum (so-called "white strawberry" tongue), and the breath has a sweet acetone smell.

In malignant cases the "toxæmia" may be sufficiently severe to produce collapse with subnormal temperature and death before the development of characteristic symptoms. Such symptoms are usually met with in children, and are liable to be mistaken for acute gastritis or gastro-enteritis, *e.g.*, from ptomaine poisoning. In the absence of evidence of infection, or of a

complaint of sore throat, it may be impossible to say that vomiting and collapse were even probably due to scarlatinal infection.

The characteristic rash generally makes its appearance at the end of the first 24 or 36 hours, though it may be delayed, more particularly in adults, for 4 or 5 days. The earliest indications are noted about the neck and the upper part of the front of the chest. From this situation it rapidly spreads in the course of a few hours over the trunk, the upper limbs, and finally the lower extremities. The rash does not invade the face, the occasions on which it may be detected on the forehead and temples being so rare that for practical purposes they are better ignored.

The lips are bright red, the cheeks uniformly flushed, and the region round the mouth and including the chin decidedly pale. This circumoral pallor is apparently an active vasomotor condition, being distinguishable even when there is no flushing of the cheeks, but naturally made more evident by contrast.

It may be taken as an absolute rule that a rash invading the facial aspect of the chin is not due to Scarlet Fever.

The characteristic feature of the eruption is that it is composed of fine erythematous points, very slightly or not visibly raised, and very closely set, as well as evenly distributed over the area affected, thus giving the surface a bright scarlet and finely mottled appearance. The punctæ may stand out clearly, or the minute intervening spaces may be erythematous. As development proceeds, and when the rash is intense, the redness becomes quite diffuse,

apparently from fusion of the areolæ surrounding the individual points, the whole body then takes on the well-known boiled lobster appearance. When less intense the bright red spots may still be distinguished on their brilliant red background.

Occasionally the exanthem appears as a uniform blush from the beginning. In some severe cases it has a dark and slightly purple tinge, with a blotchy, dusky or morbilliform appearance which is particularly noticeable on the limbs, the more marked distribution of the macules on the hands, feet, and extensor surfaces of the limbs recalling the characteristics so frequently met with in septic erythemata.

The punctate appearance of the rash which is distinctive of the scarlatiniform eruption is not discernible on the palms and soles. The papular character, if present, is most marked and most persistent on the extensor surfaces of the limbs.

Sudamina are not uncommon. In some cases there is a profuse formation of small yellow vesicles which, in the process of desiccation, remain visible for some time after the rash itself has faded.

With well-marked eruptions, after the maximum intensity has been reached, there is apparently some vaso-motor inhibition and effusion of blood-pigment, since pressure shews a yellowish staining of the skin which persists for a second or two after the pressure is removed. The conjunctivæ, however, do not exhibit an icteric tinge.

When hæmorrhages occur in the skin they usually take the form, in non-malignant cases, of very minute petechiæ situated about the

flexures of the joints, the anterior folds of the axillæ, or the clavicles and upper part of the chest. In malignant attacks ecchymoses may be present, and bleeding may take place from various orifices, *e.g.*, the nose, mouth, or anus, etc. In these cases it must be remembered that the source of the hæmorrhage may be the stomach, intestines, kidneys, or other organs. Such attacks are ushered in by high fever, marked prostration or delirium, and are often accompanied by a dusky, poorly-developed exanthem.

An examination of the throat reveals evident inflammation which is not limited to the fauces, but includes the pharynx, and very frequently proceeds for some distance forwards along the palate. The intensity of the inflammatory mischief varies enormously. It may be throughout the attack limited to a distinct congestion and slight swelling with mucoid exudation over the parts mentioned. In a very large percentage of the cases, however, there is exudation followed by ulceration of the surface of the tonsils. In some cases there is a distinct formation of membrane most clearly visible about the anterior pillars of the fauces, the velum palati, and the sides of the uvula. Such membrane is rarely diphtheritic, and does not shew the tendency to steady growth which characterises diphtheria. In addition it is very unusual for the larynx to be involved, and then only later as the inflammatory swelling invades the region of the glottis.

In the severest forms of sore throat (Scarlatina Anginosa) the congestion and swelling may be so intense, that extensive sloughing and deep ulceration are necessary consequences. Gland-

ular infiltration with surrounding œdema becomes excessive, and leads to sloughing of the subcutaneous tissues and occasionally subsequently of the skin with exposure of large vessels, muscles, etc., and even fatal hæmorrhage. At the same time early profuse nasal discharge, at first muco-purulent and later purulent, excoriation of the nares and adjoining parts, nasal obstruction, suppuration in the nasal adnexa, and suppurative otitis media with the subsequent occurrence of facial paralysis, deafness, mastoiditis, septic lateral thrombosis, or meningitis all testify to the severity and extent of the inflammation of the throat.

The time of the occurrence of otorrhœa bears a distinct relationship to the severity of the faucial and pharyngeal inflammation, as well as probably to the anatomical condition of the parts. The more marked the implication of the throat and nasopharynx, the earlier does the complication make its appearance. There can be no doubt that infection usually spreads along the Eustachian tube. It is indeed conceivable that in mild attacks inflammation of the mucous membrane lining the passage may arise without external manifestations occurring. On the other hand in the cases of a severe septic type otorrhœa is apparently not uncommonly caused, or maintained, by caries of bone, more particularly in the attic and mastoid antrum. According to Dr. Gordon, in opening the mastoid process for the treatment of this condition, it is quite common to find carious bone there, even when the discharge has only lasted a month, and though clinically no signs of mastoid involvement were present.

The difficulties of feeding in the anginose

or septic attacks, the profound deterioration resulting from the severe primary scarlatinal "toxæmia," and the marked and persistent poisoning by septic absorption from an extensive area freely supplied with lymphatics, offer a ready explanation of the occurrence of marasmus, diarrhœa, and the various septic complications. Of these, in addition to those already referred to, mention may be made of pleuritis with effusion (which in these cases always becomes purulent), malignant endocarditis, suppurative arthritis, and pyæmia.

After recovery from the primary sore throat a recurrence of inflammation is not infrequent. It may, in some instances, be a re-infection or a re-awakening or re-distribution of the former infection, but in other instances it is evidently a superadded secondary infection, *e.g.*, septicæmia, or diphtheria. These secondary sore throats, like the relapses, are most likely to occur about the second and third weeks of illness, and they are not uncommonly associated with secondary rashes, as well as with albuminuria and definite nephritis.

The secondary rashes just referred to are frequently of a scarlatiniform type. Without evidence, however, of a strawberry tongue or desquamation again appearing, it is practically impossible to deny that many of these occurrences are of a septic nature. The rash usually shews a tendency to the formation of papules, more especially on the extensor surfaces of the limbs. At first discrete, they may later coalesce and produce blotchy erythemata. In addition, the face may be involved. The rash may last from 1 to 7 days, and disappears gradually.

It has already been stated that the tongue is at the onset frequently furred, with red papillæ visible, the so-called "white strawberry." This appearance is not characteristic. After the first day or two the fur peels, usually from the tip backwards, leaving a smooth-looking red surface studded with raised, rounded glistening papillæ. This is the typical strawberry tongue. Unfortunately, such an appearance is not limited to Scarlet Fever, nor does it by any means always occur in this disease, nevertheless, as a positive indication its occurrence is of the greatest value as a diagnostic aid.

A careful study convinces one that the essential feature is the peeling of the fur leaving a red tongue, which is not infrequently devoid of the papillæ described. Naturally in severe cases the tongue may become cracked, dry, ulcerated, and even assume a "typhoid" aspect.

It should be mentioned that the whole of the mucous membrane of the mouth in Scarlet Fever seems to partake in a minor degree in the inflammatory process. It is possible that carious teeth may be largely responsible for the secondary infections which arise. In any case aphthous stomatitis, and ulcerative stomatitis are not infrequent complications.

Attention has been drawn to the rapidity of the pulse, which often attains a speed out of all proportion to the pyrexia. The pulse-rate alone can hardly be considered as a valuable prognostic indication. For this purpose the efficiency of the circulation must also be kept in mind; a small pulse with coldness of the extremities, and a tendency to cyanosis constitute signs of great danger, whilst evidences of cardiac dilatation

produced by the primary "toxæmia" are the almost certain precursors of a fatal termination. In these severe cases the examination of the heart reveals changes in the sounds, and in its rhythm, identical with those met with under similar conditions in other diseases, *e.g.*, relative increase and later diminution of the first sound at the apex, foetal rhythm, systolic murmur at the apex, intermittent or irregular beat. There is no doubt that, as in every severe infection, the myocardium may shew inflammatory and degenerative changes.

In addition, endocarditis and pericarditis may arise from the scarlatinal poison, the former being much commoner than the latter. Both affections may also occur as complications when a true rheumatic arthritis supervenes (see later), and in connection with septic processes. Pericarditis may further be due to an attack of nephritis.

Dr. A. K. Gordon has noted that in about 5 per cent. of the cases of Scarlet Fever during convalescence, an illness occurs the nature of which is at present doubtful. Clinically, he says, it is characterised by a sudden rise of temperature which may be prolonged for two or three days, and accompanied merely by an indefinite malaise. This is associated with a cardiac murmur which is systolic in time, and audible at the apex, but also conducted to the angle of the scapula. No dilatation of any cavity can be made out. In about half of these cases there is slight and transient albuminuria. Recovery always ensues if the affection be detected, and the murmur usually disappears after three weeks rest in bed. Dr. Gordon is of

opinion that the illness is a specific scarlatinal endocarditis of extreme mildness, and that, if neglected, permanent valvular mischief may result.

I should like to associate myself with the recognition of such occurrences as are here described. As regards their etiology it seems difficult to avoid the surmise that the noxious element is of the same nature as that inducing scarlatinal nephritis and late adenitis. Whether directly, or indirectly, the result of the scarlatinal poison, one would then regard these illnesses as evidences of a systemic infection, with the chief brunt of the attack falling on the circulation and the heart, whereas in nephritis and adenitis a more selective influence had taken place.

Except in malignant attacks where a leucopenia may be met with, examination of the blood invariably shews the existence of a leucocytosis which may be slight or well marked. The polymorphonuclear leucocytes are especially increased, and the eosinophile cells are also more numerous than normal. The leucocytosis is most marked at the beginning of the attack, it disappears very gradually and slowly, and may be reproduced or increased by various complications.

It has been previously stated that the temperature rises rapidly at the onset. It is rarely under 101°F. (contrast with Rötheln). More commonly it is between 101°F. and 104°F. , whilst in severe anginose cases even higher temperatures are recorded. It is in the malignant cases and in attacks of this latter description that restlessness, insomnia or stupor, delirium and maniacal symptoms are most frequently met with.

The continuance of the pyrexia depends upon the severity of the attack, and varies from 1 to 5 days, when the temperature falls by lysis. In the anginose cases the pyrexia of the primary "toxæmia" may, even without any indications of falling, be continued into that associated with the septic complications. In some instances (mis-called typhoidal attacks), without marked ulceration of the throat, enlargement of the cervical glands, early involvement of the middle ear, or profuse purulent rhinorrhœa, the temperature is fairly steadily maintained, and there is frequently diarrhœa and slight abdominal fulness. In these cases particular attention should be paid to the condition of the nasopharynx.

It must be remembered that in Scarlet Fever there is usually some inflammatory swelling of the different lymphatic tissues, Peyer's patches being included. The diarrhœa, however, which is met with in severer attacks is due to an associated catarrhal enteritis, which may by its continuance assume a dysenteric character.

The urine presents the usual febrile characters being diminished in quantity with frequently an abundant deposit of urates on standing.

As in other acute febrile disorders there is a tendency to a cloudy or granular degeneration of different organs (including the kidneys and the heart) and thus to the appearance of a degree of albuminuria in consonance with the height of the temperature attained, and the severity of the toxæmia. This "febrile albuminuria" disappears as convalescence proceeds and bears no definite relationship to the occurrence of albu-

minuria or undoubted nephritis later in the disease.

A large percentage of the cases of Scarlet Fever have albuminuria as a temporary sequela. The later the albumen appears in the attack the more likely is a temporary continuance of a few days to be exceeded, and in some of these, variously estimated at from 4 to 17 per cent. of all cases and more especially in children of 5 to 10 years of age, definite nephritis supervenes.

This complication has been known to develop at periods varying from the first to the twelfth week, but it arises most frequently about the third or fourth week. In regard to its pathology it consists essentially of a cellular infiltration of the interstitial tissue, with associated changes in the parenchyma, viz., cloudy degeneration of the cells of the tubules. In most cases also the glomeruli are affected, and with the possible exception of syphilis and glandular fever this appearance of a capsulo-glomerular nephritis is practically never met with in other diseases.

The clinical manifestations of its onset are very varied, thus (1) it may arise insidiously in the manner already indicated, (2) it may be ushered in by a secondary inflammation of the throat, and adenitis, (3) it may come on abruptly with pyrexia and the appearance of scanty bloody urine, and (4) in a few cases a "spiking" temperature, with marked remissions of intermissions is noted for a variable number of days before the signs of nephritis appear. At the same time there is usually pallor, with some puffiness of the face, and changes in the heart and pulse associated with increased vascular tension. Marked œdema is uncommon whenever

the case of Scarlet Fever has been carefully treated from the beginning, and the earliest indications of nephritis observed.

The progress of the inflammation of the kidneys is in most cases very favourable. The amount of urine remains stationary or even diminishes during the first few days, the percentage of albumen at the same time rising possibly. Soon, however, the urine increases in quantity, the amount of albumen and blood gradually lessen and complete recovery ensues. Occasionally this favourable course does not take place, the albumen and blood, though varying in quantity persist for weeks, and even months, and may finally be followed by evidences of a chronic inflammation of the kidneys. The supervention of a chronic nephritis from the acute attack is probably more common than is usually described. It is very unlikely that cases shewing blood and albumen in any amount in the urine for a continuous period of several weeks will subside without leaving some pathological changes.

It is also to be noted that the nephritis at its onset may be so acute as to lead to a fatal termination with persistent pyrexia, gradual diminution in the amount of urine excreted up to complete anuria, uræmic convulsions and cardiac dilatation. The mortality of this complication has been fixed at 7 to 8 per cent. of the cases occurring. Death is said to occur most frequently in children under 5 years of age.

In some cases which recover high vascular tension and cardiac hypertrophy may develop rapidly, and attain an unusual degree.

The microscopic examination of the urinary

deposit shews blood cells, hyaline, granular, and blood casts, much débris, and not infrequently crystals of oxalate of lime, and lithates.

During an attack of Scarlet Fever the joints may be affected from different causes. About the end of the first week an exacerbation of temperature may occur with pain, tenderness, and some swelling in any of the joints of the limbs. The most typical appearance is tenderness and swelling in connection with the synovial sheaths of the extensor tendons of the wrists. With the possible exception of urethritis this manifestation is most unusual as the sole symptom of implication of a synovial membrane in any other disease, and its occurrence within a few days after a sore throat is strong evidence of the scarlatinal nature of the latter affection. It is a very temporary affection, generally subsiding spontaneously in the course of a few days, and it may be of considerable value as an aid to diagnosis. Though the wrists are most frequently affected, there may be pain, tenderness, or even swelling in the knees, ankles, elbows, etc.

Septic or pyæmic arthritis may arise as a complication in anginose cases, the time of appearance varying with the severity of the septic absorption, and the vitality of the patient.

A true rheumatic arthritis in predisposed persons, generally of a subacute type, may be seen, most frequently in convalescence, about the third week or later.

Trousseau went so far as to say that chorea occurred in a large percentage of cases of Scarlet Fever. It is occasionally seen as a complication, but only rarely.

Another characteristic feature of Scarlet Fever is peeling of the skin. The time of onset and severity bear a distinct relationship to the intensity of the rash. With a brilliant and profuse eruption desquamation, especially about the face, neck, front of the chest and axillæ, may be well-marked before the eruption has faded. Moreover in such cases large scales are formed, the skin of the hands and feet peeling en masse.

The occurrence of desquamation on the face has been cited as an indication of the probable presence of a temporary rash in that region. It is far from certain, however, that the scarlatinal toxin is unable to give rise to peeling of the skin without the evolution of the exanthem. In this connection it is sufficient to mention the authentic instances which have been reported, of desquamation taking place in cases in which no rash could be detected though carefully observed.

With a mild exanthem an interval of a fortnight may elapse before peeling begins, the first signs being noted as small round rings which increase in size and coalesce with the formation of small scales. The process affects the whole body including the palms and soles, and in these situations usually begins at the tips of the fingers and toes.

In some very mild cases a furfuraceous desquamation of the body only takes place. In severe cases the hair may fall off, and after the attack furrows may be detected at the basis of the nails from altered nutrition as after other serious febrile conditions.

The complications of Scarlet Fever are numerous and important, many have already

been considered, of the others a brief resumé only can be given.

Bronchitis is not infrequently associated with an attack. In anginose cases more particularly, one meets with broncho-pneumonia, and with nephritis lobar pneumonia.

The stomatitis already mentioned may be so severe as to assume a gangrenous type, with loosening and falling out of the teeth. This is most common in severe anginose cases in children.

The inflammatory changes in the nose may proceed along the naso-lachrymal duct and give rise to suppuration in the lachrymal sac, or there may be caries in the ethmoid bone with proptopion, and even suppurative meningitis.

The conjunctivæ may be infected and keratitis follow.

During convalescence purpura may be noted. It is especially seen when the patient first leaves his bed, and must not be confounded with the hæmorrhagic complications met with in malignant attacks.

Finally, special mention must be made of diphtheria as a complication. It has already been stated that membranous angina at the onset of the attack is usually non-diphtheritic. It would seem, however, that in a certain percentage of the cases admitted, Löffler's bacillus can be cultivated from the throat. By some observers this has been estimated as high as 20 per cent., more probably it is nearer 2 or 3 per cent. It is also known that especially after the end of the first 10 to 14 days secondary sore throats, possibly re-infections or of a septic nature, are likely to occur. It is at this time also

that genuine diphtheria arises most frequently as a complication, and the collection of a large number of patients apparently with faucial or pharyngeal mucous membranes predisposed to the attack of this micro-organism from the changes induced by Scarlet Fever, constitutes a potent reason for the frequency with which this complication occurs, and the anxiety with which its introduction is always regarded.

DIFFERENTIAL DIAGNOSIS.

I. *Early.* Scarlet Fever has to be differentiated from other acute febrile affections, and for this purpose the following characteristic features must be kept in mind, viz., sudden onset with vomiting and high temperature, diffuse punctate rash appearing generally by the end of 24 hours illness, rapid pulse, furred tongue peeling early from the tip backwards, and markedly congested and often ulcerated throat.

In the first place a warning must be uttered against diagnosing the disease upon the sudden onset of pyrexia with a diffuse punctate erythema. A scarlatiniform erythema is not uncommonly associated with various infections, so that if the presence of very distinct congestion of the throat be not considered necessary, or if dyspnoea, cough, swollen tender joints, etc., be ignored, then it will occasion no surprise for a hasty and mistaken diagnosis of Scarlet Fever to be made in such diseases as Pneumonia, Acute Rheumatism, Small-Pox, etc. In the latter disease such an erythema is occasionally seen as a prodromal rash, though more commonly the erythema is morbilliform. Its occurrence, however, is almost always limited to adult patients, and its

distribution confined to certain areas, *e.g.*, the axillæ and the lower part of the abdomen, the thighs and inguinal regions, rarely the extensor surfaces of the limbs, and other regions on the body. Moreover pain in the lumbar region of the spine is a very frequent complaint, the temperature though high at the onset of illness falls rapidly, generally on the second or third day, and the pulse also is not so rapid, so that though sore throat be complained of, in the absence of evident faucial inflammation, and especially in the presence of an epidemic of Small Pox, the above symptoms should cause the suspicion of the invasion period of this disease.

It is practically impossible to make a mistake between Scarlet Fever and Measles. In the latter affection the gradual onset with coryza, sneezing, conjunctivitis, and cough, the presence of Koplik's spots, the delay in the appearance of the exanthem till the fourth day; the origin of the eruption as discrete spots invading the whole body, and including the face, palms and soles; the production of a diffuse rash only by confluence at the height of efflorescence; and the complete absence of diffuse punctate characters, form a basis which only permit of error by the greatest carelessness or ignorance. A temporary generalised erythema may precede the specific morbilliform eruption, or the two diseases may be coincident, nevertheless the features enumerated should prevent an erroneous diagnosis.

On the other hand with German Measles (*syn. Rötheln*) the rash appears early, and if it is not seen from the beginning, it may be impossible later, from its characters, to differentiate with

certainty between the two diseases. There is, however, a constant absence of any sudden onset of illness, the temperature is very slightly raised, sore throat is frequent as a subjective symptom, but not as a marked objective sign, and the conjunctivæ are but slightly suffused. If the patient has been closely observed there will be a history of distinct spots giving a morbilliform appearance (not a generalised flush) on the face (including the chin), and possibly on the upper limbs. There will also frequently be found enlargement, with slight tenderness of the superficial glands in the posterior cervical triangle. By the second day the rash is often typically scarlatiniform.

Rötheln is also remarkable for the extreme mildness of the constitutional symptoms even though the rash be well-marked.

Not only is the onset insidious, but even throughout the course the feelings of illness are so slight that the patient is loath to take to his bed. It is true that the same may occasionally be said of mild attacks of Scarlet Fever, nevertheless, with a well-marked scarlatiniform rash, a low temperature, slight indisposition, and inconsiderable throat affection are points in favour of a diagnosis of Rötheln. In this disease also, and in Measles, the examination of the blood may be of diagnostic significance since in neither is a leucocytosis present in an attack devoid of complications.

But excluding acute infections there are a number of toxic conditions which may be associated with a scarlatinal erythema. Evidently in these cases the diagnosis must rest on the *absence* of (1) any sudden onset of illness, (2) marked

pyrexia, (3) sore throat, (4) furred, and later, peeling tongue, (5) enlarged glands. Moreover, the erythema is often less generalised than in Scarlet Fever, does not shew the same steady and rapid spread from the upper to the lower part of the body seen in this disease, and may invade the face. In addition the source of the toxæmia may be known, *e.g.*, the administration of belladonna, antipyrin, or quinine, an injection of antitoxin, the giving of an enema, etc., or there may be superadded distinguishing features, *e.g.*, widely dilated pupils after belladonna, urticarial patches after antitoxin or gastro-intestinal intoxications. Even when no apparent cause is discoverable, and when the rash is associated with desquamation, as in erythema scarlatiniforme desquamativum, the absence of the usual characteristic features, *e.g.*, vomiting, sore throat, etc., the early onset of peeling of the skin, its coincidence with the erythema, though the latter does not possess the intensity of colour associated with such a coincidence in Scarlet Fever, and the persistence of the erythema during the process of desquamation, should absolutely prevent the possibility of error.

There is no doubt that an individual may have Scarlet Fever, and never present any signs of a rash, in fact every sore throat contracted in association with a case of this disease must be regarded as one of scarlatinal angina. In the absence of a known source of infection the real nature may be suspected from the extent of the inflammatory signs and their non-limitation to the fauces, or more especially if other signs develop, *e.g.*, the peeling, and later red tongue: pain and swelling in the synovial sheaths of the

extensor tendons of the wrist; the occurrence of hæmorrhagic nephritis after an interval of two or more weeks.

An acute suppurative tonsillitis should give no difficulty owing to the localisation of the intense inflammatory swelling, its frequent limitation to one side, and the absence of corroborative signs. Retro-pharyngeal abscess is occasionally seen as a complication of Scarlet Fever, but usually late in the attack, and after well marked and even septic cases. Diphtheria is rarely diagnosed as Scarlet Fever, the mistake is practically always in the opposite direction, so that it will be advisable to defer their differentiation till dealing with the former disease.

II. *Late*. In the presence of desquamation the question often arises whether the individual has recently suffered from an attack of Scarlet Fever. In the first place it must be noted that there is nothing pathognomonic in the appearance of the peeling of this disease. Irritation of the skin in association with sudamina, papular erythemata, or the use of local irritant applications to the normal skin, may be followed by desquamation which commences in small isolated rings, and any intense inflammatory hyperæmia *e.g.*, in Erysipelas, may give rise to the exfoliation of large flakes over extensive surfaces. It is only in association with a previous indisposition accompanied by sore-throat, and in a course which recognises that while the upper part of the body is in a stage in advance of the lower, the rapidity and intensity of the whole is in relation to the severity of the original rash, that one can diagnose the occurrence of desquamation

as resulting from an antecedent attack of Scarlet Fever.

There can be no doubt that too much attention is frequently paid to discovering a slight furfuraceous desquamation of the skin of the body, and limbs, in corroboration of the suspicion of a recent attack. In the absence of definite characters such as "rings," scales, or flakes no reliance whatever should be placed on any microscopic powderiness or roughness which may be detected.

III. *Complicating some other affection.* The infection of a puerperal woman with Scarlet Fever cannot be diagnosed save from the development of the ordinary manifestations of this disease, viz., rash, sore throat, etc. There is no conclusive evidence that the specific micro-organism can produce an ordinary attack of puerperal fever, and there is every reason to discontinue the use of the term puerperal Scarlet Fever. As regards the septic microbes so frequently associated with Scarlet Fever, their ability to produce puerperal fever is beyond question.

With wounds, and after burns or scalds, in the absence of the use of a dressing which might cause an erythema, *e.g.*, iodoform, the diagnosis must be considered as positive even though the erythema does not possess the typical distribution, if there has been a sudden exacerbation of temperature unaccompanied by any change in the appearance of the wound, or evidence of septic absorption, and only slight throat symptoms.

PROGNOSIS.

The occurrence of convulsions at the onset though not necessarily fatal, is an indication of a severe attack, and therefore of evil omen. A

high temperature (over 104°F), a deeply congested and œdematous throat, early and marked infiltration of the cervical glands, a deep coloured blotchy or petechial rash, marked restlessness, sleeplessness, and delirium, a rapid feeble heart with dyspnœa, small pulse, cold extremities, and a tendency to lividity, as well as a continued high temperature shewing no distinct signs of defervescence during the first week, are all indications of more or less serious moment.

It must be remembered that the disease is most fatal in infants of 2 or 3 years of age, signs of severe faucial inflammation or early septic absorption being then of very grave augury. In young children the difficulties of treatment are great, and the results of ulceration of the throat more frequently disastrous. Fortunately attacks are relatively rare under six months of age, the morbidity increasing only slowly up to 12 months.

Malignant attacks with ill-developed dusky rash, and evidences of profound toxæmia are practically always fatal, but it is of value to note that in any case if life can be maintained for 5 days, in the majority of instances the primary "toxæmia" may then be expected to subside at any time, being rarely continued beyond that period. The prognosis will subsequently depend on the degree of super-added septic absorption.

Persistent vomiting and marked diarrhœa are very serious symptoms.

Even in the mildest cases a guarded prognosis must be given on account of the possible development of nephritis. This complication may occur and lead to a fatal termina-

tion in any type of case, it is, however, relatively more common with anginose attacks. Recovery may always be hoped for when once diuresis has occurred after the onset, the amount of urine passed being the most valuable prognostic aid in connection with this complication. Uræmic convulsions are serious but not necessarily fatal. Acute cardiac dilatation may be effectually relieved by venesection, and recovery follow.

As previously mentioned a tendency to a certain type of attack may be noted as a family predisposition. There are apparently some constitutions which seem to be unable to get the upper hand of the "poison," whether by destruction or excretion. In these cases no evidence of improvement is detected, the temperature shews no signs of lysis, and the patient after holding on for a variable number of days ultimately succumbs with signs of toxæmia and cardiac dilatation.

In some instances recovery from the attack of Scarlet Fever may be followed by a period of prolonged ill-health, by the development or increase of lymphatic tissue about the fauces or nasopharynx, by the persistent presence of enlarged glands in the neck, or by the aggravation of a coincident tuberculous inflammation.

TREATMENT.

The patient must be isolated, quarantine being maintained for a variable number of weeks according to the complications which arise. The average time is usually fixed at 6 to 8 weeks, but there is no doubt that in some cases infection is of even shorter duration, whilst in others it is

very much prolonged. The available evidence throws doubt on the infective nature of the desquamation, on the other hand the closest attention must be given to inflammatory or catarrhal conditions of the nose, or throat and their adnexa, as well as to the existence of excoriations about the mouth and nose.

During the acute stage confinement to bed is imperative, and the persistent and vigorous use of cold baths, packs, or ice-rubbing must be insisted on so long as a high temperature and indications of marked toxæmia are maintained. Where the latter are, however, so profound as to produce a danger of collapse, and especially in those cases in which the temperature is relatively low, the rash ill-developed, or dusky in colour, and the pulse feeble in quality, a hot bath, or warm pack with cold affusions, or applications to the head is preferable. It is, however, important to bear in mind that in these cases no treatment requiring restraint must be persisted in. In mild cases regular sponging, and on the subsidence of the fever warm baths are to be used.

The room must be kept about 60°F, and the bed clothes, especially during the febrile period, must be very light. Sudden changes in methods of treatment, *e.g.*, clothing, bathing, etc., are to be avoided, and the time for leaving the bed, or going out into the open air must depend on the severity of the attack, the state of the weather, the age of the patient, and the presence or absence of complications. In mild attacks in older and reliable patients, it is not necessary to continue enforced rest in bed throughout the day for more than 2 or 3 days after the temperature has sub-

sided, and during warm weather these patients, if their circumstances and surroundings permit, may be allowed to leave their rooms after a further week's confinement.

It is also unnecessary to place much restriction on the diet. During the acute period milk, alone or with various carbohydrate preparations, will probably be all the patient can take. With a loss of appetite and the presence of sorethroat a fluid diet of this description only can be tolerated, and in young patients there is no hardship from its continuance. Naturally special symptoms require appropriate treatment, thus, with repeated vomiting peptonised milk given in small quantities regularly, salts of Bismuth, cold applications to the head, and counter-irritation to the epigastrium are indicated.

In older patients with convalescence and the disappearance of anorexia the medical attendant not infrequently withholds albuminoid food for 2 or 3 weeks from the fear of causing nephritis. No harm, however, can be traced to the ingestion of a limited daily amount of meat even during the first weeks, and as inclination plays an important part in digestion, it is desirable not to carry the restrictions to the detriment of the general health.

Water and simple drinks may be supplied freely, whilst butter, cream, bread, fruit, preserves, and in fact all the carbohydrates do not add any appreciable quota to the work of the kidneys.

In mild cases no further treatment may be called for beyond the possible use of a simple salve after bathing, during the period of desquamation, when the skin is unusually dry and

rough, or shews a tendency to the supervention of eczema. It is, however, customary to administer a simple saline mixture containing Liquor Ammoniaë Acetatis, Citrate of Potash, etc.

In severe cases, in which the attack is accompanied by signs of cardiac failure, stimulants are indicated, *e.g.*, alcohol, ammonia, spiritus etheris nitrosi, liquor strychninæ, caffeine, and with delirium and sleeplessness such sedatives as opium, morphia, chloral, veronal and trional. Chloral must be used with caution in the presence of any circulatory weakness, and must be freely diluted when there is soreness of the throat. Paraldehyde forms a very safe substitute as in other similar conditions, the only objection being its taste and the liability to induce nausea and vomiting.

The most important attention must be devoted to the cleansing of the mouth, throat, nose, etc. It is often advisable to extract bad carious teeth. In any case mild antiseptic mouth washes, *e.g.*, boric acid, sodium phenate, and potassium permanganate lotions, must be freely and regularly used, since the further progress of the disease, and the occurrence of complications, largely depend on the septic absorption occurring in these regions. Recently much benefit has been described from the frequent sucking of formamint tablets. With much ulceration or discharge more potent solutions may be used, *e.g.*, peroxide of hydrogen, chlorine water, etc. A mild antiseptic used freely is, however, better than a stronger one used sparingly, and the fountain douche or syringe give better results than swabbing. In septic cases Dr. Gordon recommends that the fauces should be vigorously

attacked with an effective germicide, the best for this purpose being *undiluted* izal fluid, which, according to his experience, appears to have a selective action on necrotic tissue, and is innocuous to healthy mucous membrane. The fauces being well exposed, the fluid is applied by swabbing, and any excess subsequently removed by another swab.

Dr. Meredith Young (*Pract.*, 1907, p. 316), recommends (1) ichthyol, with an equal bulk of aq. dest., formamint, two tablets in one ounce of glycerine and water (equal parts), glyco-thymoline pure, etc. Further, for persistent nasal discharge, he recommends sublamin (1 in 1500 or 2000 alcoholic solution).

The chief difficulty is with young children. They should be lying flat in bed, on either side, and enveloped in a sheet which should include the arms. The head hanging slightly over the edge or over a pillow, the fluid should be directed so as to swill the fauces. With children who refuse to open the mouth the nozzle may be placed inside the cheek, and directed behind the molar teeth. In these cases, also, on account of opposition and struggling, the risk of fluid being inhaled is diminished by using a syringe, a single sudden contraction of the ball being made only during the act of expiration, and repeated several times. If adopted it must be used for that patient only.

A gentle stream of the fluid must also be passed into the nostrils when rhinitis is present, and the discharge must be regularly wiped away with a soft swab, the nares and nasal passages being subsequently smeared with vaseline, or liquid paraffin containing a little carbolic acid

and a styptic, *e.g.*, haseline, or 10 per cent of thymol or menthol.

Incision of the tympanic membrane is rarely necessary for otitis media; it is, in fact, remarkable how frequently the earliest indication of this complication is the evidence of discharge from the external meatus, demonstrating that the tympanic membrane has given way, possibly, by a process of rapid destruction unaccompanied by pain. If pain is present fomentations applied to the pinna are serviceable, and a few drops of a 5 per cent. solution of cocaine may be instilled into the meatus. On the occurrence of a discharge this must be regularly washed away, and the meatus dried by swabbing. At first mild antiseptic lotions alone are advisable, subsequently astringent solutions containing sulphate of zinc, or rectified spirit and carbolic acid may be tried, whilst if the purulent discharge continue unabated for several weeks, the advisability of drainage through the mastoid antrum must be considered.

The inflammatory changes in the throat in children not infrequently occasion dysphagia of sufficient severity to cause a complete abstention from food, or give rise to the risk of an inhalation of food particles. Under these circumstances it is necessary to resort to feeding by the œsophageal tube passed either by the mouth or nose.

Most cases of Scarlatinal Synovitis require no further treatment than protection and rest by bandaging with cotton wool. If tenderness is marked the application of belladonna and glycerine is of value. In more severe cases sodium salicylate, or should this fail, one of the anti-neuralgic remedies, *e.g.*, phenacetin, may be

administered, but not being specific their influence is variable, and beneficial results are not always to be relied on.

Rheumatic Arthritis, Endocarditis, and Pericarditis, are to be treated on the usual principles for these affections, *e.g.*, Sodium Salicylate, rest, counter-irritation, etc. Septic arthritis requires rest and fomentations, with early resort to incision and drainage so soon as the presence of pus is diagnosed. At the same time a supporting diet is necessary, and the importance of hydrotherapy, free ventilation, local treatment of ears, throat, etc., must not be forgotten.

Pleural effusion in septic cases generally becomes purulent sooner or later. If the patient is very ill at the time of its detection aspiration should be performed, and the effect of this method may also be tried in patients less seriously ill when the fluid is only slightly opalescent, as recovery from such conditions without incision and drainage has occasionally followed.

Diphtheria must be treated by the early injection of antitoxin.

With indications of the onset of nephritis a brisk purge is advisable, and the patient should be placed between blankets, and drink warm bland fluids freely, *e.g.*, imperial drink made by dissolving two drachms of acid tartrate of potash in two pints of boiling water, and adding the juice of a lemon with enough sugar to suit the taste. At the same time the diet is to be restricted to milk. [Several observers have recommended the administration of urotropin from an early period of the attack of Scarlet Fever as a prophylactic measure against nephritis.]

If diuresis does not follow the above treatment,

fomentations to the lower dorsal region, or dry cupping, or hot saline enemata may be tried, and should these be unsuccessful then the hot pack or vapour bath are advisable, but pilocarpin must always be used with caution on account of the risk of cardiac failure. As a general rule it will be found that cases likely to do well respond to the milder measures first adopted.

If uræmic convulsions supervene chloral should be given by the mouth or as an enema, and the patient placed under chloroform. With signs of cardiac dilatation digitalis, caffeine, strychnine, and nitroglycerine may be tried, but especially in failure from high tension, if relief does not follow, the inestimable value of venesection must be kept in mind. In cases with high tension even without convulsions great value has been attached to saline infusions, given subsequent to venesection. They may be repeated as necessity arises.

In the investigations concerning the etiology of Scarlet Fever, probably the discovery of a streptococcus has been most frequently described, and some observers, having cultivated this micro-organism from a series of cases, have subsequently produced a polyvalent serum by injection into animals. The use of such a serum in large doses has been said to be followed by immediate benefits as well as diminution of complications, provided the injections are made during the first three days.

Even if such a specific serum, however, cannot be obtained, when one remembers the undoubtedly prominent part which streptococci play in the septic cases it is advisable under these circumstances to give the patient the benefit of

large injections (100 c.cs.) of such a polyvalent serum.

During convalescence fresh air, and salts of iron are indicated to restore the debilitated system.

ISOLATION.

On the occurrence of a case of Scarlet Fever in any family, after the diagnosis, the next important question is where shall the patient be treated? Amongst the poor, and with inability to devote a separate part of the house for this specific purpose, unless the attack is mild, and the patient an only child it is always advisable to isolate in a special institution. The disease is apparently not so infectious during the first 24 or 48 hours of the attack, so that as the diagnostic features are developed early, isolation can frequently be effected without others contracting it.

The dangers of re-infection, and of the transmission of such affections as diphtheria, measles, etc., as well as the impossibility of detecting when the patient has ceased to be infectious are, however, sufficiently real and serious, to make the present method of aggregation of very doubtful advisability. Under these circumstances more attention should be paid to the home risks, and a more careful selection of cases for isolation in institutions adopted, in opposition to the attempt to quarantine all cases in the special hospitals. The latter ideal is manifestly impossible. On the other hand though the transference of Scarlet Fever by fomites is possible, it is probable that an impartial critic would hardly fail to come to the conclusion that the

fear of transmission by this means is largely overestimated.

In home isolation the usual general principles must be strictly enforced, all doors and passages connecting the sick-room with the rest of the house being protected by sheets moistened with a disinfectant solution. All utensils used by, or in the nursing of the patient, must be disinfected, and waste food or discharges burnt in the room or rendered harmless before leaving it. The attendants also, as in other infectious diseases should wear washable overalls (including caps), to be removed when leaving the sick room, when they should also regularly wash their hands and faces. Before associating with other susceptible persons they should in addition spend some time in the open air.

RÖTHELN (GERMAN MEASLES).

Rötheln is an acute specific infectious disease characterised by mild constitutional symptoms, the early appearance of an exanthem, a benign course, and practically a complete absence of complications or sequelæ.

ETIOLOGY.

The disease is endemic and undoubtedly widely prevalent. Its apparent rarity in the experience of any practitioner in general practice in our larger towns is almost certainly owing to its having been wrongly diagnosed as Scarlet Fever or Measles. It is most prevalent usually in the spring, and though children and old people may be attacked, is especially seen in young people (5 to 15 years of age), and next to them in adults, though rarely in persons over 30 years of age.

It is probably almost always conveyed by proximity to one suffering from the disease, infection being most marked in, if not limited to, the early days of an attack, though the infectious period has been fixed by some observers at ten days.

The micro-organism is not known; it is apparently not very tenacious of life, so that there is little fear of its transference by fomites, though it is said to be more tenacious and persistent than that of Measles.

PERIOD OF INCUBATION.

The incubation period has been variously estimated from 7 days to 3 weeks. Most commonly it would seem to be about 17 days.

SYMPTOMS AND COURSE.

The invasion of the attack always takes place insidiously. There is generally some malaise and headache, with a complaint of sore throat. There are also not infrequently sensations of chilliness and nausea, but the occurrence of vomiting or diarrhœa is most unusual, and a rigor practically unknown.

In a fair percentage of the cases the patient complains of pain or stiffness in the neck behind the sterno-mastoid muscles, and an examination reveals numerous enlarged, hard, discrete, slightly tender superficial lymphatic glands in that situation, frequently more marked on one side than the other.

The greatest difficulty is often experienced in deciding what importance should be attached in each individual instance to this sign, since the presence of numerous shotty glands in the posterior cervical triangle is by no means uncommon, more especially in the poorer classes. The irritation caused by pediculi, or small sores upon the scalp is doubtless the essential cause in most of these cases, and their existence prior to the attack of Rötheln, or at the time of onset, if unassociated with any tenderness, are potent reasons in many cases for excluding them as diagnostic factors. In addition, assistance may be obtained by noting the relative size of the glands, a distinct variability in this respect being in favour of a local origin.

It is not uncommon for the evidence of glandular inflammation to precede any other symptoms by one or more days. More often, however, especially in children, the appearance of the rash constitutes the earliest indication.

The specific eruption, if seen from its beginning, is composed of soft macules, small, discrete and very slightly raised. They are individually not unlike the rose-spots of Enteric Fever, but are often very small in size. They appear first on the face (including the cheeks and chin) and neck. Soon after they are to be seen on the body, in which situation they are usually more thickly present, and may be throughout diffuse. Still later they make their appearance on the limbs, but the eruption is not infrequently relatively scanty below the knees, though it has been known to make its first appearance in those situations.

The exanthem is of a delicate pink colour (rose-rash or roseola). The more diffuse dissemination of the macules on the body, and possibly on the proximal parts of the limbs very frequently produces a fine punctate rash quite indistinguishable from the exanthem of Scarlet Fever. Since the eruption appears relatively slowly from above downwards, and fades quickly, only lasting 2 to 3 days altogether, this similarity to Scarlet Fever may be heightened by its having disappeared from the face. On the contrary clear evidence that it is fading, or has faded from the face whilst still well marked on the buttocks or legs is strongly in favour of the diagnosis of German Measles. In addition a careful examination of the buttocks, thighs, shoulders, or upper extremities will, in most instances, reveal the rash in the form of a fine pink mesh-work.

The colour of the eruption is much lighter than that seen in Measles, and the intervening areas of pale unaffected skin are decidedly

smaller, and more uniform in size, whilst it is to be remembered that a morbilliform appearance of the rash on the limbs in Scarlet Fever is only met with, as a rule, in well-marked and moderately severe attacks.

The presence of the rash in a few cases causes a variable degree of itching.

There is almost always some congestion of the ocular and palpebral conjunctivæ, an appearance which has been designated by the term "pink-eye." Marked injection and swelling, or the occurrence of a purulent secretion with stickiness of the lids are, however, remarkable for their absence. In addition a further contrast with Measles is found in the absence of evidence of nasal or bronchial catarrh. Sneezing or coughing may occasionally be detected, but physical signs on examination of the nose or chest are wanting.

Though the patient frequently complains of sore throat, in almost all cases there is nothing more than slight congestion. The appearance of ulceration, marked swelling, or pultaceous exudation about the tonsils or fauces is therefore strongly against the diagnosis of German Measles.

The glands at the angle of the jaw are not affected. The enlargement of other lymphatic glands has already been mentioned, and in addition the axillary and inguinal glands have been observed to be implicated in some cases.

The temperature of German Measles only attains a moderate height. In most cases it fails to exceed 99°F. to 100°F., and even with a well-marked rash a temperature exceeding 101°F. is quite exceptional. For practical purposes it

may be accepted that 101°F. represents the maximum in this disease. It is true that high temperatures with severe constitutional symptoms have been described, more especially by older writers, but present day experience seems to warrant the conclusion either of a mistaken diagnosis or of a change in type.

The pulse shews only slight increase in rapidity in accordance with the mildness of the infection. The urine shews no pathological changes. The tongue may be covered with a thin fur, but it is not infrequently clean throughout the attack, the papillæ are not enlarged, and the patient usually does not lose the taste for, or the ability to digest, ordinary light food.

After the disappearance of the rash there may be brownish stains for 1 or 2 days on the body, but they are rarely seen and do not occur on the face. Subsequently there may be slight furfuraceous desquamation.

The attacks always end in recovery. Complications, *e.g.*, albuminuria, bronchitis, blepharitis, otorrhœa, chronic lymphadenitis, etc., have been occasionally described, but their occurrence is quite exceptional.

Relapses are practically unknown, and if they occur must be most unusual. Second attacks have been described and may account for some of the cases diagnosed as repeated attacks of measles. Authentic instances, however, are very rare.

DIAGNOSIS.

The importance of the disease is essentially bound up with the question of diagnosis. Its similarity in some respects to Measles, and in other ways to Scarlet Fever, for a long time

occasioned the belief that it was a hybrid of these two diseases. This conception may be definitely dismissed. It does not protect from these affections, nor do they give any immunity against it. Moreover it always, as the saying is, breeds true, and its characters are sufficiently distinctive to occasion little or no difficulty in recognising it as a definite entity. For this purpose, however, it is essential that the idea of pathognomonic signs be dismissed, and that the entire symptomatology of each case be carefully studied.

As in the other acute fevers valuable information may be obtained by endeavouring to trace the source of infection; the symptoms exhibited in other cases, and the length of time since exposure are of great importance.

In the diagnosis from Measles the following points must be noted:—(1) the variable but usually long incubation period, (2) early appearance of rash, (3) absence of marked evidences of nasal, conjunctival, or bronchial catarrh either as preliminary symptoms or during the attack, (4) low temperature even when the rash is coming out, (5) mild constitutional symptoms, (6) delicate, light-coloured rash, (7) its frequent diffuse punctate appearance on the body, (8) rapid efflorescence, and brief duration of the rash in different regions of the body causing it to have faded from one situation, whilst still at the maximum in another, (9) enlarged glands in the neck, (10) absence of Koplik's spots.

It is more usual, however, to confound Rötheln with Scarlet Fever owing to the early appearance of the exanthem, its diffuse punctate scarlatiniform appearance on the body, and its

early disappearance from the face. On the other hand a mistake should be prevented by noting (1) the long incubation period, (2) the absence of sudden onset (more particularly of vomiting), (3) the mildness of the constitutional symptoms, (4) the low temperature, (5) the history or presence of spots on the face, (6) the absence of marked faucial congestion or swelling, (7) the relatively slow pulse, (8) the absence of a characteristic tongue, (9) the absence of a polynuclear leucocytosis, (10) the absence of complications, and (11) the absence of marked desquamation.

The presence of an erythema accompanying an attack of Influenza might give rise to temporary suspicion, but the severity of the constitutional symptoms, whether bronchial, gastro-intestinal, nervous, or cardiac, and the degree of pyrexia would soon dissipate the error. Its infectious nature and the presence of pyrexia and characteristic glandular enlargement serve to differentiate it from drug rashes.

TREATMENT.

Prophylactic procedures are hardly necessary. The suggested occurrence of chronic lymphatic enlargement about the fauces and pharynx, and in rare cases of tuberculous lymphadenitis are reasons for particularly guarding strumous, or tuberculous children whilst in a poor state of health, as well as for insisting on fresh air, change of scene, good feeding, cod-liver-oil, and iron preparations in weakly children after the attack, in order to rapidly counteract any tendency in the direction indicated.

During the attack itself the advisability of

confinement to bed must be judged from the constitutional indisposition. Ordinary light food may be given throughout, if the appetite is maintained.

Cleanliness of the sick-room, and purity of the atmosphere are points which must receive consideration amongst poor patients. If isolation is considered necessary from the local circumstances, it should be maintained for two or at most three weeks after the onset of the disease.

MEASLES.

Measles is an acute specific infectious disease, the onset of which is gradual, and is manifested by the appearance of feverishness accompanied by symptoms of coryza. The characteristic exanthem is usually not seen till the fourth day of illness. Thereafter it increases in intensity for a couple of days, the pyrexia meanwhile reaching higher limits. At the same time bronchial catarrh becomes more marked, and there is great liability to the supervention of secondary pulmonary complications.

ETIOLOGY.

The disease is endemic in all but isolated and sparsely populated districts in this country. So widespread is the predisposition that it is the exception for childhood to be passed without the individual suffering from an attack.

Though no age is exempt, there seems to be a relative immunity in infants under one year, and especially under 6 months. The majority of the patients are between the ages of 1 year and 10 years, and the disease is most fatal to children under 5 years.

Historical epidemics, *e.g.*, in the Fiji Islands and the Faroe Islands, as well as sporadic occurrences shew that the immunity of adults is to be attributed to their having suffered from an attack during childhood. As a matter of fact even in our own densely populated towns adults who have hitherto escaped, occasionally suffer from the disease in a severe form.

A temporary immunity, or a delay in the

onset of the attack may be caused by the presence of another acute infection.

Epidemics are most prevalent during the spring and autumn, the disease being in almost all instances transmitted by direct infection.

The micro-organism has not been discovered. It is probably given off in the breath, or in the secretions from the mucous membranes, more especially the nasal, conjunctival or bronchial discharges. It is possible that by this means it may become attached to clothing, and thus be transmitted indirectly. Such an occurrence can, however, very rarely be detected, so that this fact, coupled with the extreme infectiousness to susceptible individuals in the immediate vicinity of the patient, occasions the surmise that the microbe is very readily destroyed by free aëration, and is thus not very tenacious of life.

Infection is present from the earliest symptoms. The difficulty in diagnosing the disease until the characteristic rash appears, offers a ready explanation of the impossibility of preventing the dissemination of the contagious particles amongst others, and of the futility of adopting a system of compulsory isolation.

The patient is apparently most infectious during the earlier stages of the attack up to the height of the eruption, the infection probably disappearing with the subsidence of the acute catarrhal symptoms.

INCUBATION PERIOD.

The incubation period may be fairly definitely fixed at 10 or 11 days. During this period there has been described (1) a loss of weight, and (2) the development of a polynuclear leucocytosis

during the first 6 days, which then disappears gradually, with the formation of the customary hypo-leucocytosis or leucopenia associated with the fully developed attack. These facts have been suggested as of value for early diagnosis.

SYMPTOMS AND COURSE.

Usually there are no symptoms during the incubation period. Occasionally, however, pyrexia, malaise, headache, or pains may be present for a variable number of days and thus add to the length of the period of invasion. The latter is more constantly marked by the appearance of catarrhal symptoms; sneezing, running at the nose and eyes, possibly epistaxis and cough, in addition to thirst, headache, general pains and nausea constituting the usual mode of onset. Rarely does one meet with such severe symptoms as vomiting, convulsions, or rigors, but diarrhœa, and shivering are less uncommon.

The affection of the conjunctivæ causes the eyes to appear reddened and watery, frequently with some purulent secretion and blepharitis. In addition there may be photophobia, and slight puffiness of the lids.

The inflammation of the nasal mucous membrane often produces at first partial obstruction with mouth breathing, which is soon followed by a mucoid or mucopurulent discharge.

The throat may feel sore but, as regards the mouth, the characteristic feature at this period is the appearance of minute bluish white dots (Koplik's spots) on the buccal mucous membrane lining the cheek, and situated chiefly opposite the molar teeth. [In making the

examination a good light is essential.] Each spot is surrounded by a red areola. They have been described as occurring in 80 per cent. of the cases, but I have personally only observed them on very few occasions. They are said to arise one to three days before the characteristic eruption on the skin appears, and to persist for two or three days. The white dots cannot be removed by swabbing. This fact, as well as the existence of an areola round each, serves to distinguish them from small particles of food or milk.

In the earlier part of the period of invasion the temperature reaches 101°F. or 102°F. , the evening record being higher than the morning one. Often on the third day there is a more or less complete remission of pyrexia, which returns, however, with the appearance of the exanthem, and even proceeds to a higher level than before, *e.g.*, 104°F. or 105°F. The temperature usually reaches its maximum with the maximum development of the rash. Thereafter in uncomplicated cases it terminates somewhat suddenly, the persistence of distinct fever after the rash has faded being evidence of some complication, *e.g.*, broncho-pneumonia or otitis media.

In the catarrhal stage also there may be hoarseness with a frequent loud barking cough, and evidence of laryngitis, unaccompanied at first by any expectoration. This catarrhal laryngitis may even be the cause of laryngeal stridor with symptoms of laryngeal obstruction, which should not be mistaken for membranous croup. This error will be avoided by noting the accompanying coryza, and by the discovery of Koplik's

spots. Moreover though a certain degree of pyrexia (100° F and even 101° F) may accompany membranous croup, higher temperatures, unless due to complications, are quite uncommon. The further course and the appearance of the rash confirm or refute the diagnosis.

The rash of Measles appears on the fourth day of the disease. Though noticed most commonly first about the back of the ears, the edge of the scalp, the face, or the upper part of the neck, it may be first detected in some instances on the body.

It is composed of discrete macules, small in size, soft and distinctly, but slightly, raised above the surrounding skin. The macules, which are of a dull red colour, increase in number and size for 1 to 3 days and gradually spread over the whole body in the usual order from above downwards. It is to be particularly noted that the individual macules are visible all over the face (including the chin), and scalp, that they are present as discrete erythematous spots on the palms and soles, and that they exhibit considerable variability in size.

As the exanthem develops, coalescence of adjoining macules takes place, and blotches of rash interspersed with pale healthy skin arise. Though coalescence may be sufficiently general as to cause a diffuse erythema over considerable areas, the incorporated patches of unaffected skin are always to be found in some regions of the body. The coalescence of adjoining macules may occur in such a manner as to produce the frequently described "crescentic arrangement," the essential feature, however, is the absence of

uniformity in the distribution of the macules over any region.

Discrete or coalescent red spots corresponding to the macules in the skin, may be seen on the roof of the mouth during the eruptive stage, and the buccal mucous membrane in general will be found to participate in the catarrhal inflammation, being congested, very slightly swollen, and secreting an increased quantity of mucus.

The tongue is usually coated, the appetite lost and thirst marked. Though vomiting or abdominal pain are infrequent, diarrhœa is not uncommon. The urine may contain a trace of albumen, the amount varying, as in other infections, with the severity and persistence of the toxæmia. Nephritis, however, is unusual, and hæmaturia is only to be expected as a sign of the hæmorrhagic type of attack.

The severity of the attack of Measles shews a similar variety in intensity to what we are accustomed to meet with in allied infections. This may be due to the prevailing character of the epidemic, to the occurrence of the attack in a weakly and debilitated person, or to special predisposition.

Malignant forms are manifested by early prostration, unusual severity of symptoms at the onset with persistently high temperature, sleeplessness, restlessness, delirium, small pulse, quick respiration, and increased tendency to pulmonary complications, ill-defined and imperfectly developed rash, and dry furred tongue with sordes on the teeth. Repeated vomiting and, finally, fulness of the abdomen accompanied by diarrhœa, may give a typhoid appearance to the whole. In some instances the patient is apathetic

and restless from the beginning, with rapid sniffing breathing and dry retracted alæ nasi. All the foregoing symptoms are of evil omen, and the last mentioned of fatal augury.

Sometimes the severity of the attack is manifested by an accentuation of all the usual symptoms.

When the toxæmia is sufficiently profound to produce bleeding from mucous surfaces (hæmorrhagic measles) a fatal termination can be predicted with certainty.

Occasionally the toxæmia is less intense but gives rise to an effusion of blood into the rash. The effusion or rather slight extravasation starts in the centre of each macule as a small purplish, ill-defined discolouration, which does not fade on pressure. Though indicating a severe attack this condition should not be included under the term hæmorrhagic measles, as many of such cases end in recovery. Still less must that term be used for the staining from effusion of blood left after the rash has disappeared. The latter condition is by no means infrequent, and does not possess any prognostic significance.

It is in connection with the malignant attacks that myocarditis and endocarditis are liable to arise. Under other circumstances these are rare complications of Measles.

COMPLICATIONS.

The development of a purulent conjunctivitis from the more common catarrhal condition has already been described. In addition blepharitis, keratitis, and ulcerations of the cornea may supervene and become very intractable, whilst in rare cases the ocular conjunctiva may become

much thickened, and so interfere with the vascular supply of the cornea as to lead to its necrosis with subsequent panophthalmitis. In the mouth an apththous or ulcerative stomatitis may develop, and convalescence may be interrupted by the occurrence of noma, which is first noted as a dark necrotic discoloration usually on the mucous membrane lining the cheek. In this condition a localised thickening in the tissue of the cheeks arises very quickly, the skin becomes tense and wax-like, and an external necrotic patch corresponding to the internal slough is rapidly formed. The disease proceeds with such rapidity, producing marked local swelling, œdema, and loss of tissue from gangrenous changes, that the most energetic treatment is required to save the life of the patient. It should also be mentioned that this dangerous complication may arise in connection with the genital organs, more particularly the vulva.

The catarrhal inflammation of the throat frequently spreads along the Eustachian tube producing otitis media. Deafness from temporary blocking of the tube is not uncommon, it may appear early and pass away without any further evidence of disease.

Purulent otitis media may arise, however, as a later complication with perforation of the tympanic membrane and the further risks mentioned under Scarlet Fever, though these occurrences are much rarer than after the latter disease. Possibly this is due to the fact mentioned by Dr. Knyvett Gordon that the otitis of Measles is a catarrhal affection, that of Scarlet Fever an osteitis.

The most frequent complications of Measles

affect the respiratory tract. Laryngitis has already been mentioned, and its occasional liability to produce stridor. The obstructive symptoms may not develop until the exanthem is well out, and there is extensive coincident tracheitis and bronchitis. Under these circumstances every effort must be made to alleviate the condition without operative interference, as the performance of tracheotomy is almost certain to be followed by fatal broncho-pneumonia, and even intubation is not likely to have a successful result.

The occurrence of stridor is more frequently seen to develop in the stage of invasion, than after the appearance of the rash. From the point of view of treatment this is fortunate, since if operative interference is demanded, the prognosis is somewhat more favourable at that time. The explanation of this difference probably lies in the fact that in the early stage of the disease, the local catarrhal changes in the respiratory tract, and the effects of the general toxæmia are less advanced.

In some cases membranous laryngitis occurs as a complication. It may be due to the action of streptococci, but more commonly it is a genuine diphtheritic affection. An attack of Measles undoubtedly predisposes the mucous membrane, and possibly the system generally, to the action of Löffler's bacillus and its toxins. The consequent attack of Diphtheria, which may occur either as a complication or a sequela, is generally of a severe type, and very liable to implicate the larynx.

The catarrhal condition of the mucous membrane of the respiratory tract seems to extend

even to the small bronchioles; it will, therefore, be readily understood why capillary bronchitis and broncho-pneumonia constitute such a frequent and fatal mode of termination to an attack of Measles.

SEQUELAE.

The predisposition to diphtheritic infection has just been referred to, and secondary infection with septic micro-organisms will be recognised in the purulent otitis media previously described. In the latter respect Measles is much less potent than Scarlet Fever, which seems to produce a special vulnerability to streptococcic and staphylococcic infection.

Particular attention must be drawn, however, to infection with the tubercle bacillus, since a localised tuberculous focus, whether a tuberculous adenitis, osteitis or peribronchitis, may, on the subsidence of the attack of Measles, undergo rapid proliferation and acute dissemination.

There can also be little doubt that predisposition to subsequent primary infection by the tubercle bacillus is produced by an attack of Measles, and the lasting debilitating influence of this disease is a potent reason why free ventilation, good feeding, careful attention as regards nursing, and protection (not forgetting the milk supply), should characterise the management of the acute phase, whilst tonics, cod liver oil, preparations of iron, and change of scene must be utilised on the completion of the acute stage, in order to restore the health of the individual as quickly and completely as possible.

Relapses (occurring from two to four weeks after the first attack) and second attacks (occurring at periods varying from two months to

several years) have been described by numerous observers. Nevertheless the immunity afforded by an attack of Measles seems to be very complete, and great care is needed to prevent error, since, as already stated, the disease may be somewhat closely simulated in many respects by R  theln, and moreover well-marked morbilliform eruptions are not uncommon in various tox  mic conditions.

DIAGNOSIS.

With the single exception possibly of Koplik's spots, which are found during the stage of invasion, and the first two days of the eruption, there are no pathognomonic signs of Measles, so that the diagnosis must depend on a careful study of the symptomatology and anamnesis.

The distinguishing features are (1) a period of incubation of 10 or 11 days, (2) the appearance of catarrhal symptoms with pyrexia, (3) followed on the fourth day by the characteristic rash, (4) the temperature about this time attaining its maximum, and the blood shewing, on examination, an absence of leucocytosis. All grades of severity as regards the rash, coryza, or pyrexia must be expected according to individual predisposition, the prevailing type of the disease, and possibly to the intimacy and extent of the exposure, or the source of infection.

In the absence of a rash (*Morbilli sine exanthemate*) the diagnosis must depend on the catarrh with evidence of infection, and for its completion the attack should occur in an individual previously unaffected, who should remain immune to subsequent exposure, otherwise it is impossible to exclude simple coryza.

When catarrhal symptoms are wanting (Morbilli sine catarrho) the other points mentioned above must be elucidated to verify the diagnosis. Conjunctivitis and bronchial or pharyngeal catarrh are such constant features of an attack of Measles, that their absence must always demand clear evidence in every other direction before the diagnosis is accepted. Moreover it must be remembered that along with the history of onset, the pyrexia, and the date of appearance of the rash, the absence of any signs of catarrh constitutes a most important factor in the differential diagnosis of the various toxæmias (*e.g.*, from drugs, serum injections, septic absorption, etc.), which may give rise to morbilliform erythemata. In these conditions also, further evidence can frequently be obtained from a consideration of the features of the rash, *e.g.*, its colour, mode of development and distribution.

The rash produced by Antipyrin is usually absent from the face, and any temperature which may be present must be due to the affection for which the drug was administered. It is evident that if the latter be of a catarrhal nature, *e.g.*, influenza, then the difficulties are much increased.

Though Quinine more commonly gives rise to a scarlatiniform erythema, a macular rash of a morbilliform type appearing first on the face, and spreading downwards as in Measles, may occur. It is more likely to be accompanied by itching and followed by desquamation.

The rash which not infrequently arises from Copaiba is described as consisting of "rose-red colored, slightly raised patches, which may be discrete or blotchy, and generalised or limited."

Itching is here also in many cases a distressing symptom. Further the outline of the discrete or confluent macules is unusually clearly defined, and a purplish tint is often noted.

Eruptions following the injection of antitoxic sera are more commonly of an urticarial character; in addition, they are frequently most marked, and make their first appearance round the site of the injection. The associated pyrexia is further accompanied by general pains, and often by pain and swelling in the joints.

Morbilliform erythemata due to septic absorption are usually most marked on the extensor surfaces of the limbs, and by confluence of the macules form large patches with well-defined margins. The patients are always very ill, and the source of toxæmia or septicæmia is either well-known or readily discoverable.

In Scarlet Fever the sudden onset of illness, the markedly congested, swollen, and even ulcerated throat, the early appearance of a diffuse punctate rash which does not invade the face, the characteristic tongue, the absence of early conjunctivitis and catarrh, the occurrence of adenitis, otitis, etc., as later septic complications, these constitute a combination which, if elicited, cannot lead to error. Even the blotchy, morbilliform rash seen in some severe cases of Scarlet Fever should give rise to no difficulty, since under these circumstances the other features are likely to be accentuated. Similarly, in a case of Measles with ill-defined catarrh in which the eruption has by confluence become diffuse, a search will always reveal the blotchy character in some region of the body, and the history,

with the absence of sore throat and strawberry tongue will enable one to avoid a mistake.

If the attack of illness is over when the patient is first seen it is important to note that evident desquamation is in favour of Scarlet Fever, whilst blotchy brown staining speaks for Measles.

A morbilliform prodromal rash in variola is not likely to occasion any difficulty on account of the suddenness and severity of onset (vomiting, possibly rigor), the associated symptoms (rachi-algia), and the absence of catarrh. The appearance of the true rash in the form of papules on the face on the third day might give rise to a temporary suspicion, but this would soon be dispelled by noting the hardness of the papules, and their palpability even in the stretched skin (Grisolle's sign), features which are absent even in a case of "papular measles." In addition, the temperature would be found to be falling or normal, and confirmatory evidence would be obtained from the state of vaccination, and the presence of an epidemic of Small-pox. If any doubt still existed the progressive development of the papules, and the want of response to vaccination would be conclusive.

The diseases from which the presence of conjunctivitis is of less diagnostic value are Rötheln, Typhus, and Influenza, but even in comparison with these it is much more common to observe it in a marked degree in Measles, and in contrast with those ailments it is frequently accompanied by photophobia, a purulent discharge, and puffiness of the lids. From Rötheln also the severe constitutional symptoms, the appearance of the rash on the fourth day, its darker colour and coarser character, as well as the higher tempera-

ture are distinctive. On the other hand, relative to observable signs and symptoms the constitutional depression is greater in Typhus Fever, and the temperature probably higher, whilst the rash when limited to the so-called subcuticular mottling is lighter in colour, less raised, of a more delicate and more indefinite character, and fails to develop from day to day. Moreover the face is free from eruption, the temperature more sustained, and older members of the family are usually first affected.

PROGNOSIS.

Measles is most fatal to infants of two and three years of age. The prevailing character of the epidemic plays some part, but the mortality is greatly influenced by the care, attention, nursing, and hygienic surroundings to which the patient is subjected during the attack. Children debilitated by previous disease (rachitis), or malnutrition, frequently succumb to Measles. The characters of severe and malignant attacks which usually foretell a fatal termination have been given previously. It may be mentioned that convulsions are always of serious omen.

Tuberculous infants are liable to suffer subsequently from a rapid extension of the tuberculous process, and the serious prognostic importance of obstructive laryngitis, marked diarrhœa, etc., has been referred to under symptomatology.

The commonest and most fatal complication is broncho-pneumonia, and this is dependent not only on the severity of the attack, but on the presence of dusty or irritating atmospheres, on exposure to variable and especially lower temperatures, and on neglect of continual atten-

tion to the hygienic surroundings until all signs of illness, and of inflammation of the respiratory tract, have completely disappeared.

TREATMENT.

The patient should be placed in bed in a well-ventilated room, the temperature of which should be maintained at about 65°F., and if signs of laryngitis or bronchitis are present, the air should be impregnated with moisture from a steam-kettle. Warmth must not be procured by the piling on of bed-clothes.

The least possible amount of furniture is a desideratum. Unnecessary curtains, ornaments, or dust retaining articles must be removed, and strict cleanliness of clothing and bedding observed. No dusting nor dry sweeping should be allowed.

With photophobia excess of light must be excluded.

During the acute stage only rapid and warm sponging of the body, without exposure, is to be permitted. At the height of the disease it is desirable to avoid unnecessary washings for two or three days. This does not, of course, refer to the hands and face.

With signs of an ill-developed rash, and a poor colour or over-taxed circulation, warm baths or packs are indicated. Cold affusions and applications are only to be used in severe cases with hyperpyrexia, and signs of suffocative catarrh.

The diet should be fluid, nourishing, and largely composed of milk, soups, and farinaceous foods in liquid form. Only mild laxatives (*e.g.*, castor oil, cascara sagrada, liquorice powder) are

to be allowed, and not repeated without cause. Diarrhœa should be checked by bismuth salicylate, tannalbin, vegetable astringents or chalk, and the milk diluted with lime-water. If unrelieved a starch and opium enema may be given.

The mouth, eyes, and nose must be repeatedly cleansed with mild antiseptic lotions (see Scarlet Fever), particular attention being paid to the mouth, and, in female children, to the vulva.

Otitis and its complications must be treated on the usual principles.

With much swelling of the ocular conjunctiva early instillation of atropine, and repeated warm applications are advisable; in one memorable case followed by double panophthalmitis the swelling of the conjunctiva was preceded by persistent and troublesome blepharitis and irritation of the lids.

With laryngitis, in addition to a moist atmosphere, fomentations are to be applied to the neck, and expectorants given, *e.g.*, squills, ipecacuanha, antimony, etc.

If pneumonia develops the same treatment is beneficial omitting the warm moist applications, but enveloping the chest in a flannel, or cotton wool, jacket. In addition, ammonium carbonate should be added to the drugs mentioned, and with a failing heart alcohol, strychnine, caffeine, or digitalis may be given, though the resort to these remedies in most instances fails to stay the fatal termination.

Gangrenous stomatitis (noma) requires early and free excision under chloroform, followed by cauterisation, the prevention of the inhalation or absorption of septic material by careful attention to the wound, and the administration of a nour-

ishing diet. The evidence points against this complication having any connection with Löffler's bacillus, so that apparent benefit after injecting diphtheritic antitoxin is more likely to have been dependent on the other measures adopted.

The fatality of Measles amongst young children demands that prophylactic methods should be particularly observed in their case. On this account even if exposure to infection has taken place, it should not be allowed to continue. Further, as association with other children is the almost constant mode of conveyance, they should not attend school, and their choice of playmates should be closely scrutinised, during the first five years.

The rules to be observed for the disinfection of the sick-room, and of all articles, utensils or wearing apparel exposed to infection, as well as the care to be taken by those mediating between the sick and the healthy are the same as mentioned under Scarlet Fever, but the poison is apparently much less tenacious of life, and as already stated much less liable to be conveyed by these means.

"FOURTH DISEASE."

Attempts have been made to distinguish another infectious disease, the symptoms and characteristics of which are said to resemble R \ddot{o} theln very closely, though in one or two minor details a greater resemblance to Scarlet Fever is described. To such a combination of symptoms the name of "Fourth disease" has been provisionally given.

In the absence, or mildness, of the premonitory symptoms, the slight subjective and constitutional disturbance, as well as in the detailed character of its manifestations the description is practically identical with German Measles. There is the same slight conjunctival injection, the same enlargement of glands in the neck, and the pulse, temperature and course of illness shew no variation. There is further an absence of any pathological changes in the urine, of any sequelæ, and of any characteristic alterations as regards the tongue in every aspect as met with in German Measles. The only distinctive features for its differential diagnosis from that disease are (1) that the rash is of a scarlatiniform type from the beginning, and that it may cover the whole body in the course of a few hours, (2) that congestion and swelling of the throat are somewhat more marked (3) that desquamation is more distinct, (4) that it is said to be less infectious during its earlier stages, and (5) that it is usually met with only in small epidemics.

Since it is generally admitted that the rash of German Measles not infrequently assumes a

scarlatiniform appearance in its further development, and the remaining points of difference are only relative, and not decisive, it is evident that the possibility of making a diagnosis is dependent on seeing the rash from the beginning and noting its scarlatiniform characters. At the same time the diagnosis from Scarlet Fever is made by observing the slow pulse, mild onset, slight constitutional or local (*e.g.* faucial) symptoms, the clean or slightly furred and non-characteristic tongue, the less free desquamation, and the absence of sequelæ.

It is therefore evident that for the diagnosis of "Fourth disease" an epidemic or succession of cases shewing the above characteristics is required, and it is precisely the lack of such an occurrence which makes most observers sceptical as to its existence.

Its similarity at the onset to mild Scarlet Fever would lead one to expect that it would at any rate occasionally be sent by mistake into an isolation hospital. On the other hand no medical officer of a fever hospital has described a case with genuine Scarlatiniform eruption which was apparently a case of mild Scarlet Fever, and which has, whilst subsequently contracting Scarlet Fever in the ward, been the source for the dissemination amongst the other patients, of a disease with the above-mentioned characters.

Under these circumstances it must be admitted that the definite existence of a "Fourth disease" has not as yet been proved.

SMALL-POX.

Small-pox is an acute specific infectious disease characterised by a sudden onset with high fever, and the appearance of a papular rash on the third day of illness, the pyrexia at that time being of distinctly lower degree or even absent. The rash later becomes vesicular, and then pustular. The subsequent general symptoms, temperature, and complications depend on the number and situation of the pustules. The formation of scabs and cicatrices is a secondary result of pustulation.

ETIOLOGY.

The disease only occurs in epidemics which are of very variable severity. Though formerly very extensive and frequent, as the result of the practice of vaccination which conveys a more or less lengthy immunity on susceptible persons, epidemics are now much rarer, and less widely spread.

The disease is met with in all climates, but in our own country epidemics are generally worst during the colder weather of winter and spring, a distinct tendency to subsidence being not infrequently observed in the summer months.

The predisposition to the disease is very widely spread, only a very small percentage of any population enjoying a natural immunity. A temporary insusceptibility has been described as being present during various acute diseases, but it must be admitted that this is not a marked feature. No age is exempt, and the foetus may even contract the disease in utero.

Before the introduction of vaccination Smallpox was most common in the young, older persons having usually passed through an attack by contracting it in the ordinary way, or by inoculation.

Intentional transmission of the disease by inoculation is now illegal. Infection is usually conveyed by the air, the poisonous particles being apparently exhaled in the breath, and probably later contained in all discharges. Infection is therefore densest in the immediate vicinity of the patient.

The micro-organism is not known with certainty. Many kinds of cocci, bacilli, and protozoa have been described. The most recently advocated microbe is a protozoon to which the name of *cytocytes variolæ* has been given, and it has in its favour the fact that a practically identical body, shewing a difference chiefly in the life-history, has been described in vaccinia.

Whatever the nature of the microbe may be it is apparently very tenacious of life, being conveyed by fomites, by air currents, or by flies for considerable distances. On this account Smallpox hospitals are not allowed to be placed within a certain distance of other institutions or buildings.

Though infectious from the onset of the earliest symptoms, it is highly probable that the infection is relatively not well marked during the first day or two, as compared with the disease in the stage of suppuration. It is especially with a collection of cases all in this latter stage, that one is most likely to have the disease conveyed for considerable distances. It may be largely prevented from occurring by systematically oiling the skin of

all patients. This so-called "long striking distance" has been attributed to various agencies, but against its transmission by fomites, as a rule, is the fact that such is not the usual occurrence in Scarlet Fever, though in that disease the micro-organism is also very tenacious of life, whilst against the action of flies is the fact of its greater occurrence during the colder months. On the whole it is, from the evidence, very likely that the disease is often conveyed by air-currents, though it should be mentioned that ærial convection is not universally accepted as the cause of its dissemination around Small-pox hospitals.

It must not be forgotten that infection may be transmitted from the dead body, hence the not infrequent occurrence of small epidemics amongst those attending the "wake" of an individual who has succumbed to an attack.

INCUBATION PERIOD.

The period of incubation is usually about 12 days, the extreme limits being from 8 to 14 days. During this stage symptoms are, as a rule, absent, though there may be malaise, headache, chilliness, or nausea during the last few days.

INVASION AND COURSE.

In the great majority of cases the onset of the attack takes place suddenly. There is frequently chilliness (probably rigors, and in children even convulsions), headache, and general pains, acute pain in the lumbar region of the spine (rachialgia), high temperature (103°F or more), often vomiting with pain in the epigastrium which may continue for 2 or 3 days, and finally vertigo. Diarrhœa is not uncommon in children.

The rapidity of onset and the height of the pyrexia on the first day is a marked feature of Small-pox, even cases which subsequently pursue a mild course exhibiting these early acute symptoms. It must be mentioned, however, that in modified Small-pox the early symptoms may be slight and indefinite, a condition not met with in severe or unmodified cases.

In the mild and modified disease also the high initial pyrexia, though it may reach 104°F or more, is likely to be of only temporary duration, possibly beginning to fall by lysis before the end of the first twenty-four hours. More usually, however, in cases of ordinary severity the temperature is maintained for a longer period, the subsidence taking place late in the second, or during the third day of illness, and being accompanied by a general amelioration of symptoms. In severe cases in which the constitutional depression is more profound, and often associated with sleeplessness, delirium, etc., the temperature and general symptoms may become still further aggravated during the second and third days.

In mild cases, more especially on the second day of illness, a non-raised morbilliform or scarlatiniform erythema (*roseola variolosa*) of an evanescent description may develop. The morbilliform type is the commoner of the two. These erythemata may have a localised or general distribution, and must be distinguished from the purpuric rash which occurs in the hypogastric and inguinal regions, as well as on the inner aspect of the thighs. The latter eruption may even give the appearance of a diffuse deep redness in the situations mentioned, and is more common in very severe cases. On the other hand, the

non-occurrence of the roseolæ in severe attacks makes these accidental rashes an indication of good, rather than evil significance.

The remaining symptoms of the invasive stage, which may be quite absent in modified cases, do not exhibit any distinctive characters. The tongue is often thickly coated, the breath offensive, the bowels constipated, the spleen slightly enlarged, the pulse of a febrile type, its fulness and rapidity as well as the rate of respiration depending on the age of the patient and the severity of the toxæmia. Occasionally towards the end of the period of invasion there may be a complaint of sore throat which, taken in conjunction with the diffuse roseola previously mentioned, may give rise to the suspicion of Scarlet Fever. The throat on examination, however, shews nothing more than congestion, and the error must be avoided by noting the mode of onset, including rachialgia, the prevalence of Small-pox, the indefinite character of the rash or its distribution, and the appearance of the true eruption on the third day.

The characteristic eruption appears almost regularly on the third day though in modified cases it may be somewhat delayed. It is composed of small, shotty papules, which are at first more easily felt than seen. They are found early on the forehead, and backs of the wrists, spreading later over the face, body and upper extremities, and finally over the legs. The full complement of spots is not attained for two or even three days, their number being some indication of the severity of the attack, though, as the result of previous vaccination, they may be profuse and yet abort in various stages. By this means are

produced Hornpox when abortion occurs in the papular stage, and Wartpox when drying up and shrivelling takes place in the vesicular or pustular stage.

The papules appear in any situation on the surface including the palms and soles. An important feature is their relative distribution, as regards which, it is to be noted that exposed parts, *e.g.*, the face and the hands, are most affected, the distal portions of the extremities next, and the trunk and proximal parts of the limbs relatively least.

In the mouth the papules appear as small, round, red elevations especially seen on the palate. They early become converted into white vesicles, which in this situation are soft, thin-walled, and readily undergo ulceration.

By the third day of their appearance the papules on the skin shew distinct evidence of vesiculation, the vesicles being firm, and round, with a pearly surface, and often shewing umbilication in the centre. By the sixth day they have still further increased in size and are becoming pustular. Each pustule is surrounded by an inflammatory areola, which during the next few days extends, and in situations where the connective tissue is lax, *e.g.*, the face and external genitals, the lesions may be accompanied by very marked swelling, which in the scrotum may even lead to gangrene.

It should be stated that the development of the eruption is always slightly in advance in those regions in which it first makes its appearance, but that in any localised area the spots will be found to be fairly uniformly in the same stage.

The gradual increase in size of the pustules causes neighbouring ones to run together in certain situations (more especially on the face and hands) when the eruption is sufficiently profuse. Under these circumstances the attack is said to be of the confluent type (*variola confluens*), in contradistinction to the discrete variety (*variola discreta*). Occasionally in some cases confluence takes place over considerable areas, *e.g.*, an arm, or the face, the pus forming a layer under the skin with very little accompanying œdema.

With the onset of suppuration pyrexia returns, or is aggravated. Its height is rarely equal to that of the initial fever, and along with its persistence the degree attained is necessarily dependent on the extent of the eruption, and the consequent amount of septic absorption. It is maintained throughout the suppurative stage, and subsides in cases which are uncomplicated about the 12th or 13th day. In milder cases the fall occurs earlier. In the meantime the pustules largely lose their primary umbilicated character, becoming more globular, and increasing in size, whilst the constitutional symptoms steadily become worse. The pulse-rate is accelerated, the patient, from the presence of the pustules and inflammatory œdema, may be unable to find a comfortable position, or to bend his limbs so as to feed and help himself. Later, also, many of the pustules become lax, and their walls rupture with the extrusion of their contents, and the giving off of a most offensive odour.

Though active delirium is more common in the earlier stages of the attack, sleeplessness, and delirium, possibly with suicidal or homicidal

tendencies, may lead to a fatal issue, which most frequently occurs about the 11th or 12th days.

In other cases about this period signs of retrogression are noted. The inflammatory swelling gradually diminishes, the pustules undergo desiccation with or without rupture, and with the gradual formation of crusts and scabs. Intense itching may arise leading to scratching, and in children, especially, to the production of an extensive impetigo. Coincidentally the temperature falls, and the general symptoms slowly subside. As at other times the first alteration in the appearance of the rash is usually seen in the face.

In the course of three or four weeks the crusts, which are at first brownish and later dark coloured are thrown off, and a reddish area followed by a brownish discoloration marks the site of the pustule. This disappears in a few months, or when the ulcerative process has proceeded more deeply a pigmented scar results which contracts, and gives rise to the well known pitted cicatrix.

When the pustule does not rupture, the rounded, dark brown, lentil like spots are particularly distinct, and where the cutis is thick, *e.g.*, on the palms and soles they become so condensed in time, as to allow of their being mechanically scraped out, a process regularly resorted to by convalescents to diminish the period of isolation.

The variation which may be met with in the severity of the attack, and in the consequent difference in symptoms and signs, is fully as marked in Small pox as in any other disease. Though this variety was observed before the introduction of vaccination, it is now enormously

accentuated, and has given rise to the use of the term "Varioloid" for markedly modified cases. It must in the first place be clearly understood that such attacks are genuine Small-pox, their mild or indefinite characters being due to a more or less marked individual insusceptibility, yet quite capable of producing the disease in its severest form in persons who are not immune.

The 'varioloid' nature of an attack is not decisively shewn by slight symptoms at the onset, since this is by no means an invariable rule, but more particularly by the rapid improvement which may take place at any period after the onset of illness, by the scantiness of the eruption, or as already indicated by its abortion and aberrant course, and finally by the subsequent mildness of the symptoms after the onset.

It is not uncommon to meet with cases beginning acutely and apparently severely, but quickly undergoing amelioration, and followed by the appearance about the 3rd, 4th, or 5th day of a few scattered spots, which may not shew any characteristic relative distribution in the various regions of the body. These spots may fail to develop, and there may be no further symptoms. The modification may even be carried so far as to permit only of an initial fever (*Variola sine Variolis*).

At the other extreme, especially in unvaccinated adult individuals, or in old, debilitated or alcoholic persons, the attack may be so severe as to produce death during the first few days from the primary toxæmia.

In these cases (Malignant Small-pox) the initial symptoms are usually violent, prostration

with signs of cardiac failure and low temperature may arise early; the mind may remain clear almost to the end, or there may be delirium or stupor: hæmorrhagic prodromal rashes make their appearance (*Variola purpurica* or hæmorrhagica), ecchymoses may take place from various mucous surfaces, *e.g.*, the nose, kidneys, rectum, uterus, the whole aspect of the patient being dusky and livid, and death occurring even before the development of the typical eruption. More frequently the fatal termination is postponed till after the appearance of an ill-defined eruption.

To a certain extent the severity of cases of this malignant type may be judged by the earliness with which hæmorrhagic extravasations appear, as well as by their extent. Practically all are fatal, but recovery has been described from a case in which a bluish discoloration appeared in some of the spots during the vesicular stage. The occurrence, however, of hæmaturia, epistaxis, hæmatemesis, metrorrhagia, or bloody stools with lividity may be taken as fatal indications.

When the hæmorrhage makes its appearance in the pustular stage (*Variola pustulosa hæmorrhagica*) there is slightly more hope, but it must be in a limited number of spots, and occur late, or in a case modified by previous vaccination.

Even ordinary attacks of Small-pox are instrumental in bringing on menstruation, which is often profuse, whilst pregnant women very frequently abort, and in them the mortality is high. Unvaccinated pregnant women are liable to suffer from malignant attacks.

To the ordinary types of the disease in the mother, the foetus may respond in various ways.

It may (1) suffer from Small-pox in utero, (2) be born incubating the disease, (3) be born apparently healthy but temporarily immune to vaccination, or finally (4) it may be susceptible to this operation.

When it is remembered that with an extensive eruption, the total amount of pus contained in the pustules scattered over the body, may attain a quantity of one or more quarts, the occurrence of the secondary or suppurative fever, as well as of septic complications and sequelæ, *e.g.*, multiple abscesses, boils, bedsores, erysipelas and septic rashes, arthritis, pleuritis, empyema, pyæmia, uncontrollable diarrhœa, and occasionally endocarditis, will be readily understood.

In addition the situation of the pustules is responsible for other complications, thus (1) on the palpebral or ocular conjunctiva they may give rise to conjunctivitis, keratitis, ulcer of the cornea, iritis and panophthalmitis, (2) on the tongue and in the mouth they may produce much swelling, profuse salivation, parotitis, and dysphagia, (3) in the throat the resulting inflammation may lead to deafness, otitis media and its after affects, or to œdema glottidis, and (4) in the respiratory tract there may be laryngitis with aphonia, and stridor. In addition tracheitis, bronchitis, and pneumonia may occur as complications.

Myocarditis or cloudy degeneration of the heart muscle may be caused by the primary toxæmia, or the secondary suppurative processes, and the same may be said of the changes in the renal tissue and the consequent albuminuria. The latter usually appears early, is said to fluctuate

greatly in amount from day to day, and in a large proportion of the cases to be accompanied by casts in the urine.

DIAGNOSIS.

A. *General Principles of Diagnosis.* In every case the condition of the patient as regards vaccination should receive consideration. If this operation has been successfully and efficiently performed a few years (5 to 10) previously, there is strong *prima facie* evidence against the case being one of Small-pox. It is by the observance of this fact alone that, in periods of epidemic prevalence, ambulance drivers may detect, or suspect errors, amongst the numerous children sent into the hospital suffering from Chicken-pox. Further, by vaccinating a doubtful case, we are always able to obtain valuable confirmatory or negative evidence, a successful result being inconsistent with the diagnosis of Small-pox.

The first point to recognise is that we are dealing with an acute systemic disease, we shall not then be likely to mistake rachialgia for lumbago.

In the next place a careful enquiry must be instituted into all the symptoms, and the practitioner must refrain from suspecting acute gastritis in the presence of a furred tongue and vomiting, or meningitis from a severe headache.

The suddenness of onset and the absence of characteristic signs usually prevent a diagnosis being risked during the first three days, unless exposure to infection is known, and the symptoms enumerated as arising in the period of invasion are fairly typical. It is evident that

during this stage a mistake is very liable to arise from hasty conclusions. Thus, the presence of fever, pain, and sweating may be taken for Acute Rheumatism if the initial symptoms are not suggestive, if the practitioner does not lay stress on the markedly sudden onset of illness, and if he is not careful to require swelling and tenderness of the joints for the completion of his diagnosis. Again a diagnosis of Acute Croupous Pneumonia has been made when frontal headache and rachialgia were not marked symptoms, and clinical evidence of this disease in the lungs was not demanded. Error has also occurred from a hasty diagnosis of Influenza and Typhus Fever. The incorrectness of the suspicion in the foregoing and for that matter in each of the subsequent circumstances should, however, be dissipated by the appearance of the true eruption on the third day of illness. Moreover, it is important to remember that in Small-pox the symptoms of headache, bodily pains and general malaise are subsiding, and in milder cases may have disappeared, as the eruption comes out, whereas in other diseases these symptoms are not only largely proportional to the amount of the rash, but persist and become aggravated at the same time as it makes its appearance.

B. *Differential Diagnosis.* The development of a scarlatiniform erythema, and a complaint of sore throat may cause the disease to be mistaken for Scarlet Fever. The erythema, however, is very evanescent, often especially seen on the extensor aspect of the limbs, and usually less generalised. It is uncommon in patients under 10 years of age. Moreover congestion and swelling of the fauces and tonsils are not

marked features, and there is no ulceration or exudation about the throat. The severity of the initial symptoms is out of all proportion to the appearance of the erythema or the throat. The breath is foul, whereas in Scarlet Fever it frequently has an acetone smell. The tongue is coated but the red papillæ are not visible, and there is no tendency to early desquamation.

With regard to Measles the morbilliform erythema is not likely to be mistaken on account of the sudden onset of the disease, the early appearance of the erythema, its distribution, its light colour, and non-raised character, as well as the absence of conjunctivitis and catarrhal symptoms. A resemblance to Measles is greater in some confluent cases, on account of the frequently associated suffusion of the conjunctivæ at the time of the appearance of the Small-pox papules. The characters of the papules are, however, different, being hard, shotty, and still palpable after stretching the skin. Moreover in Measles the temperature rises as the rash develops, whilst in Small-pox it falls during the early papular stage, and the course of the rash in the two diseases is quite different. Finally Koplik's spots are absent, whilst, on the contrary, whitish vesicles develop on the buccal mucous membrane from the small, rounded, red papules which form the exanthem in Small-pox.

Only great carelessness or ignorance allows Typhoid Fever to be mistaken for Small-pox. There is an absence of sudden onset with vomiting, vertigo and backache, and however profuse the lenticular spots may be they are not shotty, are not relatively most numerous on the face and hands, and do not undergo a pro-

gressive development, or come out altogether in the course of one or two days.

Malignant attacks may at first be indistinguishable from malignant attacks of other infectious diseases, more particularly Scarlet Fever. The age of the patient, the prevalence of Small-pox, the condition as regards vaccination, the absence of marked sore-throat, the presence of conjunctival ecchymosis, and later the development of dusky papules, or ill-defined vesicles would be valuable in coming to a conclusion.

The evidence of severe toxæmia and constitutional disturbance is in itself sufficient to prevent a diagnosis of purpura. Syphilitic eruptions are not infrequently diagnosed as Small-pox, but the absence of sudden onset with vomiting, backache and feverishness, or of a history of the rash appearing on the third day of illness, as well as the non-characteristic distribution, and the lack of progressive development should exclude such an error.

The same considerations apply to acne, and other non-febrile eruptions, *e.g.*, the pustular bromide, and iodide rashes.

Though opportunities for studying Glanders are fortunately rare, the attack should not be mistaken for Small-pox, since (1) the occupation of the patient is usually connected with horses, thus permitting the infection to be traced; (2) there is a pustular eruption with subcutaneous abscesses; (3) the course and distribution of the pustules is quite different, and (4) bacteriological examination of the pus will reveal the bacillus *mallei*.

The most frequent mistakes, however, occur with varicella, and since they generally take the

form of wrongly diagnosing this disease as Small-pox the differential characters will be more fully discussed after describing the former disease. In severe cases of Small-pox the history, the profuse eruption on the face, and hands, its appearance, and the marked constitutional symptoms prevent the possibility of error in the opposite direction, but in varioloid the very mildness of the symptoms has given rise to wrong diagnosis with disastrous results. To prevent such an occurrence it must be remembered that, occasionally, the initial symptoms may be limited to headache, chilliness and general pains, with an absence of vomiting or backache. The distinctive character of the rash appearing about the third or fourth day is, however, almost always retained, and the papules are not transformed irregularly into vesicles, pustules, and scabs, nor do they appear in crops on successive days.* The vesicles and pustules are also of fairly uniform size, rounded, and retain their hemispherical shape despite the influence of lines of cleavage in the skin, *e.g.*, in flexures of the joints, etc. Moreover, save in the mildest cases with very scanty eruption, one can always distinguish that the spots are *relatively* more numerous on the face, the backs of the hands, the forearms, and possibly the feet, pursuing a fairly uniform progress in each region. This uniformity of progress showing the spots in any region of the body in the same stage, is an important diagnostic point. The epigastrium may

* It should, however, be stated that a few observers have described rare instances in which, apparently in undoubted attacks of Small-pox, the spots have appeared in crops, or have undergone rapid evolution.

be quite free from spots, and even over the whole of the trunk they will be found to be sparsely distributed. Further, it is important to note that a normal temperature about the time of the appearance of the eruption does not contraindicate Small-pox, on the contrary it is more usual to meet with pyrexia than in Chicken-pox, than in mild, and modified cases of Small-pox.

PROGNOSIS.

In the prognosis of every case of Small-pox the condition as regards vaccination requires consideration, the more efficiently and the more recently performed this is, and the better the prognosis. A modifying influence may be expected throughout life, whilst efficient re-vaccination is an almost certain prophylactic against a fatal attack, however long deferred. The number of vaccination cicatrices, their distinctness and foveated character may be utilised as the means for estimating their prophylactic value.

Small-pox in an unvaccinated infant is practically always fatal, and the same may be said of the hæmorrhagic types of the disease, which have been described. *Variola pustulosa hæmorrhagica* may terminate in recovery, and this is more likely to occur if the effusion of blood into the pustules is late in appearing.

A markedly sudden and severe onset does not exclude a mild subsequent course; on the other hand if the symptoms during the stage of invasion are mild a favourable prognosis may be hazarded. The more marked the prostration, and the longer it persists, the more severe is the attack likely to be. Particular attention should

be devoted to the nervous system, such symptoms as continued restlessness, insomnia, and delirium being unfavourable.

Accidental erythemata during the invasive stage are rather of good omen than the reverse; if, however, petechiæ develop in the axillary and crural regions the prognosis must be much more guarded, though they are not necessarily of grave significance.

On the appearance of the eruption some idea of the severity of the attack may be obtained from the number of spots, though it must be remembered that, in vaccinated persons an apparently serious case with profuse eruption may cease to progress at any stage, and proceed to recovery. Confluent cases must always be regarded seriously, the mortality of this type being variously estimated at 30 to 75 per cent. In the discrete form the rate of mortality is relatively low (about 4 per cent.). Laryngeal complications and pneumonia are of very serious moment. As in other acute infections prognosis must also take into account the age of the patient, the previous condition of health, or some super-added affection. Debilitated, aged, and alcoholic persons, or those suffering from chronic diseases (*e.g.*, nephritis) shew greatly diminished powers of overcoming the disease. In pregnant women there is not only great liability to abortion, but the rate of mortality is very high in all types of the disease.

In the unvaccinated the death rate is highest in young children, and lowest between 10 and 15 years of age.

TREATMENT.

The mildest case of Small-pox must be

isolated in a special hospital, such institution being placed in a sparsely populated district, and well removed from the residences of other healthy or sick persons. Stringent quarantine regulations are also necessary for all the officials and servants. Every individual in any way associated with a Small-pox hospital must be rendered immune by vaccination, and doubtful cases admitted must also be submitted to the operation. It is advisable under the latter circumstances, on account of urgency, to use lymph from more than one source in order to obviate the risk of failure.

The house, etc., from which the patient is removed, and its contents must be disinfected, and exposed persons either vaccinated or quarantined for two weeks.

Mild cases require no special treatment. Malignant cases must be symptomatically treated, *e.g.*, warm packs and stimulants for collapse, turpentine for hæmatemesis, ergotin for metrorrhagia, large doses of perchloride of iron for the various other hæmorrhagic conditions, but all measures in these cases are likely to be of no avail.

Considering now a case of ordinary severity, the patient should be confined to bed, a nourishing liquid diet administered, and the hair cut off, this being desirable not only on account of the frequency with which the hair falls out, as well as for the more efficient relief of headache, but also in anticipation of the subsequent free pustulation which occurs on the scalp.

Antifebrin, phenazone, phenacetin, etc., are valuable for the early headache and general pains, and tepid sponging, packs, or even cool

baths with cold to the head for the feverish condition. If pain is very severe or sleeplessness and delirium troublesome, chloral, opium or morphia may be necessary. A word of warning must be given against the use of hot or irritating applications early in the attack, as these may increase the severity of the rash in that area. Iced compresses are better for the relief of pain and swelling.

On the fall of the primary pyrexia a more solid diet may be allowed if desired by the patient.

Vomiting must be checked by salts of Bismuth, effervescing drinks and the administration of milk in small quantities only, or if necessary peptonised. For diarrhoea chalk preparations, vegetable astringents, tannalbin, and opium are indicated.

With the development of the rash it is advisable to keep the face and hands covered by moist cloths, holes for the mouth and eyes being made in the mask. Innumerable remedies have been suggested for wetting the cloths, or applying locally, but none have any specific virtue. A lead lotion compress, or "glycerine poultice," using equal parts of glycerine and water, is as effective as any other means, whilst for the rest of the body it is advisable to oil the surface frequently in order to allay irritation and diminish the likelihood of ærial convection. At the same time the body must be lightly covered with the bed-clothes, and regular warm sponging or bathing is acceptable. It is often advisable to completely remove the weight of the bed-clothes from the body by the use of a cradle.

The strictest watch must be made, even in the

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absence of marked delirium, for any tendency to suicidal or homicidal mania, and if necessary suitable measures of restraint adopted, either by providing extra assistants or, in addition, by so fixing a strong sheet along the sides of the bed, as to permit the patient to move freely under it, without allowing him to throw back the clothes.

Conjunctivitis must be treated by frequently bathing the eyes with warm mild antiseptic lotions. With much hyperæmia iced compresses should be applied. When ulceration of the cornea, iritis, keratitis or pustules on the conjunctiva develop, more energetic measures are necessary, *e.g.*, instillation of atropin, painting with a solution of protargol (5 to 10 grains to the ounce), or Nitrate of Silver (3 to 5 grains to the ounce), but in these cases the advice of an eye specialist should be sought.

Otitis media and its sequelæ are to be treated on the usual principles (see Scarlet Fever). The mouth must be regularly cleansed, glossitis relieved by sucking ice, and laryngitis by inhalations of steam, compresses to the neck, or on the supervention of stridor by resorting to tracheotomy.

The greatest difficulty is often experienced during the period of suppuration. The skin is so tender that the patient may be unable to obtain any rest, though his suffering may be somewhat relieved by the use of a water-bed. He may be unable to bend his limbs to assist or feed himself, and yet he is in a life and death struggle with an exhausting septicæmia. The need for constant nursing, attention, and the regular administration of nourishing food, which

is required to maintain the patient's strength can thus be readily imagined.

In general, as regards local treatment, it is found that frequent warm bathing of the body, or the use of warm baths, with the free application and repeated changing of absorbent dressings, when the pustules rupture, constitute the basis of the management of this troublesome condition.

The patient must not sit up on account of the risk of fatal syncope. Septic collections, *e.g.*, boils, abscesses, empyema, etc., must be treated by evacuation and drainage.

During desiccation itching may be a marked feature; it should be relieved by regular warm baths, followed by inunction with a mild antiseptic ointment, or covering with cloths soaked in weak carbolic acid or corrosive sublimate solutions.

The severity of the suppurative process, and the later development of impetigo has been stated to be somewhat curtailed by painting the surface of the skin with iodine early in the eruptive stage. The use of red light is probably not efficacious in this direction.

During convalescence a liberal diet, regular bathing, and the administration of quinine, and preparations of iron are to be recommended.

Isolation is to be maintained till all signs of pustulation or scabbing have disappeared. For the hastening of this process it is frequently necessary to scoop the dried-up brownish or blackish remains of the pustules out of the hardened skin on the palms and soles.

VACCINATION.

Vaccination is the process of the inoculation of the body with vaccine lymph. It is resorted to as a protection against small-pox. Vaccine lymph was originally obtained from the vesicles of cows suffering from Vaccinia or Cow-pox. It is at present not decided whether this disease in cows resulted from inoculation with the Small-pox virus, or whether the two diseases had a common ancestor. Experimental inoculation of cows with Small-pox lymph does not give rise to Cow-pox. Nevertheless the repetition of the process from one cow to another, after three or four removes, in successful cases, has produced a lymph with all the properties of vaccine lymph.

The original investigations by Jenner demonstrated that after successful vaccination, Small-pox virus could be inoculated with impunity, and subsequent experience has, to the unbiassed mind having any practical acquaintance with Small-pox, abundantly confirmed the prophylactic value of the operation against that disease.

It would occupy too much space to go into the evidence at all in detail, but the following facts are worthy of recapitulation: (1) The morbidity and mortality from Small-pox have been enormously diminished since its introduction. Previously it was commonly said that "from Small-pox and love but few remain free." This unenviable position has now been taken by Measles. (2) The age incidence of, and the maximum rate of mortality from Small-pox have changed from infants and young people, who are now largely vaccinated, to adults and older

persons, who have neglected to keep themselves immune by its repetition. (3) The most efficiently vaccinated communities are now most free from Small-pox. (4) In every epidemic severe and fatal attacks are more numerous, *relative to the numbers* in each class concerned, in the unvaccinated or inefficiently vaccinated patients. As mentioned under Small-pox the number and character of the foveated cicatrices is an indication of the degree of prophylaxis obtained. (5) Though natural immunity to Small-pox is most unusual, physicians, nurses, and attendants in Small-pox hospitals regularly live in the most intimate contact with the patients without contracting the disease, after recent successful vaccination. (6) Patients removed by error to a Small-pox hospital are repeatedly being protected by immediate vaccination. (7) Failure to observe the procedures mentioned in (5) and (6) has on more than one occasion led to the contraction of Small-pox. (8) Protection may be obtained even if the operation is postponed for three days after exposure to infection. (9) During the next three or four days, that is from the fourth to the seventh days of incubation, though protection is incomplete the subsequent attack of Small-pox will be more or less favourably modified. (10) If maturation of the vaccination does not occur before the time for the development of the eruption, the two affections will run concurrently, the attack of Small-pox being uninfluenced. (11) After the development of the Small-pox eruption, it is impossible to perform vaccination successfully. This constitutes a most reliable diagnostic test in doubtful cases.

In members of the same family arm to arm vaccination may be practised. The lymph must be taken from normal looking vesicles not later than the 8th day, before suppuration has occurred, or a marked areola has formed. The vesicle is to be pricked in several places without drawing blood, and the extruding clear droplets used.

In general it is preferable to use one of the various strains of calf-lymph supplied. By this means there is no fear of inoculating syphilis or tubercle, and the mixture of glycerine in the preparation will have destroyed any septic micro-organisms which may have been originally included.

The underlying principle is the aseptic introduction of the lymph into the system, and the subsequent protection of the wounded or inflamed surface from extraneous contamination. The site usually selected is the upper arm over the insertion of the deltoid muscle. If desirable the outer side of the thigh may be chosen.

The skin having been washed with soap and water, and subsequently rubbed with ether or alcohol, the contents of the tube are placed in 3 or 4 separate pellicles on the sterilised skin, each pellicle being at least $\frac{1}{2}$ inch distant from its neighbours. Whilst slightly stretching the skin, it is gently scratched through each pellicle of lymph until blood just begins to shew itself on the surface.

After a few minutes the site is covered by an aseptic dressing. If a bandage be necessary to hold the latter in position it should be removed after a couple of days. It is very essential that, as inflammatory swelling takes place, the circula-

tion of the part should not be interfered with, and no shields or other apparatus should be used, which may mechanically produce rupture of the vesicle, or local irritation. If rupture occurs a clean absorbent dressing only is required.

Whilst preventing local impregnation with any other infectious material, it is also important to guard against re-inoculation of the lymph into another region.

If the above instructions are followed the supervention of such diseases as erysipelas, sepsis, and syphilis may be dismissed. Tetanus may arise from a contaminated lymph, but it is practically unknown in this country. Gangrene may follow in debilitated, anæmic children, so that, save in the presence of an epidemic, it is advisable to postpone the operation till the infant is in a more healthy condition. In generalised skin eruptions, or in hæmophilic individuals, the operation should also not be performed save under urgent necessity, and the same rule should be observed in the presence of eczema, since the inoculation of an eczematous region by lymph may be followed by serious and extensive inflammatory changes.

The part inoculated should not be subjected to more movement than is necessary throughout the period that acute changes are taking place, and on the occurrence of marked inflammatory œdema more complete rest, and sedative aseptic applications are advisable.

A certain amount of feverishness and indisposition must be expected, but it is unusual for the general symptoms to be of such severity as to necessitate confinement to bed.

About the tenth day (possibly as early as the 3rd or as late as the 18th), a pinkish morbilliform eruption may appear (*roseola vaccinosa*). The macules are less raised than in Measles, and are generally first noticed on the arm vaccinated.

Towards the end of the first week also, or early in the second week, the vaccinia may become generalised. It has been suggested that dissemination may occur by the lymphatic, digestive, respiratory or circulatory tracts, but it is probably not infrequently also due to an auto-infection. The spots have been especially noted on the wrists, and on the back; they often appear in groups, which shew different stages, and are associated with fever.

The following classification of the complications and accidental eruptions, and their probable dates of occurrence has been given by Acland:—

(1) In the first three days after vaccination, erythemata, urticaria, vesicular and bullous eruptions, and invaccinated erysipelas. Bullous eruptions may also appear much later: they generally begin on the arms, arise as successive spots, and are often more numerous on the limbs than on the trunk.

(2) After the third day to maturation, urticaria, lichen urticatus, erythema multiforme, and accidental erysipelas.

(3) After maturation, generalised vaccinia, impetigo, accidental erysipelas, vaccinal ulceration, glandular abscess, boils and septic infection, gangrene, and purpura.

(4) After involution, invaccinated diseases, *e.g.*, syphilis or tetanus.

The following abnormalities in the course of vaccination may be met with :—

(1) Occasionally the development of the vaccinal lesion may be delayed even as late as a month. This occurrence is more common when the dried virus is used, and is serious if the individual has been exposed to Small-pox.

(2) At other times the reaction may be precocious. Under these circumstances it is important to make sure that one is not dealing with the spurious form.

(3) Spurious vaccination. Without the formation of a vesicle, pustule, areola and scar the reaction cannot be considered to be genuine. In re-vaccination, and more especially with calf-lymph, imperfect development not uncommonly occurs (Vaccinoid), but even then the reaction should not take place before the third day, and the operation should be repeated with a fresh strain of lymph to ensure protection.

One of the commonest types of spurious vaccination is the formation of the "raspberry excrescence." It appears early, has a conical or globular shape, is often surmounted by a crust, but not surrounded by an areola, or followed by a scar. It has no protective power.

CHICKEN-POX (VARICELLA).

Chicken-pox is an acute specific infectious disease of gradual onset, and usually presenting a mild course. The characteristic eruption appears as a rule on the first day of illness, successive crops of spots continuing to develop on the four or five days immediately following. The early formation of thin-walled vesicles, which readily break and form scabs, constitutes a marked feature of the eruption. Serious complications are quite uncommon.

There is no necessity to discuss the evidence for the separate existence of this disease, and for its absolute distinction from Small-pox; one can only marvel that certain writers of some eminence, more especially in Germany, can still endeavour to maintain their identity.

ETIOLOGY.

The disease is endemic in larger centres of population. At times it becomes more prevalent in a district, and assumes the form of a local epidemic. These occurrences are apparently independent of seasonal influence, though they have been stated to be more marked in late autumn.

Chicken-pox is chiefly met with in children, but it may occur at any age in a person not protected by a previous attack.

The micro-organism responsible for the production of an attack has not been differentiated; it is probably given off by the breath of the patient, and is very diffusible, since susceptible individuals in the immediate vicinity readily contract the disease.

Infectiousness is probably present from the earliest symptoms, and is apparently most marked during the acute febrile stage. Transmission by fomites is possible, but must be very unusual, the very mildness of the disease increasing the opportunities for direct transference.

INCUBATION PERIOD.

The incubation period is most commonly about 17 days; it has been variously fixed at from 8 to 21 days.

INVASION AND COURSE.

The attack always comes on insidiously, the first indication not infrequently being the detection of one or more papules, or vesicles on the body. At the same time there is usually feverishness with malaise, and, except in mild cases, headache and anorexia. Nausea and vomiting are quite exceptional occurrences, and there is no complaint to which special attention should be drawn, *e.g.*, pronounced headache, or backache.

Occasionally the mild invasive symptoms just mentioned may be present for one or more days previous to the development of the eruption; this is more likely to happen in adult patients than in children, and may give rise to a suspicion of Small-pox, though the temporary early high fever, severe backache, and prostration of the latter disease are never simulated.

In most instances the rash appears as small, slightly raised, soft papules, many of which in the course of an hour or two develop into well-marked vesicles. The vesicles are thin-walled, with clear contents, and very irregular in size and shape. They may be hemispherical, or the tense projecting bleb may have a more or less

elliptical base. A rounded vesicle is hardly ever found in creases or folds of the skin.

Surrounding each vesicle there is usually a narrow inflammatory areola. The areola may, however, be absent, the clear watery vesicle being then apparently situated on perfectly normal skin. In some cases the vesicle is formed with such rapidity, as to throw doubt on the existence of a previous papule.

The vesicles continue to appear in crops for four or five successive days, and irregularity in their mode of appearance, their size, and their development constitutes a well marked feature of the disease.

The earliest vesicles are generally to be found on the front or back of the trunk, others developing soon after on the face and limbs. The fresh vesicles arising on the following 3 to 5 days make their appearance in any region of the body amongst those already developed. Some of the papules never become vesicular. On the other hand vesicles present at the first examination may, through scratching or pressure, have been ruptured by the time of the second examination. The collapse of the vesicle may be complete, or the central portion may be flattened and dried forming a scab, whilst the periphery is still raised slightly by retained fluid. This pseudo-umbilicated appearance is really almost characteristic of Chicken-pox. Where the contents have been completely extruded the whole of the thin overlying cutis will be found to be drying and forming a scab. It is, therefore, not uncommon, even from the first day of the eruption, to find small papules, vesicles of irregular shape, size, and appearance, as well as scabs, in the

same region of the body, and it will at once be noted that such a combination forms a very marked distinction from Small-pox.

The rupture of the vesicles is largely due to their thin walls, but it is also to be attributed in some measure to itching, which may be troublesome, and occasion much scratching. Definite umbilication of the vesicle, as seen so frequently in Small-pox, does not occur in Chicken-pox, though occasionally a pin-point depression may be present if the vesicle has formed round a hair follicle.

The copiousness of the eruption varies enormously, and, as in Small-pox, is some indication of the severity of the attack. There may be only a few spots on the trunk and limbs, or they may attain to several thousands and may make their appearance in any situation, including the palate, palms, soles, scalp, etc. They are, however, unknown on the conjunctivæ, or the mucous membrane of the larynx.

The *relative* distribution of the spots is fairly typical, and is in distinct contrast to that seen in Small-pox; thus the eruption is most profuse on the trunk, the back being possibly more affected than the front. Next come the proximal parts of the extremities, and lastly the face and distal portions of the limbs. It will be remembered that the latter are the situations in which the eruption is *relatively* most profuse in Small-pox.

Sometimes the vesicles fail to rupture, and the contents become wholly pustular. In rare cases, more particularly in older patients with a profuse rash, the vesicles maintain a somewhat uniform size, and subsequently undergo almost

general transformation into tense pustules. In this manner a great resemblance to Small-pox may be produced.

The temperature during an attack of Chicken-pox does not present any characteristic curve. The onset of the disease may even be afebrile, though usually there is some pyrexia during the time of the appearance of the eruption, the height depending on the severity of the attack. Temperatures reaching 104°F. or 105°F. at the height of the disease are very rare, more commonly the maximum does not exceed 100°F. to 102°F. , and occasionally it may never exceed 99°F. During the four or five days it lasts, the pyrexia is of a remittent type, and terminates by lisis.

The pulse varies in rapidity with the severity of the attack, the tongue may be more or less furred but presents no characteristic features, and there is usually an absence of any symptoms pointing to an affection of the bowels or kidneys.

On the subsidence of the eruption no permanent trace is left save in the case of the deeper pustules, or where from scratching the corium has been implicated in the sore produced. The latter may give rise to large cicatrices, whilst from the former a definitely circumscribed, punched out, thin cicatrix is formed.

The immunity conferred by an attack of Chicken-pox is so great that second attacks are practically unknown.

COMPLICATIONS AND SEQUELAE.

It has already been stated that serious complications are quite uncommon, the disease being characterised by the mildness of its symptoms. Occasionally albuminuria may be detected, and

in rare instances hæmaturia and definite indications of nephritis have been noted.

At times the disease may assume a severe character and be associated with high temperature, delirium, hæmorrhage into the individual vesicles, as well as a tendency to cardiac failure, but such occurrences are quite exceptional.

The most frequent complications are of a local character, and concern changes in, or secondary infections through, the eruption. Thus impetigo, erysipelas, and even pyæmia may result from the inoculation of septic micro-organisms. In some cases the pustules themselves may enlarge and produce blebs of a pemphigoid or bullous character. In other cases some of the pustules undergo a gangrenous change giving rise to large, dark sloughs which may seriously imperil the life of the child, but they only occur in debilitated, anæmic or tubercular infants.

Synovitis and arthritis have been described as complications, as well as bronchitis and pneumonia, but these occurrences, along with the supervention of purpura during convalescence are very rare.

PROGNOSIS.

As will be gathered from the foregoing the prognosis is almost uniformly good. A high temperature (104°F. to 105°F.) with profuse eruption, rapid pulse, and restlessness may give rise to temporary concern till the severity of the infection has abated, and, on account of the risk of gangrene, and septic complications, special care must be taken in debilitated infants against the risk of secondary infection, by close attention to the skin during an attack, and by giving an abundant and nutritious but suitable diet.

DIAGNOSIS.

The onset of the disease may be preceded by, or associated with, the presence of an erythema, and as this is usually of the scarlatiniform variety, a diagnosis of Scarlet Fever may be made. Moreover it must be remembered, that the two diseases are occasionally seen to run concurrently in the same patient. In each instance other characteristic features of Scarlet Fever must be found, *e.g.*, high temperature, vomiting, marked sore throat or strawberry tongue, before the presence of this disease can be confirmed.

From impetigo the diagnosis is made by the definite and recent onset, the development of the spots in crops on successive days, by their distribution, by the history of papules and vesicles with pseudo-umbilication, and by the history of infection. The same considerations apply also to lichen, herpes, and pemphigus.

The greatest importance, however, must be attached to the differential diagnosis from Small-pox. In every case the condition as regards vaccination should be noted, and it should be remembered that in efficiently vaccinated children Small-pox is very unlikely to occur in any form under 6 or 7 years of age. Further evidence must then be obtained by considering the mode of onset, and the whole course and manifestations of the attack (see also diagnosis of Small-pox). In cases of Small-pox we meet with a sudden onset, headache, backache, chilliness, vomiting, or nausea, and high temperature. Mild initial symptoms are only occasionally seen in varioloid. The eruption appears on the third day, and is composed of hard papules, whilst at the time of

its appearance the temperature is falling or may be normal. The spots are scanty on the trunk and relatively most numerous on the face and hands, the absolute number of the spots being no reliable guide. In each region also the eruption is in a uniform stage of papules, vesicles, or pustules, which are undergoing a steady evolution. From the earlier appearance of the rash on the face than on the rest of the body, the spots are usually more advanced in the former situation. When the attack is over, the presence of round dark coloured spots in the skin of the palms, and soles, is in favour of Small-pox.

In Chicken-pox, on the other hand, the onset is almost always insidious and the eruption appears on the first day of illness. The pyrexia varies with the severity of the attack, being maintained so long as the fresh spots are appearing. Vesicles are formed almost at once, they are readily broken and collapse, so that papules vesicles, pustules and scabs can generally be seen at the same time. The eruption does not undergo a steady evolution, individual spots appearing in any part of the body for several successive days. Finally the spots are always relatively most profuse on the trunk, and vary in shape and size.

TREATMENT.

It is advisable to place the patient in a room separate from other susceptible children, as continued exposure may be a factor in causing an attack of unusual severity. Reference has already been made to the necessity for taking special pains for the protection of weakly infants against infection.

Confinement to bed is not requisite unless there is fever and malaise, and no special directions as regards diet need be given, the patient's own inclinations being a sufficient guide.

Attention to the skin constitutes the most important consideration. The giving of warm baths or daily sponging is advisable. The cleanliness of the bed linen and body clothing should be attended to, and these should be changed if soiled by secretion from ruptured pustules. The child must be prevented from scratching the skin, and absorbent dressing or antiseptic ointment applied to local abrasions after bathing. Menthol or ichthyol ointment is useful to keep the spots aseptic, and to relieve itching.

Though the presence of the pustules may produce restlessness, this can generally be relieved by covering with aseptic wool or gauze, a water bed being very rarely necessary.

In the management of doubtful cases it is sometimes recommended that such should be treated as Small-pox but *not* removed to a Small-pox hospital. Two facts may be cited against this absolute statement: (1) The infectivity of Small-pox is so great, and so readily transferred to adjoining rooms or buildings that, if the case should happen to be one of this disease, then there is serious risk of starting an epidemic. (2) In the second place it must not be forgotten that by vaccination we possess a means of protecting against Small-pox, and at the same time confirming or refuting the diagnosis. The vaccination must, however, be done at once, preferably with more than one strain of lymph, and repeated if a negative result occurs (see Vaccination).

ERYSIPELAS.

Erysipelas is an acute infectious disease characterised by inflammatory redness and swelling of the skin, which shews a tendency to spread over adjoining areas, so long as the active stage persists. The advancing edge is raised and sharply defined. The degree of fever and the severity of the constitutional symptoms accompanying the local process shew great variability.

ETIOLOGY.

The disease is endemic but exhibits seasonal exacerbations, being most prevalent in cold, damp, changeable weather. It may occur at any age, being particularly fatal in very young infants or old people, as well as in individuals debilitated by disease, occupation, mode of life, or unhygienic surroundings. Nephritis and chronic alcoholism are particularly potent predisposing factors. Some apparently healthy persons shew a special predisposition to suffer from repeated attacks. In every case, if an immunity is produced, it must be of a very temporary duration, relapses and second attacks being frequently met with.

Formerly the attempt was made to distinguish between traumatic and idiopathic erysipelas according to whether a wound was, or was not, known to be present. Nowadays it is recognised that the micro-organism may have gained an entrance by abrasions so small as to be undiscoverable, so the distinction largely falls to the ground.

An attack owes its origin to the invasion of the body by a streptococcus which may be spread through the air, or by any intermediate objects, *e.g.*, instruments, hands of attendants, clothing, etc.

The most recent experiments have tended to shew that the streptococcus described by Fehleisen, though possibly always present in the disease, is yet not specific. Suppurative lesions in other situations have been apparently produced by inoculation with the streptococcus of erysipelas, and, vice versa, this disease has been caused by the inoculation of streptococci taken from suppurative foci. It is somewhat remarkable that a disease with such clearly defined clinical characters should apparently not be due to a specific micro-organism.

PERIOD OF INCUBATION.

The period of incubation has not been definitely fixed, it may vary from a few hours to several days, four days to a week representing probably the average interval.

COURSE AND SYMPTOMS.

The onset of an attack may take place with great suddenness, persistent and uncontrollable vomiting, rapid pulse, rigor, profound prostration and hyperpyrexia being observed in severe cases. The symptoms thus arising from the toxæmia are a better guide to the severity of the attack than merely noting the extent of the area of skin affected.

More commonly the onset is insidious with headache, chilliness, malaise, and the appearance of a tender red spot in some situation, especially

about the nose, face, ears, or in the vicinity of a wound.

The inflammatory area steadily spreads over the surrounding unaffected skin, the advancing edge being raised, irregular in outline, and clearly defined. The inflamed skin is swollen, tense, tender, bright red, and frequently shews the formation of blebs of various sizes containing yellowish, serous exudation. In the older regions where the inflammation of the skin is subsiding, the redness and swelling fade gradually into the unaffected parts.

The lymph glands associated with the area implicated are swollen and tender.

The temperature usually rises suddenly with the onset of the disease, the height depending on the severity of the attack. This sudden onset is exemplified by the not infrequent occurrence of rigors as already indicated. The temperature is maintained so long as the inflammation in the skin is spreading, but it may shew considerable fluctuations.

The attack varies in length, the average period being from a week to ten days. At the end of the attack the temperature falls somewhat suddenly but defervescence may be very protracted, and relapses are common.

In most cases there is anorexia, and the tongue is furred. In some instances the mouth and throat are implicated, producing salivation, dysphagia, and sore throat. In attacks of even moderate severity albuminuria may be present, and in severe cases this is often large in amount producing definite nephritis, which may be associated with diarrhœa, convulsions, and cardiac failure. Delirium may be of an active maniacal

type especially in alcoholic patients, and is also seen in cases with hyperpyrexia, when it may be rapidly replaced by coma.

On the subsidence of the attack there is often free desquamation, and extensive shedding of the hair may take place.

DIAGNOSIS.

The essential features for the diagnosis of erysipelas are an acute illness, with the presence of a clearly defined area of inflammatory redness and swelling in the skin, the edge of which is raised, and advances steadily over adjoining regions during the acute period of the disease. Sloughing may take place as the result of an interference with the blood supply to the part, or from secondary infection with other septic micro-organisms (phlegmonous erysipelas).

In suppurative cellulitis and diffuse phlegmonous inflammations the redness is of a darker colour, and not always sharply defined. The swelling of the skin is less tense and board-like, does not spread in the same manner, and with the formation of pus fluctuation may be detected. Frequently the constitutional symptoms are less severe and less acute, and the neighbouring glands not so tender.*

In *erythema* there is usually an absence of pyrexia, and the skin is not swollen, tense, or tender. Moreover there is no raised margin and no enlargement and tenderness of the glands.

Pemphigus is usually a chronic affection, and

* Dr. Knyvett Gordon adds, as a further distinguishing feature from cellulitis, that in this disease the skin cannot be moved on the subcutaneous tissues, whereas in erysipelas the more superficial limitation of the inflammatory process permits of such movement being detected.

could not be mistaken for the blebs in erysipelas on account of the absence of the characteristic acute inflammatory changes in the skin.

Urticaria may affect large areas, but the wheals, whatever their size, do not exhibit marked tenderness, tension and redness. In addition they are scattered over the body, are only of a temporary duration, and are not accompanied by severe general symptoms, unless as a complication of some other disease.

Malignant pustule is to be diagnosed by its very localised character, the absence of a well-defined spreading margin, and the formation of a central black eschar, as well as by the discovery of the specific micro-organism.

PROGNOSIS.

The prognosis should be guarded in all severe cases with high temperature (over 104°F.), persistent vomiting, marked albuminuria, and profound prostration.

Attacks in puerperal women, in the new-born, in the aged, in debilitated and alcoholic individuals, or in those suffering from a chronic ailment are also very grave.

Recognising that the disease is generally self-limited in 7 to 10 days, the probabilities of recovery must be judged from the rapidity and state of the pulse, and the acuteness and severity of the symptoms. Hyperpyrexia, pericarditis, endocarditis, and signs of meningitis are very grave complications.

Signs of laryngeal obstruction from œdema glottidis, of pneumonia, of lividity whether from cardiac dilatation or from changes in the blood, and finally a typhoid or comatose state, are usually of fatal augury.

Erysipelas migrans, in which the disease continues to appear even for months in various parts of the body, is said to be a particularly dangerous form of the disease.

TREATMENT.

The patient must be confined to bed and isolated. The degree of isolation requisite necessarily varies with the surroundings. The most urgent action, and strict quarantine is to be recommended to prevent its contraction by those who have already been stated to be predisposed. In surgical wards, maternity hospitals, and even in medical wards, the greatest care should be taken by those coming into association with patients, to prevent its introduction, and the occurrence of a case must be followed by prompt removal, and thorough disinfection, which should include instruments, utensils of all kinds, clothing and bedding, as well as the room itself, and the person and covering of the attendants.

In the absence of any contra-indication in the surroundings, and in severe cases with adequate accommodation and assistance for nursing, the patient may, without any disadvantage to himself and his friends, often be isolated in his own home.

The sick-room must be of sufficient size, free from unnecessary furniture, and dust-containing articles, and it must be separated from the rest of the house as in other infectious diseases. The same considerations also apply for disinfection, and for those mediating between the sick and the healthy.

A nourishing liquid diet must be administered

from the outset. Vomiting must be treated by effervescing cold drinks, salts of Bismuth, dilute hydrocyanic acid, and, if necessary, by morphia. For diarrhoea, preparations of chalk, tannalbin, vegetable astringents and opium are indicated, whilst in delirium, paraldehyde, veronal, chloral, or morphia are to be given; other complications, *e.g.*, otitis media, pericarditis, etc., must be treated on ordinary principles.

A close watch must be kept on delirious or alcoholic patients, and efficient help should always be at hand in case they become maniacal. Moreover, all articles such as poker, knives, etc., which might be used as dangerous weapons of offence, must be removed.

The bed clothes must be light and, when pyrexia is marked, tepid sponging or even cold packs, and ice, or alcoholic, rubs are beneficial. With hyperpyrexia an ice-pack or cold bath is urgently indicated.

With signs of cardiac failure or severe prostration, stimulants may be used freely.

Antistreptococcus serum has been tried but the results obtained hitherto are not conclusive, failures being recorded on numerous occasions. In the first place it is possibly advisable that streptococci from more than one case of erysipelas should have been used in its production, and, judging by the effects described in Scarlet Fever, large doses (up to 100 c.c.) are to be recommended. As regards local applications to the skin, the methods and substances vaunted from time to time have been almost innumerable.

Since the streptococcus is present at the advancing margin of the inflammatory area, attempts have been made by the injection of

antiseptics, by scarification followed by the use of antiseptics, as well as by local constriction or cauterisation, to destroy the microbe locally, or prevent it from spreading in the lymphatic spaces. It may be said that all these methods are of no avail.

The following applications, though not exhibiting any specific action, will serve as a basis for choice. (1) Ichthyol ointment 10 to 50 per cent. (2) Lead lotion compress. (3) Glycerine poultice. (4) Compress of 1 in 20 sodium salicylate. In combination with the last mentioned the administration of quinine and salicylate of soda on alternate days has been strongly advocated.

Whatever the topical remedy selected it must be kept in constant, and close contact with the skin. When the eyelids are much swollen, coverings must be regularly removed to permit of the eyes being washed with mild antiseptic lotions.

Increasing doses of perchloride of iron have been recommended during the acute stage of the disease, and this drug has long held its place as a valuable internal remedy in erysipelas.

During convalescence, tonics, preparations of iron, good food, and change of scene are all required to overcome the debilitating effects of the illness.

TYPHOID FEVER (ENTERIC FEVER).

Enteric Fever is an acute specific infectious disease, the attack in almost all cases setting in gradually. There is, in the enormous majority of the cases, some evidence of an affection of the intestinal tract with enlargement of the spleen. After the first week characteristic spots often appear, more especially on the skin of the abdomen. They come in crops. The whole course of the disease lasts on an average about 3 weeks, but it may be much shorter, or greatly prolonged. The temperature pursues a fairly characteristic course, and numerous complications and sequelæ may arise. A relapse occurs in a not inconsiderable proportion of the cases.

ETIOLOGY.

The disease is endemic in large centres of population, but it shows a decided seasonal epidemic prevalence, the height of which is attained in each autumn. It has thus been called Autumnal or Fall Fever. The autumnal epidemicity varies greatly from year to year, being decidedly more marked after hot dry summers. It has for long been held that this periodicity is connected with alterations in the level of the ground water, and with the opportunities for contamination of the subsoil water, owing to its abnormal sinking or subsequent flushing. There is, however, a growing belief that it is related in no small degree to the prevalence of flies at this period.

Since infection is contained chiefly in the

urine and fæces, the methods by which the disease may be transmitted can in large part be readily imagined. The habits of flies are too well known to require further consideration, they offer a ready explanation for the relatively more common occurrence of the disease in houses with middens, and cess-pools, as well as for the recurrence of the disease in the same or adjoining houses in successive years.

Severe epidemics have from time to time arisen by pollution of the water supply, either from cesspools to surface wells, or from the adjoining gathering ground to reservoirs. The use of such contaminated water in cleansing milk cans has infected the milk supply, but this may also arise by direct infection from those suffering from the disease, or attending on the sick, and taking part in the milking of cattle without disinfecting their hands. With the contamination of milk the possibilities of butter being infected must also be included.

Various other forms of food have also been infected, more especially shell-fish, *e.g.*, oysters and mussels, or cress, from sewage flowing over the gathering ground. Since freezing does not at once destroy the micro-organism, the dangers of ice and ice-creams will be readily recognised.

It is further evident that attendance on the sick is not devoid of risk, and the frequent occurrence of the disease amongst nurses in fever hospitals is a sufficient proof of this. The handling of the bed-linen, and bed-pans, and the washing and cleansing of the patient offer the means for infection, unless the greatest care be taken with personal cleanliness, and disinfection. On this

account the use of rubber gloves has been recommended, and if properly used, *i.e.*, disinfected before removal, and the hands again well washed after leaving the sick room, they should form an excellent preventive.

So long as the infectious material is not allowed to become dry, there is no risk of the disease being conveyed through the air.

An attack may occur at any age, but the disease is only occasionally met with in infants and old people. The greatest percentage of the patients are between 15 and 25 years, the sexes being fairly equally affected. From that age period the rate of morbidity falls in each direction. It is possible that infants do not enjoy anything like so marked a relative immunity as has been surmised, the abnormality of the clinical appearances at that age accounting for the disease being frequently undetected.

It is probable that one attack confers a somewhat lengthy immunity, and that this accounts, in some degree, for the stated greater liability of the disease to arise in those who have recently come into an infected district. Second attacks, however, are by no means uncommon.

A previous intestinal affection, *e.g.*, catarrhal enteritis, is said to predispose to the disease. There is, at any rate, evidence that a large percentage of the severe type, known as "colotypoid" fever, in which the large intestine is chiefly or prominently affected, occur in persons who have suffered from some chronic intestinal trouble.

An attack of enteric fever is the result of infection with Eberth's bacillus, the micro-organism gaining entrance by the intestinal tract or

possibly in rare instances by the breath. A *de novo* or "pythogenic" origin is no longer accepted.

INCUBATION PERIOD.

The period of incubation is of variable length, but the average time may be fixed at two to three weeks. During that interval there are, as a rule, no symptoms. Prodromata may, however, occur in the form of malaise, languor, looseness of the bowels, headache, insomnia, anorexia, and slight irregular pyrexia, with chilliness.

SYMPTOMS AND COURSE.

The invasion of an attack nearly always takes place gradually, the symptoms mentioned as prodromata being also met with at the time of onset. Particular attention must be drawn to the occurrence and persistence of headache, which may be frontal or occipital.

The tongue is furred, appetite lost, a gradually increasing weakness and indisposition is experienced, and the temperature in typical cases rises by stages during three or four successive days. In many instances there is epistaxis, occasionally there may be vomiting, and some abdominal pain or discomfort, whilst even after a few days' illness the spleen is frequently enlarged, and the diazo-reaction may be obtained in the urine. The latter is also at this time diminished in quantity, and of a darker colour than normal.

In mild attacks no further symptoms may be detected, and after the temperature has been maintained for a variable period at 101°F. to 102°F., the morning record being slightly lower than the evening one, gradual recovery ensues.

In other instances, however, the temperature attains a higher level, 103°F. to 104°F. , the headache continues till the end of the first week, and may be replaced by mental confusion or dulness, with drowsiness or delirium. The cheeks are flushed, the pupils dilated, the sclera clear, the skin is hot and frequently presents numerous sudamina. The pulse is at first slow considering the height of the temperature and the evidence of toxæmia, but later full and dicrotic. The breath has a peculiar musty and offensive, almost fœcal odour; the fur on the tongue may slowly disappear, often at first from the centre, sides, and tip, later over the whole dorsum, leaving a red surface. In severe cases it becomes dry and cracked, and sordes collect on the teeth. The abdomen becomes full, rose-spots appear on the body during a period of one or two weeks, diarrhœa occurs or is aggravated, and the spleen increases in size. In most cases also there is bronchitis, which in severe attacks, constitutes a marked feature of the disease.

After maintaining this condition for a variable length of time, a tendency to a greater morning remission of the temperature is noted in favourable cases. On succeeding days this becomes more marked, and is followed by a remission in the evening temperature, the pyrexia thus disappearing by lysis, often accompanied with more profuse perspiration. The symptoms enumerated above then undergo gradual abatement.

In severe attacks the pulse increases in frequency, and becomes smaller, signs of cardiac dilatation occur, the sounds at the apex may at first show increased sharpness, but later the first sound becomes diminished and indistinct, or a

foetal rhythm or systolic apical murmur develop. Delirium, instead of being limited to the night time, becomes continuous, and may be of a muttering wandering type, or active and noisy, whilst in other cases there is marked somnolence, and a semi-comatose condition. The tongue is now possibly dry and contracted, so that protrusion and articulation are difficult. Diarrhœa may be excessive and accompanied by marked tympanites, or again, in some, intestinal hæmorrhage or perforation may supervene. The urine is diminished in quantity, and may contain a variable amount of albumen. Marked rhonchi are present all over the lungs, and later broncho-pneumonia may develop. With failing heart there may be œdema at the bases of the lungs, the hypostatic congestion proceeding further to pneumonic infiltration. Carphology (grasping at imaginary objects), floccitation (picking at the bed-clothes), or subsultus tendinum (jerkings of the hand and fingers) may appear in so-called ataxo-adyamic attacks, and the patient may pass into a comatose state with eyes open and fixed (coma vigil).

All of the symptoms just enumerated as occurring in severer cases are not only signs of great gravity, but of more or less immediate danger, a fatal issue taking place with signs of cardiac dilatation, *e.g.*, failing pulse, cyanosis, coldness of the extremities, profuse clammy perspiration, and finally tracheal rales.

Though the foregoing represents a general picture of the conditions met with in various cases of enteric fever, it is important to consider some of the symptoms and signs in greater detail.

ERUPTION.

Rose-spots are present in more than half of the cases. They vary greatly in number. As extreme conditions only one or two may be detected, or rarely, they may be so profuse on the trunk as to simulate an exanthem. They are always in relatively greatest number on the skin of the abdomen, and lower part of the chest. They make their first appearance usually at the beginning of the second week (7th to 12th day), and may continue to appear in crops until deferescence is completed.

Each spot is of a pinkish colour, soft, slightly raised, rather oval in shape, the long axis is from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in length. The edges of the spot fade off into the surrounding skin. The spots are just discernible to light palpation, and disappear completely on pressure. Each spot lasts about four days, and the development in crops is best detected by placing a uniform mark round those which appear on the same day. The spots may sometimes be surmounted by a vesicle, but are never petechial.

STOOLS.

It must not be forgotten that in some epidemics, even to the extent of half of the cases, and more especially in mild or only moderately severe attacks, constipation may exist throughout the whole course of the illness. When diarrhœa occurs the stools are at first of normal colour but unformed, in many instances they then become bright green and choppy. Subsequently a liquid, highly offensive yellow stool (pea-soup) of penetrating odour, and depositing a granular sediment, is met with, but this is not by any

means pathognomonic. The number of stools may vary from 5 or 6 to 20 or 30 in the twenty-four hours, the higher frequency being especially seen with marked ulceration of the colon ("colotyphoid"). Sloughs, shreds of mucus, or small quantities of blood may be detected in the stools in the later stages.

ABDOMEN.

With marked diarrhœa there is not infrequently much gaseous distension (tympanites). The abdomen is tense and resonant all over, and gurgling may be periodically audible. Tympanites may also be present with only slight diarrhœa, in cases which have been badly fed and nursed, or, in association with constipation, it may be a symptom of peritonitis.

INTESTINAL HÆMORRHAGE.

Intestinal hæmorrhage is met with in about 6 or 7 per cent. of the cases, the amount varying from 1 or 2 ounces to 1 or 2 pints. Single small clots or streaks are not included in the term. The larger hæmorrhages are often accompanied by a fall in the body temperature, and may produce fatal syncope. The blood may arise from oozing at the inflamed or ulcerated surface, or from the erosion of a vessel. It is evident that small amounts of blood, which are indistinguishable to the eye might be detected by chemical tests, but the term is limited to cases in which bright red, fluid blood or clots, not proceeding from hæmorrhoids, are clearly distinguishable.

At the time of a severe hæmorrhage a sickening, offensive odour, often pervades the room.

As recovery takes place, the blood retained in the intestine undergoes alteration, the stools becoming tarry and of a pasty consistence.

INTESTINAL PERFORATION.

In a certain proportion of the severer cases of hæmorrhage, intestinal perforation arises either about the same time or subsequently. This complication, however, may also occur without any association with hæmorrhage. It is seen in about 3 per cent. of all cases, and is, relatively, decidedly more common in men. A certain amount of abdominal pain and tenderness, with occasional vomiting, may be present throughout the attack of enteric fever, but the occurrence of perforation is usually distinguished by the onset of sharp pain in the right lower quadrant of the abdomen. The temperature at the time rises suddenly, or may undergo a marked temporary fall, the pulse increases in frequency, the abdominal walls become rigid, there is tenderness to deep pressure, and the respiration assumes the costal type. In some cases the patient is conscious of some sudden grave alteration in his condition.

The foregoing symptoms are always sufficient to warrant a provisional diagnosis of perforation, and a resort to exploratory laparotomy, preparation being also made for the suturing of the bowel over the perforation, should one be found. It is futile to wait for the disappearance of the liver dulness, or for vomiting, tympanites, constipation, frequent or painful micturition, or signs of collapse, since the chances of success depend upon early operation. The onset of sharp pain in the situation mentioned, with ab-

dominal tenderness and rigidity, after the attack has lasted two weeks, constitute so frequently the first indications that perforation has occurred, that these symptoms in themselves justify surgical intervention. Even if the suspicion be unconfirmed little harm will probably have been done. On the other hand it is only by adopting an attitude of this description that one can hope to obtain any diminution in the very high rate of mortality after perforation has occurred.

PERITONITIS.

Peritonitis may also arise by extension of the inflammatory process to, or infection of the peritoneum without perforation, from rupture of a mesenteric gland, or from rupture of the gall-bladder owing to ulcerative cholecystitis. In each of these conditions the symptoms are similar to those occurring in perforative peritonitis, but the pain may be situated in a different region, and the downward course may be less acute. In addition loss of the liver dulness is less often seen, but this is far from being a constant sign in perforation.

BACILLURIA.

Some of the changes in the urine have already been described, but special mention must be made of typhoidal bacilluria. Eberth's bacilli have been cultivated from the urine even in 25 per cent. of the cases. They are most frequently found late in the attack or during convalescence, and may be so numerous as to produce a slightly opalescent shimmering appearance in the urine, with or without the presence of pus from an associated pyelitis. The bacilli

have been known to be present in the urine for long periods after the completion of the attack of Enteric Fever (so-called typhoid carriers), so that the risks of dissemination and the necessity for disinfection are quite apparent.

A similar persistence of the bacilli may be met with in the stools, the source in these cases being the gall bladder, when the micro-organisms apparently continue to grow, and be discharged with the bile into the duodenum.

BLOOD.

The blood in uncomplicated cases shows a reduction of hæmoglobin, and a hypoleucocytosis with a relative increase of small mononuclear lymphocytes. Polynuclear leucocytosis may occur from various complications. These characters may be of diagnostic value, but the most important features in this respect are (1) the power of the serum to agglutinate a fresh cultivation of Eberth's bacilli (Widal reaction), and (2) the possibility of cultivating this micro-organism from the blood. The last-mentioned process constitutes the most definite diagnostic procedure; special bacteriological facilities are necessary, but in doubtful cases it may be of the greatest value, the bacilli being regularly discoverable in the blood, by appropriate methods, in the early period of the attack. Usually the blood is taken from a superficial vein by means of a syringe under strict aseptic precautions. Successful results have been obtained by pricking the end of the finger, but the difficulty is to prevent septic contamination from imperfect disinfection of the skin. A series of flasks containing bouillon are inoculated with small quantities of the blood and

incubated. Recently Conradi has suggested the collection of the blood into tubes containing bile* to prevent coagulation of the former, in the belief that this change in the condition of the blood develops bacteriolytic properties.

For the performance of the Widal reaction a small quantity (*e.g.*, a loopful) of a culture of bacilli, under 24 hours old, is mixed with ten or more times as much serum from the blood to be tested, and the mixture allowed to stand for a definite period. An examination is made at intervals, and in positive cases the bacilli, instead of uniformly covering the field and swimming freely about, are seen to be collected into clumps of greater or less size, with little or no free movement. With larger amounts in a test-tube (macroscopical test) the bacilli fall to the bottom, leaving the supernatant fluid clear.

As a modification of the Widal reaction, Ficker found that very reliable results could be obtained with dead bacilli, thus obviating the danger of infection. Recently the means of making this observation have been placed within the power of every medical practitioner by the introduction of the agglutometer.†

TERMINATION OF ATTACK AND SEQUELAE.

The character of the defervescence has been already described. It is usually accompanied by polyuria, which has been stated to be an early and reliable sign of the termination of the acute symptoms. In a large percentage of the cases, however, the temperature does not pursue a normal course. Slight exacerbations occur from

* Meyerstein finds a solution of bile salts equally efficacious.

† Messrs. Parke, Davis & Co. *B.M.J.*, March 17, '05, p. 629.

complications, from excitement, from injudicious feeding, and even not uncommonly without apparent cause, *i.e.*, recrudescences. In some cases the temperature, instead of settling, continues to intermit for long periods without discoverable evidence of suppuration or other cause. A more liberal diet is sometimes the best treatment for this condition, as it may be due to marasmus. Even as long as four weeks after the termination of the primary attack, there is the possibility of a relapse, in which all the symptoms and signs of the disease may be again repeated.

RELAPSE.

The relapse occurs most commonly within 12 days of the completion of the primary attack, it may even arise during defervescence, and there can be little doubt that very prolonged attacks are of an identical nature, that is to say, superimposed relapses or re-infections. The occurrence of a relapse is evidently the result of a re-infection, but whether this is due to the infection of fresh Peyer's patches from the intestine, or of an excessive extrusion of bacilli from the spleen into the blood stream is not known. It is usually of shorter duration and milder character than the primary attack, but may be of greater severity, any of the symptoms or complications already enumerated being repeated. It must be carefully distinguished from a recrudescence, and for its diagnosis one or more characteristic features are requisite, *e.g.*, course and length of temperature curve, rose-spots, etc.

It is probable that suppurative parotitis usually arises by infection through Stenson's duct, so

that the importance of regularly cleansing the mouth is seen in this respect, as well as in the diminished risk of an inhalation pneumonia, or other septic complications of the respiratory tract.

The catarrhal inflammation in the throat may spread along the Eustachian tube, giving rise to a certain amount of deafness, and even to suppurative otitis media. On the other hand it is only to be expected that the auditory nerve will be affected by the general toxæmia, and it has been stated that typhoid deafness is sometimes labyrinthine in origin. The inflammatory process may also extend to the larynx, producing a simple congestion, but in severe cases the changes may be more marked and show themselves as œdematous or ulcerative laryngitis, or suppurative perichondritis, and necrosis. The development of hoarseness in Enteric Fever should always be looked upon with some concern, and immediate steps taken by means of inhalations and compresses to alleviate the condition. Usually there is no pain and no dysphagia, though with perichondritis there may be tenderness. It is remarkable to what degree stenosis may proceed before urgent symptoms arise; the earliest indications are not infrequently noted during sleep, and relief by tracheotomy must not be postponed too long, on account of the danger of sudden collapse.

Endophlebitis and endarteritis are not uncommon complications of severe attacks, and the latter may even give rise to gangrene. The most frequent affection of the vessels, however, is a venous thrombosis implicating the femoral vein or the deep veins of the calf. There is usually some pyrexia, and often marked pain and tenderness. The limb is swollen, the superficial veins

evidently enlarged, and in some cases apparently there is an associated lymphatic obstruction, recovery from which may be very tardy. The complication occurs towards the end of an attack or during early convalescence.

Periostitis is especially seen on the ribs or tibiae, in the former the cartilage may be attacked (perichondritis). Other bones may also be affected. A localised tender swelling is produced, which may subsequently disappear, or break down and undergo necrotic changes requiring active surgical intervention. It occurs especially in convalescence.

Occasionally during convalescence the patient suffers from severe pain, especially in the lumbar region of the spine. Frequently the patient is confined to bed, the slightest movement being accompanied by unbearable suffering. No evidence of an organic lesion such as alteration of deep reflexes, anæsthesia, etc., can be discovered, but there are almost always indications of a functional neurosis, *e.g.*, hyperæsthesia, or emotional excitement. The condition may last a variable length of time, but as it invariably ends in recovery, its pathology is unknown.

Suppuration may be met with in various situations, *e.g.*, the subcutaneous tissue, the pleural cavity (empyema), the joints, the thyroid gland. The condition of the intestines, and of the patient generally, is sufficient to account for the origin of the septic infection. It is, however, highly probable that some of the suppurative complications, more especially those occurring as late sequelæ, are due to the specific bacillus.

Arthritis is usually monarticular, and may or may not proceed to suppuration. The larger

joints, *e.g.*, the shoulder, are most frequently involved. The mental changes described as occurring in the attack may, during convalescence, be replaced by melancholia, possibly with suicidal tendencies, thus necessitating the strictest supervision during this period.

Other manifestations of alterations in connection with the nervous system may take the form of post-typhoid dementia (which in most cases is followed by ultimate recovery), meningeal irritation, serous and even purulent meningitis, encephalitis, convulsions and peripheral neuritis.

The occurrence of rigors is almost always limited to cases of some severity, they are met with late in the attack, are often associated with very great and sudden variations in the temperature of the body, are probably as a rule of septic origin, and may be very alarming, though they do not in themselves specially affect the prognosis.

When the attack of enteric fever is over there is usually marked bradycardia, frequently anæmia, and there may be marasmus to be overcome. The low state of vitality causes a liability to secondary infections, *e.g.*, erysipelas, noma, diphtheria and tuberculosis. Even without apparent lesion of the biliary tract typhoid bacilli seem in a large percentage of cases to gain an entrance into the gall-bladder, since they can frequently be obtained in pure culture from its contents at the autopsy. Numerous instances are on record where the changes induced have, after variable intervals of time, led to the development of cholelithiasis. The large number of typhoid bacilli which may be found in the gall-bladder has even given rise to the suggestion

that the production of an excessive flow of bile, by too early administration of food, may be the cause of a relapse.

In connection with the skin reference must be made to bed-sores and the necessity for their prevention by cleanliness, avoidance of any source of irritation, or pressure, *e.g.*, folds in the sheets, and the use of air-cushions and water-beds. It has been said that the best treatment is to discharge the nurse.

During the attacks ill-defined, bluish, non-raised circular spots (*taches bleuâtres*) about one-quarter of an inch in diameter may occur on the abdomen; they are not limited to this disease and are apparently of parasitic origin.

It is important also to note that the giving of an enema is occasionally followed by a distinct scarlatiniform erythema, whilst in most cases not treated regularly by baths or packs, there is a certain amount of desquamation noted after the illness has continued a few weeks.

The variety in the clinical manifestations met with is very great, some of the appearances are of sufficient importance to demand special reference. The attack may set in quite suddenly with rigors, thereafter it may present an ordinary course, or may show at first all the evidence of acute croupous pneumonia. This form, known as pneumo-typhoid, in which the usual symptoms of Enteric Fever only develop subsequently, must be clearly distinguished from pneumonia occurring as a complication in the later stages of the disease. The former is supposed to be due to the direct action of the typhoid bacillus, though it is conceivably due to a concomitant action of the pneumococcus.

In a similar manner the brunt of the affection may fall on other organs, *e.g.*, the kidneys, when there is much albumen and possibly blood in the urine (nephro-typhoid), or the meninges when severe headache, photophobia, strabismus and retraction of the head may be present (meningo-typhoid).

The attack may be so mild that the patient is not confined to bed during the whole period (ambulatory typhoid). It has happened on more than one occasion that perforation of the intestine has occurred during apparent good health, the autopsy revealing the existence of one or two typhoidal ulcerations of that viscus. In other mild attacks the symptoms of illness may be distinct, but of short duration (abortive typhoid).

On the other hand on rare occasions the disease may be so severe as to assume all the characters of a pure septicæmia with early cardiac failure, low temperature, profound prostration, and slight or absent abdominal symptoms (fulminating attacks). In these cases the Widal reaction may be negative, the diagnosis being dependent on the findings at an autopsy, or on a bacteriological examination of the blood.

Without being of this severe type or accompanied by marked prostration, the attack may pursue its course devoid of fever (apyrexial typhoid). This type is stated to be specially associated with patients who have been exposed to hardship and privation.

In children, abortive attacks and an irregular or atypical course are relatively more frequent. The temperature is often of a remittent type, severe headache, drowsiness, strabismus, retraction of the head, and other meningeal symptoms

are more common, whilst rose spots are absent in a larger percentage of the cases.

DIAGNOSIS.

General considerations. In every case of an acute disease lasting more than four or five days, in which there is an absence of localising symptoms pointing to an affection of some organ which might account for the condition, it is customary to suspect Enteric Fever. The suspicion should be confirmed by noting the serum reaction, the absence of a leucocytosis, the relative increase of the lymphocytes, the presence of the diazo-reaction in the urine, and, if necessary, by the bacteriological examination of the blood.* A negative Widal reaction does not exclude the diagnosis of typhoid fever. In every case it should be again repeated after an interval of a few days, and if still negative at the end of a fortnight's illness, the probabilities are very strong that the attack is not one of typhoid fever, since it is only on rare occasions that it appears for the first time after that period, or fails to develop throughout the course of the disease. On the other hand it must be remembered that a positive Widal reaction might possibly be due to a previous attack of typhoid fever, or to the

* In the *Münch. Med. Wchnschrft*, 1906, p. 1862, Fornet suggests the use of a "precipitin reaction." Having experimentally demonstrated that the blood of a guinea pig injected some hours previously with a typhoid culture, gave a turbidity with the serum of another guinea pig immunised against the typhoid bacillus and toxins, he made similar observations with a patient's serum and a corresponding immune serum, and obtained evidence of precipitation even at a time when no agglutinating or specific bactericidal properties had as yet developed in the blood.

injection of typhoid vaccine (a sterilised bouillon culture), occurrences which can be readily excluded by taking the history.

The diazo-reaction (Ehrlich's test) is specially valuable on account of its early appearance, often by the fourth or fifth day of illness. For the performance of the test two solutions are requisite: (1) a saturated solution of sulphanilic acid in hydrochloric acid 1 in 20, (2) a 0.5 per cent. solution of sodium nitrite in distilled water. One part of solution (2) is mixed with 40 parts of solution (1) (2 drops of the former to about one-third of an ordinary test-tube of the latter answer very well), and an equal quantity of urine is then added, and the test-tube shaken. A few drops of strong ammonia are allowed to run into the tube rendering the fluid alkaline and at the same time producing a deep red colour as it trickles down the froth, as well as in the upper layer of the mixture. A mere deepening in colour to dark yellow or brown is of no value.

Unfortunately the test is not a pathognomonic sign of Enteric Fever, and its presence can only be accepted as a point in favour of the diagnosis. Nevertheless since the other diseases in which it is most likely to be met with are Measles and Acute Tuberculosis, its presence in the absence of these affections is strong presumptive evidence, whilst a negative reaction to repeated examination is as strongly against the diagnosis.*

* The methylene blue reaction of Russo has been introduced as a substitute for the diazo-reaction, it is performed by adding four drops of a 1 in 1000 watery solution of methylene blue to 3 to 5 cc. of urine. If there is any turbidity from urates or excess of phosphates the urine should first be filtered. The reaction is said to be positive when a uniform mint or emerald green colouration is obtained on shaking the test tube, and

The suspicion of Enteric Fever, however, is not infrequently maintained, and allowed to interfere with a more complete examination for the discovery of the cause of illness, when a clear conception of the usual course of the disease, and the condition likely to be found at various stages should cause grave doubts to arise. In this connection special emphasis must be placed upon the gradual onset, on the relative frequency with which headache, lasting for several days at the beginning, forms a prominent feature, on the rarity with which the temperature fails to reach 101°F. or 102°F. , or, when the pyrexia is of a remittent type, the rarity with which it completely intermits till late in the attack.

Further, some weight should be attached to the rapidity of the pulse, which even after several days' illness is often relatively slow, whilst the absence of any enlargement of the spleen, not only to palpation, but to percussion, should always cause the diagnosis to be viewed with great suspicion.

The presence of coryza, conjunctivitis, or icterus as symptoms in an acute illness constitute *prima facie* evidence against such being Enteric Fever.

With regard to the method of palpating the spleen, it should be mentioned that when, with

negative when no change in colour occurs, or only a light green colouration is produced.

Rolleston (*The Medical Press*, 1906, page 303) found the methylene blue test more constant and more persistent than the diazo-reaction, its disappearance also coinciding more closely with the commencement of lysis. Unfortunately it is not pathognomonic, its presence having been noted in other diseases, *e.g.* measles, scarlet fever, lobar and broncho-pneumonia.

the patient on his back, the head and shoulders being raised by a pillow and the lower limbs flexed on the abdomen, a negative result has been obtained by pressing the right hand, with the index finger upwards, into the left hypochondrium, the patient meanwhile drawing a deep breath, a positive result can not infrequently be obtained by then causing the patient to roll over on to his right side whilst retaining the same flexed position of the body, while the practitioner, from the left side of the body, lightly grasps the region with the palm of the hand. By this means the action of gravity is brought into play, and the sensitive finger tips hooked under the costal margin will detect the edge of the spleen as it is depressed by each inspiratory effort.

The occurrence of rose-spots on the skin of the abdomen, or the lower part of the thorax after a week's illness with fever, associated with enlargement of the spleen, furred tongue, and especially with offensive pea-soup stools, may be accepted as conclusive evidence of Enteric Fever, if the spots appear in crops on successive days. It is not advisable to obtain splashing sounds by sudden, jerky palpation over the right iliac region since the test is not pathognomonic, and its value as a diagnostic aid is completely overshadowed by the risk of causing injury to the ulcerated intestine.

Loss of the abdominal reflex has been noted in Enteric Fever, but since the reflex also disappears in other abdominal affections, its absence can hardly be considered of great diagnostic value.

Differential Diagnosis of other diseases from Enteric Fever.

In Acute Catarrhal Enteritis the onset is usually more sudden, pyrexia if present is lower, less sustained, or of shorter duration, there is no enlargement of the spleen, there are no rose-spots and though there is marked diarrhoea, often there is no abdominal fulness.

Ulcerative Enteritis is a more chronic, and evidently localised affection.

In Appendicitis the attack generally comes on suddenly, often with vomiting and constipation. There is acute localised pain, tenderness, and later swelling in the right iliac region, but no enlargement of the spleen and no rose-spots. It should be mentioned that ulceration, etc., of the appendix may occur in Enteric Fever and that Appendicitis may therefore be met with as a complication or sequela.

In the different forms of Acute Tuberculosis errors are not uncommon, owing to the absence of definite localising signs. In the acute miliary form, however, the pulse and respiration rates are either singly, or together, greatly accelerated, the pyrexia is markedly remittent, profuse sweats occur during the height of the disease, purpura and signs of meningitis may be present, and choroidal tubercles may be detected by the ophthalmoscope. Too much reliance must not be placed on enlargement of the spleen, though it is more often absent in Acute Tuberculosis, on the diazo-reaction, on diarrhoea with liquid yellow stools, though the offensive pea-soup character is most unusual, nor even on the presence of a few rose-spots since these may be found in both diseases. In miliary tuberculosis

roseolar spots do not occur in crops when present. Where the acute tuberculous process is limited to the intestine or peritoneum, the frequent absence of enlargement of the spleen, the co-existence of a clean tongue, the more chronic nature of the illness, its association with ascites, matting of the bowels, or retraction of the omentum, and the preponderance of these local abdominal symptoms over the signs of a general toxæmia, will usually permit one to recognise the real nature of the disease. In all cases the discovery of an old tuberculous focus is important, but it must not be forgotten that Enteric Fever is not thereby excluded.

In some cases of Enteric Fever emaciation reaches a high degree, and with the existence of râles and rhonchi all over the chest the suspicion of acute pulmonary tuberculosis may arise. The results of feeding, nursing, and treatment will readily dispel the error.

The shortness of an attack of Influenza, the severe general pains, the presence of herpes, or coryza, and the absence of any of the distinctive signs of Enteric Fever with the possible prominence of others, *e.g.*, vomiting (not usual in the latter disease) are sufficient to prevent a mistake even in the abdominal form. The diagnosis of Influenza is not infrequently made during the early stages of an attack of Enteric Fever. As a means of satisfying the patient's friends during the period in which a definite statement is impossible, the practice is quite excusable, but it is necessary to urge that, though practically convenient, a careful search for another cause must always be made in any febrile affection lasting more than four days.

In Ulcerative Endocarditis evidence of previous cardiac mischief is usually present. Moreover, though the patient may be the victim of a chronic valvulitis or a systolic murmur may develop in severe cases of Enteric Fever, the more remittent type of pyrexia, the more rapid pulse, the occurrence of infarcts in the brain (paralysis) or kidney (hæmaturia), and the occurrence of purpura, or rigors, as well as the steadily downward progress of the disease, are as a rule distinctive of the former affection. The spleen is enlarged in both diseases.

In other septic conditions the discovery of a focus of suppuration, the irregular temperature, the presence of a leucocytosis, the occurrence of shivering or rigors from an early stage, the absence of abdominal symptoms with the exception of diarrhœa in severe cases, and the absence of a history indicating Enteric Fever will be found of service in arriving at a conclusion.

A sporadic case of Typhus Fever, or one in which there is no knowledge of infection, and in which there is neither subcuticular mottling nor petechiæ, may give rise to difficulty. The onset of illness is more sudden but it is not always sufficiently well marked to fix the attention, whilst the persistent headache, the continuous pyrexia, and discrete macules closely resembling rose-spots constitute a picture not unlike Enteric Fever. The eruption, however, appears on the 5th day, does not come out in crops, and each macule is of longer duration. In addition the enlargement of the spleen is less, abdominal symptoms are not a marked feature, though looseness of the bowels may be temporarily present. Still the stools are not of the offensive,

pea-soup character, the Widal reaction is negative, and the attack terminates abruptly.

Relapsing Fever is so rare that the probabilities of its occurrence are remote. It is characterised by sudden onset, rapid pulse, high temperature, the presence of spirilla in the blood, absence of eruption, and of intestinal symptoms, frequent complication with jaundice, and short duration of about 7 days, followed by one or more relapses with an interval of several days to a week between each. The termination of the attack is abrupt and convalescence rapid; during the apyrexial intervals the temperature is at first subnormal.

In Trichiniasis, vomiting, diarrhoea and prostration with pyrexia occur, but there are no spots, the spleen is not enlarged, and in addition muscular pains constitute a marked feature, and there is œdema of the eyes or other parts of the body.

The possibility of mistaking a profuse eruption in Enteric Fever for Small-pox has been considered when dealing with the latter disease. Attention must, however, be drawn to the occasional occurrence of a typical scarlatiniform erythema during an attack. In some cases it may be due to the giving of an enema. It is distinguished from Scarlet Fever by the absence of sudden onset or marked exacerbation and of sore throat, by its invariably light pink colour, and its more marked distribution on or limitation to the trunk. At the same time in certain situations the rash may have an urticarial character.

Scarlet Fever may occur during the attack of Enteric Fever but, in my own experience, the combination has never taken place, and on more

than one occasion cases of the *latter* disease, admitted in error for the former, have spent a variable length of time exposed to infection.

The cases of pneumo-typhoid, nephro-typhoid, and meningo-typhoid previously mentioned must be diagnosed by the circumstances under which they arise, by the later development of symptoms suggestive of Typhoid Fever, or by the invariable sheet anchors in all cases of doubt, viz., the Widal reaction, or the cultivation of the specific microbe from the blood. In meningo-typhoid the bacillus may be recovered from the spinal fluid obtained by lumbar puncture.

PROGNOSIS.

Prognosis in Typhoid Fever should always be guarded. The causes of death may be summarised as follows: (1) from the severity of the intoxication, (2) from the localisation of the brunt of the affection to particular organs, *e.g.*, the intestines, lungs, brain, and (3) from complications. Roughly, if the attack-rate be excluded, it may be said that the mortality increases as age advances, the probabilities of recovery being greatest in children, and least in adults over 40 years old. As in other acute diseases those debilitated by chronic alcoholism, by chronic nephritis, or chronic respiratory and cardiac affections are less able to hold out against the ravages of an exhausting illness: obesity is also unfavourable. The prognosis is, however, markedly influenced by the earliness with which treatment is begun, as well as by the efficiency of such treatment. It is in this respect only that there is any importance to be attached to social position.

Excluding the possible supervention of hæmorrhage or perforation, as well as malignant attacks, the probability of recovery is almost certain in a case treated from the onset with suitable diet and regular hydrotherapy, in which the temperature does not exceed 102°F. to 103°F. On the other hand a persistent temperature of 104°F. or over, is of bad prognosis unless regularly counteracted by cold baths or packs.

Early prostration and rapid pulse are of grave augury, and the same may be said for alterations in the character of the pulse, *e.g.*, irregularities in force, loss of dicrotism, etc. Even later in the disease if there be no indications of the attack terminating, a pulse exceeding 120 per minute is of serious moment, though due allowance must be made for nervous adults and for children.

A severe attack may be expected if no moderation in the temperature occurs by the twelfth day.

Pneumonia, especially the hypostatic form, and signs of cardiac failure, *e.g.*, small rapid pulse, enlarged veins in the neck, and cyanosis of dependent parts with cold extremities, usually lead to a fatal termination, and coma vigil may be accepted as invariably being followed by death.

Active delirium, if unrelieved, is more serious than a stuporous condition, since the patient runs greater risk of exhaustion.

Marked diarrhœa, or abdominal fulness are of bad prognosis unless they respond to treatment. A large percentage of cases with hæmorrhage recover, but it cannot be said to be of favourable augury. On the contrary, when severe it may lead to fatal syncope, the mortality possibly

varying from 10 to 20 or 30 per cent. of the cases affected with this complication.

When perforation occurs, laparotomy offers the only chance of recovery. From the recorded cases a recovery may be expected in about 25 per cent. of the cases operated on.

Albuminuria arising during an attack is an unfavourable indication if present to the extent of more than a trace. It is rare for any chronic affection of the kidneys to be produced.

If stridor occurs, even after tracheotomy, there is grave risk of the laryngeal obstruction remaining permanently.

Pregnancy and parturition affect the prognosis adversely only to a very slight extent. Abortion is not infrequent, but recovery is usually not thereby impeded.

During convalescence it must not be forgotten that the myocardial degeneration resulting from the toxæmia may be the cause of fatal syncope from exertions undertaken too early, *e.g.*, sitting up, whilst on rare occasions pulmonary embolism and, exceptionally, embolism of the cerebral arteries have occurred.

TREATMENT.

The patient should be confined to bed from the first, and all his wants supplied by others; he should not be allowed to dissipate any energy on acts which can be relieved by the assistance obtained from nursing. Nurses accustomed to cases of Typhoid Fever are to be preferred, otherwise careful instructions are necessary not only for the patient's benefit, but for the nurse:—she must be warned against the risk of infection, and receive detailed information as to

the means by which it is usually transmitted. Special attention must be paid to the importance of disinfecting the hands after washing or cleansing the patient, changing the bed or body linen, and handling the various utensils. In addition the danger of soiled material being permitted to undergo drying must be pointed out. If typhoid vaccine be used as a prophylactic measure, the two injections must be completed at least a week before exposure to infection.

In the treatment of the patient it is a good routine rule to administer a dose of calomel (3 to 5 grains) at the beginning of the attack. Thereafter, if the diet be carefully regulated according to the patient's digestive capabilities, there is generally little need for the further use of laxatives. In most cases during the acute period it is advisable to restrict the diet to milk. Not more than three pints should be allowed during the twenty-four hours, and, if the patient drinks freely, it should be diluted with water. With the appearance of curds in the stools it should be temporarily stopped and only gradually resumed. The practitioner must bear in mind that diarrhoea and abdominal distension are not infrequently brought about, and maintained, by the persistent administration of milk in amounts, or in a form which the patient is unable to digest. In suitable cases other easily digestible foods may be added, *e.g.*, sugar, prepared carbohydrate foods, beaten up eggs, cream, fruit juices and jellies. It is not advisable to press any other food than milk upon the patient. If it is taken reluctantly and only in small quantities it may be given undiluted, and sugar and cream may be added to it. In all cases water should be

taken freely (so-called internal hydrotherapy), the elimination of toxins by the kidneys being thereby greatly facilitated.

Where abdominal fulness, and diarrhœa are present even after careful dieting, great benefit is sometimes seen from the free administration of water, and the coincident temporary stoppage of all food. The interference with the digestive processes, the consequently diminished absorption of nutriment, and the taking up of toxic substances from the bowel contents, as well as the continued drain from the diarrhœa, all offer a ready explanation of this apparent paradox.

The attempt to secure what is known as the "clean bowel" treatment is conducted in different ways. Some advocate the repeated use of purgatives, *e.g.*, calomel, either in small doses regularly, or large doses every two or three days, at the same time the diet is rigorously limited to liquid, nutritious, and easily digestible foods. Others endeavour to limit the putrefactive changes by the administration of antiseptic drugs, *e.g.*, B. Naphthol, Salol, Chlorine Water, Liquor Hydrargyri Perchloridi, Charcoal, etc., a very large number of disinfectant remedies having been recommended by various writers. Those mentioned are at any rate harmless, and may diminish the putrefactive changes, but no marked alteration is to be expected from their use. On the contrary, after clearing offensive material from the bowel by purgation, or by enemata, a temporary stoppage of all food with the free administration of water, as well as the use of local applications to the abdomen (ice-bags or fomentations) is frequently followed by most beneficial results. Thereafter the resumption of

food is only to take place by stages, *e.g.*, limited quantities of whey, then small amounts of diluted milk regularly given at intervals, and if necessary peptonised. The condition of the abdomen and stools remaining satisfactory, the amount of milk may be gradually increased, and sugar or cream, etc., added later.

Though the results published shew that the serum produced by Chantemesse is apparently a very effective remedy, it is unfortunately not yet procurable by the profession in general, and other organic preparations have not stood the test of experiment. We are therefore driven to enquire what other procedure is of service, and in this respect special attention must be devoted to hydrotherapeutic measures.

It is almost uniformly conceded that the regular cooling of the surface of the body in Typhoid Fever by means of baths and packs, materially diminishes the mortality from this disease. The mere withdrawal of heat is not the essential or important feature, this being shewn by the increased heat loss produced by various antipyretic drugs, *e.g.*, antipyrin, phenacetin, pyramidon, etc. Though a fall in temperature follows their use the constitutional symptoms are not improved, and moreover they have the great disadvantage of adversely affecting the circulatory system.

On the contrary the withdrawal of heat by means of cold or cool applications increases the tension in that system, and thereby the elimination of toxins by the urine. Further, the mind becomes clearer, refreshing sleep follows, respirations are deeper, bronchitis and congestion of the lungs are diminished, the tongue becomes

more moist, the condition of the digestive system and of the skin improves, and the strength can be maintained for long periods.

Unfortunately it is customary to fix a temperature (102.5°F.) at and over which the use of baths or packs is recommended, and some observers even go so far as to restrict them to severer cases. It is important, however, to remember that the length of an attack cannot be definitely forecasted, and since it is manifestly advisable to maintain the general condition, and to limit the toxæmic effects on the various tissues as much as possible, it would seem to be preferable to adopt hydrotherapeutic measures in every case, their severity being proportionate to that of the attack.

In mild cases occasional tepid sponging may be sufficient, but so long as the pyrexia is maintained it should be regularly repeated every few hours. In more severe cases the patient should be enveloped in sheets loosely wrung out of water, the temperature of which may be made to vary, according to the type of the attack, from lukewarm to cold, and even supplemented when necessary by ice-rubbing.

Again, if bathing be impossible, a bath may be improvised by raising the sides of the macintosh on which the patient is lying so as to form a trough, the head of the bed being slightly tilted so as to allow the excess of water to flow into a receptacle at the foot, and the patient, covered with a sheet, douched with tepid or cold water. Various means may be adopted, the practitioner recognising the principle that it is by the regular cooling of the surface that the benefits above mentioned are obtained.

There is no evidence that hydrotherapy increases the risk of hæmorrhage or perforation. Theoretical considerations would rather lead us to expect the reverse in cases in which the treatment is begun early. The measures are, however, to be discontinued if these complications arise.

It is impossible to do more than briefly refer to the treatment of the more important symptoms, a full consideration would cover a large part of the domain of medical and surgical treatment in general. Moreover the treatment already outlined will materially influence the supervention or relief of many of the symptoms.

For diarrhœa, in the first place, nothing but water for 24 or 48 hours should be given, then a change in the kind of food should be tried. In addition, tannalbin, preparations of chalk, vegetable astringents, and opium are valuable; for vomiting, salts of Bismuth, small quantities of milk, peptonised or with soda water, or all food stopped temporarily and fomentations applied to the epigastrium; for tympanites, turpentine is a favourite remedy, and an ice bag to the abdomen is often beneficial.

With hæmorrhage, opium gives the best results in the form of a starch and opium enema and a small dose of morphia subcutaneously. In the meantime nothing beyond sips of water is allowed by the mouth. Turpentine, ergot, lead acetate, etc., may be tried but they are of doubtful value. Special attention must be drawn to the danger of obscuring signs of perforation by the administration of opium.

Bronchitis, if unrelieved by hydrotherapy, is best treated by Ammonium Carbonate, Squills,

Senega, etc., and if signs of failing circulation are present Caffein, Strychnia, and Digitalis are indicated. In these cases also alcohol is of value.

If pneumonia develops cardiac tonics and expectorants are required, baths must be discontinued and the position of the patient should be periodically altered. The latter procedure is also advisable as a prophylactic measure.

For pleurisy or localised pain fomentations give temporary relief.

Constant attention is required to prevent the occurrence of bed-sores. The skin must be regularly washed and dried, and such situations as the buttocks dusted with pasma. The patient must not lie too long in one position, water beds or air cushions not too tightly filled must be provided to relieve the pressure on prominent parts, and no creases in the sheets should be present. If a bed sore has formed antiseptic applications, *e.g.*, boracic fomentations, boracic ointment, should be applied and frequently renewed.

For *phlebitis* the limb must be wrapped in cotton wool, and raised on a pillow. The tender region is to be painted with belladonna and glycerine, or belladonna fomentations may be applied and, if the pain is severe, morphia injected. No movement or manipulation of the limb should be permitted.

Cholecystitis is rarely diagnosed. If an enlarged gall-bladder is distinctly palpable it is probably advisable to operate and drain, as perforation is likely to ensue. If the contents become extruded into the peritoneum symptoms very like those caused by intestinal perforation

develop. Laparotomy is then a necessity but there is less chance of success.

For rigors, extra blankets, hot drinks and hot applications to the feet are indicated. The anxiety of the patient also must be relieved.

Boils and septic complications must be treated on ordinary principles.

After having successfully passed through the acute febrile stage, the greatest care is still necessary in the management of convalescence. In the first place, there is much difference of opinion with regard to subsequent feeding. Practical experience has convinced many observers that the absolute interdiction of all solid food for a definite number of days after defervescence is established, is neither necessary, nor in all cases advisable. It is much better to study the condition of each individual patient. It will then be found that after severe attacks, though various forms of fluid diet, or additions to such, may be allowed, *e.g.*, carbohydrate foods, eggs, gelatine and prepared nitrogenous foods, yet a considerable interval must frequently elapse before the tongue of the patient, his condition and his inclinations, have so far recovered as to cause him to wish for a more solid diet. On the other hand, in many milder cases with the onset of convalescence the tongue has cleaned, the bowels are no longer loose, the abdomen shews no fulness, and the patient craves for food. Under these circumstances to maintain the same restrictions is unnecessary, but it is advisable to observe a definite routine, limiting the list to easily digestible foods, and following some such order as the following: custard, bread pap, blanc-mange, boiled fish, stale bread and butter,

minced meat, and mashed potato. It has been said that early feeding may lead to a relapse, but the fact that a relapse must be a re-infection is in itself strong evidence against the apparently direct association often described. In every case it must be emphasised—(1) that the physical examination should agree with the patient's request; (2) that the routine recommended should be followed by an interval of twenty-four hours before each further addition; (3) that a complaint of not liking any particular food as its turn arrives should cause a longer pause on that already permitted; and (4) that food is never to be pressed on the patient.

Confinement to bed must be strictly maintained, and only gradually relaxed. It must be remembered that the ulcerations in the intestine require a further two or three weeks to heal, and that any undue exertion may be followed by disastrous consequences not only from that cause but from myocarditis. The latter complication is more likely the more severe has been the attack. It is therefore advisable to keep the patient lying flat in bed for the first week of convalescence, and at the end of that time to allow the use of an extra pillow, others being added gradually on succeeding days, so that by the end of a fortnight he may be sitting up in bed. In every respect the return to ordinary conditions must be made by very gradual stages.

PARATYPHOID FEVER.

In 1896 Achard and Bensaude described a case clinically one of Typhoid Fever, in which the Widal reaction was negative, and from which a bacillus was cultivated, the cultural characteristics differing in certain minor details (more especially in the power of producing active fermentation with mannite and dextrose) from those of Eberth's bacillus.

Since that time numerous similar observations have been made in various countries, and it has become generally recognised that cases do occur which are clinically indistinguishable from Typhoid Fever, and caused by an allied though not identical micro-organism to which the name of the paratyphoid bacillus has been given.

Two varieties of this micro-organism have been described, and designated as paratyphoid bacillus A and B. The former in its cultural characters is more closely allied to Eberth's bacillus, whilst the latter more nearly simulates the bacilli of the coli group. It has been estimated that 80 per cent. of the cases met with belong to the group owing their origin to the paratyphoid bacillus B.

Not only is it impossible to differentiate by clinical examination between Typhoid and Paratyphoid Fever, but further observation has shewn that relationships exist between the micro-organisms respectively producing these diseases, as regards immunity and agglutination. Thus it has been found that an animal immunised against the paratyphoid bacillus, so as to be able to withstand a thirty times fatal dose, has at the same time developed an immunity against a single fatal dose of Eberth's bacillus.

Similarly the serum of such animals shews agglutinative powers with both forms of bacilli, though as regards Eberth's bacillus this only occurs in low dilutions, whilst in the case of the paratyphoid bacillus it occurs in high dilutions, and is much better marked.

Some of the observations made seem to be inexplicable on the assumption of the specific nature of the various micro-organisms. It is sufficient in this respect to mention Libman's case, referred to by Prof. Lorrain Smith,* in which an autopsy showed the presence of typical typhoid lesions, whilst from the blood the paratyphoid bacillus was isolated, and the serum had agglutinated this bacillus at 1 in 50, and Eberth's bacillus at 1 in 250.

In view of the close relationship which exists between the typhoid and paratyphoid groups, it has even been suggested that it is necessary to abandon the idea of the specificity of Typhoid Fever, in order to prevent hopeless confusion. Fortunately, though anomalous occurrences may arise, in practice the cultivation of the micro-organism from the blood, or the marked agglutinative properties of the serum against one or other variety of bacillus during the course of the disease, permit us in almost all instances to come to a definite conclusion as to the nature of the infection.

Not only are the cases of infection with paratyphoid bacilli clinically indistinguishable from mild attacks of Typhoid Fever, but the etiology of these two diseases as regards the methods of infection, the distribution of the micro-organism

* *System of Medicine*. Allbutt and Rolleston, 1905. Art. Paratyphoid Fever.

in the body, and the channels by which it is usually extruded shew essentially identical features. Attacks of Paratyphoid Fever, moreover, are met with in localised epidemics, but these are not extensive, or periodic, in the manner seen in Typhoid Fever.

SYMPTOMS AND COURSE.

The disease begins insidiously with headache, lassitude, malaise, and general pains; the tongue is furred and moist; there may be constipation or diarrhœa, more commonly the former, and there is usually some enlargement of the spleen, though not to the degree frequently met with in Typhoid Fever, the free edge being indeed rarely palpable. The temperature is said to rise somewhat suddenly, but it is not persistently maintained beyond a few days at the beginning of the attack. Usually it is of an irregular type with distinct remissions, unassociated with the occurrence of complications, and devoid of a typical or characteristic course. It lasts from ten days to a fortnight, and its maximum rarely exceeds 102°F. or 103°F. Occasionally the fever terminates rapidly. Rose-spots have been stated to occur in a moderate percentage of the cases, but details with regard to them are wanting, and Keith* points out that "it is not mentioned by any of the observers whether or not the spots come out in crops.

Complications are unusual. In some instances rigors with marked intermissions in the temperature have been described—the so-called "pyæmic" type. In other cases the gastro-intestinal symptoms have been unduly prominent, *e.g.*,

* *Scottish Medical and Surgical Journal*, 1904. Vol. XIV., page 389.

vomiting, abdominal pain (more especially in the epigastrium and the right hypochondrium), or diarrhoea with mucus and blood in the stools. The profuse or fatal attacks of intestinal hæmorrhage met with in Typhoid Fever do not occur, and in no case has intestinal perforation arisen. Blood has been stated to be present in the stools in 5 per cent. of the cases.

Bronchitis, pleurisy and albuminuria may be present, but signs of nephritis are quite exceptional.

Septic complications, *e.g.*, boils, arthritis, suppurative osteitis are met with, and in the pus evacuated the paratyphoid bacillus has been found.

The blood on microscopical examination shews characters identical with those occurring in Typhoid Fever, *e.g.*, leucopenia with a relative increase of lymphocytes, and the only means of effecting the diagnosis is by the cultivation of the bacillus from the blood, urine, stools, or some complicating inflammatory process, or again by the discovery of a high power of agglutination with the serum against the paratyphoid bacillus, and a low or absent reaction against Eberth's bacillus.

The prognosis is good, only a few deaths having been described.

Relapses have been said to occur in about 10 per cent. of the cases.

Treatment is on lines identical with those given under Typhoid Fever. It has been suggested that some of the instances of second attacks of the latter disease may, in reality, have been due to infection with the paratyphoid bacillus.

TYPHUS FEVER.

Typhus Fever is an acute specific infectious disease occurring in an epidemic form. It is characterised by a rapid onset with persistent headache, the early appearance of an exanthem which presents a very variable appearance according to the severity of the attack, a continuous pyrexia which lasts about two weeks, the association of an unusually marked muscular and nervous debility, and a somewhat abrupt termination of the acute febrile period. There are no specific lesions.

ETIOLOGY.

Epidemics of the disease are now very rare. They are especially associated with poverty or overcrowding and their attendant evils, insufficient or improper food, uncleanness, and want of fresh air. On this account one can readily understand its greater prevalence in temperate and cold regions, more particularly in the winter months, and its former close connection with war and times of distress. The occurrence, under these conditions, of epidemics without any signs of an original source of infection, and apparently totally unconnected with a previous case, was for a long time responsible for the suggestion of its autogenous origin: our knowledge of other infectious diseases, however, interdicts this view. Until the micro-organism has been isolated, speculation only is possible, but we must suppose that in every case the circumstances mentioned have been responsible for

the maintenance of its vitality. We know that it is readily destroyed or rendered innocuous by free ventilation, since though the disease is highly infectious during its acute stage, and though it has claimed numerous victims amongst those attending on the sick, yet its transference can be readily prevented by insisting on a free supply of fresh air round the patient.

On the other hand again, by analogy with other diseases, infected clothing stored in dark, unventilated places may possibly retain the micro-organism in a potentially active state for an indefinite period, and in this connection light clothing offers less danger than dark.

The disease is usually compared with Typhoid Fever on account of the continued nature of the fever, and the occasional similarity in clinical manifestations. Nevertheless it is much more closely allied to the exanthemata, being accompanied by a characteristic eruption in most instances, and transmitted by the breath or exhalations from the body as a rule, whilst infection of the evacuations is possibly only a secondary process.

No age or race is exempt from Typhus Fever, but attacks are commoner in adolescents and adults, whilst infants at the breast seem to enjoy a partial immunity, a fact frequently noted in the infectious diseases generally. Its relatively higher prevalence amongst adults is responsible for its comparatively high death-rate, viz., 18 to 20 per cent., the rate of mortality shewing a fairly steady rise with advancing years. No difference as regards susceptibility can be detected in the two sexes.

From the point of view both of the risk of

contraction and also for prognosis, great importance must be attached to various debilitating influences, *e.g.*, fatigue, anxiety, intemperance and chronic disease. Second attacks are described, but relapses are practically unknown.

INCUBATION PERIOD.

The period of incubation has been variously estimated at from 5 to 21 days, most commonly it is between 8 and 12 days. As a rule it is not accompanied by any symptoms of illness, though during the last one or two days lassitude, slight headache, vertigo, and anorexia may occur as prodromata. Headache has also been described as a not infrequent complaint of those attending on the sick, without the subsequent development of symptoms indicating an attack,

SYMPTOMS AND COURSE.

The onset of the disease takes place suddenly with headache, malaise, chilliness, early prostration, pains in the body and limbs (more especially the thighs), insomnia, vertigo, and possibly with vomiting or a rigor. The temperature rises abruptly, possibly to 102°F. or 103°F. It then continues to ascend for four or more days until the fastigium is reached, records of 104°F. and 105°F. being by no means uncommon in severe attacks. Frequently in the early part of the second week, save in the worst cases, a remission of the temperature occurs, which in mild forms may be complete, and terminate the attack (abortive). In other instances, however, the temperature rises, though in favourable cases it does not attain its former height, and in uncomplicated attacks it finally falls about the 12th to the 14th day by a rapid defervescence.

Amongst early symptoms mention must be made of epistaxis, and of tinnitus aurium, the latter being followed by more or less deafness. As the disease progresses deafness is often a very marked feature, though tinnitus may never have been elicited.

The face is flushed, the eyes suffused and watery, the pupils small, and the features dull and expressionless.

The tongue is furred, the breath offensive, a peculiar odour surrounds the patient, thirst is often present, the bowels are usually constipated, there is slight enlargement of the spleen, and the pulse is rapid in accordance with the pyrexia the dorsum and at the tip; later it may be brown and the other evidences of the severity of the toxæmia.

The exanthem appears about the 4th or 5th day, but in severe attacks it may be seen earlier, even on the 2nd or 3rd day. It is of a composite character, its manifestations varying largely with the type of the attack. In some cases macules only are seen, which may be first detected on the wrists, and about the axillæ and sides of the trunk. Soon after they are found scattered over the anterior surface of the body, and later over the back and the limbs. The face and neck, and the palms and soles are free from eruption.

The macules are indistinguishable from the rose-spots of Typhoid Fever, though possibly of a darker red colour. They do not, however, come out in crops, but attain their maximum development, as regards numbers, in the course of a couple of days, subsequently persisting throughout the acute stage, *i.e.*, for a period of

seven to ten days, though in some instances they may fade after one or two days.

Most commonly in addition to the macules there is an associated pinkish erythema, of ill-defined character, but forming an indistinct reticulum, the so-called "mulberry-rash" especially seen in children. In mild cases this erythema may be the only part of the exanthem which develops, and it is very liable to become less marked on exposure of the skin to the cooling influence of the atmosphere. In other instances, in association with macules or petechiæ, the erythema presents the ill-defined appearance of not thoroughly reaching the surface, thus accounting for the manifestation of "subcuticular mottling."

The petechiæ, which are to be noted in most cases of any severity, may arise from the macules, and also may appear independently in the intervening skin. It must not be supposed that in these cases all of the macules shew effusion of blood, some may remain unchanged, whilst others become darker in colour, though yet affected by pressure.

The "toxæmia" may reach such a degree that large hæmorrhages appear in the skin, and bleeding takes place from various mucous surfaces, but even short of this the tendency to hæmorrhage may be noted in the blood extravasation which follows slight trauma.

As the exanthem develops the other symptoms of the disease also increase in severity, and prostration becomes more intense. The tongue is frequently dry, especially along the centre of the dorsum and at the tip, later it may be brown in colour, dry and contracted, though rarely

glazed and fissured, whilst sordes collect on the teeth.

In many cases there is a slight temporary looseness of the bowels, but it has no special characters.

Headache and general pains disappear as the obtuseness of the mental faculties develops, and restlessness, sleeplessness, or even active delirium, which may be marked features of the early stage of nervous excitement, give place later to a stuporous condition. The relative frequency of this state is responsible for the name Typhus. Other nervous manifestations which may arise are wandering delirium, suicidal tendencies from delusions, subsultus tendinum, muscular tremors, intense nervous and muscular prostration as evidenced by retention of urine, involuntary evacuations, or dorsal decubitus, and finally coma. The latter may on rare occasions be preceded by convulsions, possibly of uræmic origin.

The heart muscle is implicated in the general muscular weakness. This is shewn by the early and marked increase in the rapidity of the pulse, its smaller volume, and feebler character, as well as by the absence of well-marked dicrotism. Moreover, examination of the heart may reveal a weak apical impulse, a diminution and even total absence of the first sound at the apex, or the supervention of a foetal rhythm owing to the shortening of the diastolic period. Finally the tendency to cardiac failure may be more distinctly manifested by the supervention of cyanosis, and the skin, which is hot and dry during the earlier stages, often with numerous sudamina, may in these cases be bathed

in a profuse clammy perspiration. Further evidence of the debilitating influence of the poison of this disease may be noted in the greater tendency to the occurrence of gangrene, which may affect more particularly the distal parts of the extremities or the lungs.

The urine exhibits changes similar to those met with in other febrile affections, *e.g.*, diminution in quantity, higher specific gravity, darkening in colour, and the presence of albumen. The amount of the latter varies largely with the severity of the toxæmia, and the condition of the circulation. In severe cases deficient elimination of waste products from damage to the kidney cells, as evidenced by the albuminuria, seems to be in no small degree instrumental in bringing about the "typhoid" aspect, as well as in causing the convulsions which have been already referred to as rare complications. In a few instances the presence of leucin in the urine has been demonstrated.

The disease being self-limited, at the end of twelve or fourteen days, so long as heart failure has not occurred, or grave complications, such as pneumonia, have not developed, it is surprising how serious the condition may apparently be, and yet recovery follow. The most important indications of approaching convalescence are seen in the slowing of the pulse-rate with an improvement in the character of the pulse, in a coincident slight fall in the temperature, and in a disposition to natural sleep. In the course of thirty-six hours or so, the temperature frequently falls to normal, urine is meanwhile passed in increased amount, whilst the patient for some days continues to spend the greater period of his

time sleeping quietly. The tongue becomes moist, nourishment is taken more willingly, and the mind is clearer in the intervals of waking, though deafness and apparent stupidity may remain for several days.

Bronchitis is so common that it almost deserves consideration amongst the ordinary symptoms of the disease. Naturally it may be of any grade of severity dependent on the stage and type of the attack.

The pneumonic complications which may result are of the lobular or lobar form, and it not infrequently happens that lividity of the face, and increase in the rate of respiration, or alteration in its character, draw attention to their supervention, when the helplessness or mental hebetude of the patient has been responsible for their non-detection owing to deficient examination. In many cases there is an absence of pain or cough, the physical signs being limited to dulness, moist sounds, and diminished breath sounds. The last-mentioned is often a very marked feature. It should be noted that pneumonia may even occur as a sequela after the defervescence is completed.

Laryngeal complications may occur, as in Typhoid Fever, but with the exception of the catarrhal form they are of rare occurrence.

Beyond the not uncommon supervention of slight and temporary looseness of the bowels, complications affecting the digestive tract are unusual. Under suitable conditions dysenteric ulceration of the colon may readily arise, and in very severe cases when dissolution of the blood occurs, there may be hæmatemesis, or hæmor-

rhage from the bowel, and in addition hæmaturia. Jaundice is rare, but of fatal significance.

Nephritis, whether primary or secondary, is always serious. When due to the attack of Typhus Fever, if recovery takes place, no permanent damage to the kidney remains.

During the stuporous condition retention of urine may occur, and as a consequence of this cystitis.

Endocarditis and pericarditis are rare. Endarteritis may lead to thrombosis and gangrene, or the same result may be produced by arterial embolism. Endophlebitis may also give rise to thrombosis with swelling of the limb, and, when the lymphatics are also implicated, to "phlegmasia."

The extreme cardiac weakness produced by the degenerative changes in the heart-muscle, and the marked general prostration, will be readily recognised as potent factors in the formation of bed sores. The feeble circulation and altered state of the blood may even lead to spontaneous gangrene and noma.

The extreme variety in the severity of the attacks has led to the distinction of different types, and the undue prominence of certain symptoms, or features, to the coining of numerous synonyms.

From the occurrence of a "typhus headache" with malaise and no other manifestations, to an attack with high fever, profound prostration, and death in a few days (*T. siderans*) various grades in severity may be met with bridging over the interval. One may thus note the development of a temporary prostration, with a pyrexia of variable duration (abortive *T.*), and

unaccompanied by an exanthem (*T. sine exanthemate*), or the symptoms of the invasion may be followed after the usual interval by a distinct erythema, but unaccompanied by marked prostration, high temperature or signs of serious illness (*T. levissimus*). At the other extreme the occurrence of bleeding into the skin or from mucous surfaces, which gives rise to the term *Hæmorrhagic Typhus*, has already been described, and the ataxic or adynamic forms, so-called from the associated nervous symptoms or signs of cardiac and general debility, are comparable with the similar clinical types met with in Typhoid Fever.

DIAGNOSIS.

The protean aspect of the disease occasions considerable difficulty, more especially in the detection of the milder forms, save in the presence of an epidemic or with clear evidence of infection. This difficulty is enhanced by the rarity of the disease, and the consequent impossibility of obtaining acquaintance with its varied manifestations.

A well marked attack with mulberry rash and petechiæ is hardly likely to be mistaken for any other affection, so long as the practitioner has ever formed a mental picture of its appearance, character, and course. The definite and somewhat sudden onset of illness, the persistent headache and general pains, the early prostration with high temperature and quickened soft pulse, the development of a macular and erythematous eruption all over the body, with the exception of the face, palms and soles, after three to five days, the transformation of some

of the macules into petechiæ, and the appearance in addition of purpuric spots in the intervening areas are sufficient to distinguish this disease from other infectious ailments.

The suffusion of the face may give rise to a suspicion of Measles, but for this affection there is lacking the early catarrhal symptoms, including definite conjunctivitis, the onset also is more sudden, and prostration a more marked feature. In addition, the course of the temperature in the two diseases is quite different, the macular rash in Measles is present on the face, palms, and soles, the individual macules, being coarser in character and more diffusely distributed, whilst by coalescence they form large well defined erythematous areas. Moreover there is in Measles an absence of petechiæ save in rare instances, and Koplik's spots may be detected.

In Small-pox the sudden onset is soon followed by a marked improvement and a falling temperature. These features are noted before the appearance of the eruption (3rd day), which has a totally different character and distribution.

It is conceivable that difficulty may arise with regard to hæmorrhagic attacks, but under these circumstances information may be obtained from the prevalence of one or other infectious disease. From purpura this type is distinguishable by the sudden onset, and marked prostration with pyrexia which accompanies the hæmorrhagic condition.

Apart from epidemic prevalence the conditions under which an attack of illness has developed may furnish circumstantial diagnostic evidence. This is especially the case in Typhus Fever which, in the absence of direct infection to

nurses, attendants, etc., is always associated with conditions of poverty, uncleanness, overcrowding, or deficient ventilation.

From Typhoid Fever the differentiation is to be found in the more rapid onset of illness, and rise in temperature; in the earlier prostration and appearance of the rash; in the heavy and dull facial aspect with suffused eyes, and small pupils; the smaller size of the spleen as a general rule; the absence of diarrhœa and characteristic stools or distended abdomen; as well as the rapid fall in temperature at the end of a fortnight in cases which recover. Even in cases in which macules only arise, the latter are unlike those seen in Typhoid Fever in their individual longer duration, their non-appearance in crops, and their relatively greater numbers on the limbs. When the mulberry character of the rash is present, and more especially when hæmorrhages develop in and between the macules, the exanthem is in itself distinctive. In all doubtful cases the Widal reaction is of diagnostic value.

The tendency to implication of the respiratory system as shewn by the prevalence of signs of bronchitis even in the milder attacks, is apparently responsible for the relative frequency with which various forms of Pneumonia, often with signs of pulmonary consolidation, at first ill-marked but with unusually severe toxæmic symptoms, are notified as Typhus Fever. The recollection that in Pneumonia the symptoms are, as a rule, sooner or later proportionate to the evidence of the implication of the lungs, the absence of an exanthem, the careful examination of the chest, and the subsequent course of illness will enable one to avoid or correct such an error.

The marked headache at the onset, with later delirium and predominant cerebral symptoms, may lead to the suspicion of meningitis, the petechial rash which occurs in the epidemic cerebro-spinal form offering further difficulty. In meningitis, however, headache persists after the stage of delirium or stupor has been entered, whilst the occurrence of vomiting, retraction of the head, and the various paralyses are distinctive.

The appearance during the later stages of a moderately severe case of Typhus Fever may be simulated in many respects by a patient suffering from advanced uræmic intoxication, but the history of the attack including onset, course, temperature, and exanthem should prevent this mistake even though an examination of the urine might reveal the existence of albuminuria. Under the opposite condition also, in which pyrexia is present with uræmia, it must be remembered that this may arise from some complication, *e.g.*, pneumonia, pericarditis, etc.

Relapsing Fever may be difficult to distinguish from Typhus Fever, more especially at the beginning of the attack, since in both the onset is sudden and prostration occurs early, whilst the temperature quickly rises to a considerable height. Relapsing Fever is, however, characterised by a very rapid pulse, the prostration is relatively less profound, and mental disturbance is not so marked. Moreover, there is no exanthem, an examination of the blood reveals the specific micro-organism, and the attack terminates at the end of a week, to be followed by

a relapse after another few days' interval. The disease is, of course, extremely rare.

The facial aspect of Typhus Fever is in many instances, on account of the suffusion and the myopic pupils, suggestive of opium poisoning, and the stuporous state does not diminish the similarity. The absence of any history of the drug being administered, the temperature, exanthem, and history of the course of illness would soon dispel the suspicion.

PROGNOSIS.

The mortality from Typhus Fever is greatly affected by the age of the patients. Up to twenty years of age the rate is relatively small, and only slight differences are noted, after that period there is a steady increase with advancing years, until in old people the fatality reaches its maximum.

Cases with a high temperature (104°F. or over), more especially if this is persistently maintained, are likely to prove grave, but in general a more correct estimate of the condition can be obtained from a consideration of the heart and pulse.

As regards the temperature, Murchison expressed the opinion that "a severe case is characterised not merely by a high temperature in the first week, but by an anomalous or irregular range in the second, *e.g.*, by an absence of the morning fall, or by a sudden fall with rise of pulse, or with no improvement in the general symptoms." It is unfavourable for the temperature during the second week to be still rising. Late in the attack a rise of two or more degrees may precede a fatal termination.

The heart, however, forms the key to the

prognosis in Typhus Fever, and it is thus that one explains the increasing mortality with advancing years, as well as the baneful influence of chronic alcoholism, previous ill-health or definite disease, and the debilitating effects of unhealthy environments or occupations. Should the pulse increase in rapidity, and become smaller and more feeble, the prognosis is rendered even more grave by an associated fall in temperature.

Unfavourable signs or symptoms may be seen in the intensity of the prostration, the height of the pyrexia, the early appearance of petechiæ, and the supervention of marked nervous and more particularly cerebral complications. Acute maniacal symptoms, persistent sleeplessness, increasing stupor, subsultus tendinum, convulsions, and coma vigil are all of more or less immediately grave significance. Irregular, sighing, or Cheyne-Stokes breathing, hiccough, relaxation of the sphincters with tympanites, evidence of cardiac failure or dilatation, and of pneumonic consolidation in the later stage of a case with well-marked prostration, are also signs of more or less immediate urgency, and usually foretell a fatal termination. In many instances death is preceded by a period of profuse sweating.

TREATMENT.

In the management of Typhus Fever the most important indications are free ventilation and efficient nursing.

The patient usually seeks his bed early on account of the severe prostration.

Isolation is, of course, necessary as a prophylactic measure. Pending the establishment of

the diagnosis, if the room be large and situated on the topmost floor, if there be a fireplace, and the windows be kept widely open so as to secure ample ventilation and the passage of a free current of air round the patient's bed, the risk of the disease spreading to others will have been greatly minimised. In hospitals, when the ward is not on the ground floor, a special word of caution must be given on the vigilance required to prevent suicidal attempts.

In buildings of more than one storey, the uppermost floor is recommended because the micro-organism is believed to have a very low specific gravity.

Free ventilation rapidly renders the microbe innocuous, and in the examination of, or attendance on the patient, it is always advisable to take suitable precautions by raising the bed-clothes for a short period previous to, or by holding the breath during any act requiring an unusually close proximity.

Food must be fluid, easily digestible, and highly nutritious. When the attack terminates there is no contra-indication to a rapid return to a more solid diet according to the patient's inclinations and abilities.

During the acute period the fever must be treated by some form of hydrotherapy, *e.g.*, sponging in milder cases, or packs and baths in the more severe attacks. The great tendency to cardiac failure, and the weakness of the circulation, make generalised cold packs and baths not free from danger during the later periods of the disease. Moreover they are not followed by the same beneficial effects seen in Typhoid Fever. Light clothing is very helpful as an adjunct,

while tepid sponging, ice-bags and douches of iced-water to the shaven head for the headache, with later warm applications as counter-irritants, when indications arise, constitute the safest and most acceptable hydrotherapeutic measures.

The mouth must receive constant attention and cleansing. The body must be kept clean by the usual daily ablutions, and the position regularly changed when evidence of hypostatic congestion arises, or implicated regions protected when tendencies to bed-sores are noted (see Typhoid Fever). Retention of urine must be relieved by enemata, by fomentations locally, or by catheterism under aseptic precautions.

Constipation may be treated by mild laxatives. For vomiting relief may be sought by sucking small pieces of ice, by applying fomentations to the epigastrium, or by a temporary abstinence from all food. With diarrhœa salts of bismuth or chalk, vegetable astringents, or a starch and opium enema are indicated.

Phenacetin, antipyrin, etc., may be tried for the early headache and general pains, in addition to the ice-bags mentioned.

Bromides, paraldehyde, or chloral hydrate are of benefit in sleeplessness, the latter, however, must be used with caution. Opium or morphia is indicated when pain or insomnia is unrelieved by the remedies indicated.

In most cases of any severity stimulants are necessary. Alcohol must be freely administered with evidence of circulatory failure, more especially in old or debilitated persons. Its action may with advantage be supplemented by ammonia, strychnia, caffeine, and digitalis.

With signs of bronchitis, stimulant expectorants are to be recommended.

RELAPSING FEVER.

Relapsing Fever is an acute specific infectious disease, characterised by a rapid onset, a continuous pyrexia lasting five to seven days, the absence of any rash or localising symptoms, the not infrequent presence of icterus, and an abrupt termination of the attack. After an apyrexial period of seven to eight days, during which convalescence is apparently taking place rapidly, there follows a recurrence of shorter duration than, but identical nature to, the primary attack. This may be followed similarly by other relapses. During the acute febrile stages the specific micro-organism, the *Spirillum Obermeieri*, is present in the blood.

ETIOLOGY.

The disease is only met with in epidemics, which are of very rare occurrence, and associated particularly with conditions of privation. Conditions of fatigue and overwork, overcrowding, uncleanness, deficient sunlight or ventilation, may each play a part as etiological factors, but the essential predisposing cause is a state of famine. It is on these accounts that epidemics of this disease have, in the past, not uncommonly been connected with epidemics of Typhus Fever.

No age is exempt from attack, but adults are most frequently affected.

The relatively larger number of males suffering during an epidemic has been attributed to their greater number amongst the class of tramps and vagrants, from which a large proportion of the cases is drawn.

The disease may possibly be spread by fomites, but infection most commonly occurs by direct ærial transmission, from association with the sick, or through the intermediation of the bed-bug.

An attack does not confer any immunity.

INCUBATION PERIOD.

The period of incubation has been estimated at from three to seven days, the lower limit being probably the more usual one. During this time there is, as a rule, an absence of symptoms, but malaise, headache, languor, pains in the limbs and thirst may be met with.

SYMPTOMS AND COURSE.

The onset of the disease takes place suddenly, and is characterised by chills (or even rigors), marked frontal or occipital headache, pain in the back, neck, and limbs (especially muscular pains in the calves), vertigo and tinnitus aurium. Even during this "cold stage" the temperature is high, and may reach 104°F. to 106°F. within twelve or twenty-four hours of the earliest symptoms.

A reaction quickly follows, the "hot stage" being characterised by flushing of the face, a hot dry skin, and increase of the pains and thirst. In many cases there is epistaxis.

Usually the tongue remains moist, though covered by a yellowish white fur, save at the tip which is red. Anorexia is complete, and there is frequently epigastric tenderness, with nausea and even vomiting. In a moderate percentage of the cases there is jaundice of the catarrhal type, which must be carefully distin-

guished from that occurring in those rare and severe attacks of the hæmatogenous variety ("bilious typhoid"), in which the vomit consists of green-bile, or is like coffee-grounds.

There is practically always enlargement, and frequently tenderness, of both the liver and the spleen, the latter at autopsy shewing patches of yellow softening, and the former much fatty degeneration with cell infiltration by the portal vein channels. The pulse is very rapid, 120 or more beats per minute being the rule. In character, however, it is not small, but retains its fulness well, so that mere rapidity in this disease is of little prognostic value. A systolic murmur at the apex is not uncommon. The clinical manifestations are to be associated with fatty changes in the heart muscle.

A rose-rash, as in Typhoid Fever, has been met with on the chest, abdomen, and limbs in a few cases. It occurs about the third day, or possibly later, lasts three or four days at most, and the spots are of smaller size.

The respirations are hurried. In many cases there is cough, and on examination rhonchi are found.

Sleeplessness is often present, but delirium is not frequently met with, though it may occur occasionally just before the crisis, in association with an increase in the temperature, the pulse-rate, and the general prostration.

The urine exhibits the usual febrile characters, and may in some instances contain sufficient albumin with the presence of casts, to warrant the diagnosis of parenchymatous nephritis. When jaundice supervenes, the presence of bile in the urine is noted.

In addition to the presence of the spirilla in the blood during the acute stage, there is also a marked and increasing polymorphonuclear leucocytosis, a diminution occurring again after the crisis.

During the attacks sudamina are frequently present on the skin, and there may be herpes labialis, or more rarely a roseolar rash, as already mentioned, or petechiæ.

Throughout the acute stage the high temperature is maintained, the general symptoms of the "toxæmia" being hardly in consonance with the rapidity of the pulse, and the degree of pyrexia.

At the end of five to seven or even nine days a crisis occurs, often accompanied by profuse sweating. For a few days subsequently the temperature may remain subnormal. Convalescence is rapid, but in some epidemics the apyrexial intervals between the primary attack and successive relapses, may be complicated by arthritic swelling affecting several joints. They usually subside readily under treatment with salicylate of soda.

The rate of mortality is, as a rule, about 2 to 3 per cent.; it rarely reaches 6 to 8 per cent. Death occurs from collapse about the period of crisis, from exhaustion, acute pneumonia, or uræmia.

The mortality from Relapsing Fever is generally stated to be higher amongst males than in females, but on this point it is important to note that pregnant women, when attacked, invariably abort and often die.

Hæmorrhages may occur from various mucous surfaces, but other complications than those already mentioned are rare.

During convalescence an internal inflammation of the eyes may occur which may even lead to blindness, whilst diarrhœa, and dysentery may arise as sequelæ.

In the malignant form known as "bilious typhoid" the temperature is lower, the abdomen is hard and tender, the abdominal muscles are "knotted," intestinal spasm with intussusception ("twisting of the guts") has been noted, jaundice and hæmorrhages are regularly present, the pulse is unusually rapid, the extremities cold, the nose purple, and prostration severe.

DIAGNOSIS.

The presence of an epidemic is naturally of the greatest assistance in causing one to suspect the occurrence of the disease. The difficulty is to detect a case before the existence of an epidemic is known. Poverty, bad air, and insufficient nutrition are necessary associates. Their recurrence in such degree as to permit of the disease arising again is conceivably not yet outside the bounds of possibility, so long as panics, "corners," wars and "rumours of wars" exist, and it therefore behoves us to retain some knowledge of its main features. In every suspicious case the blood should be examined during the acute febrile stage for the specific spirilla.

Typhus Fever is distinguished from Relapsing Fever by the onset being usually less sudden, and the temperature lower. The pulse rate also is slower, prostration is more marked, there is a characteristic eruption, icterus and enlargement of the liver are absent, and the spleen is of smaller size. Finally, the attack is of longer

duration, is not followed by relapses, and terminates less suddenly.

Most of the considerations just enumerated for Typhus Fever form an even more marked distinction between Relapsing and Typhoid Fevers, the enlargement of the spleen and the occurrence of relapses being alone excluded.

A suspicion of one of the other infectious diseases, *e.g.*, Small-pox, might arise during the early stage, but the absence of the development of the characteristic exanthem, or local signs, after the usual intervals should prevent error.

Remittent Fever is essentially a disease of hot climates, the only similarity with Relapsing Fever being the occurrence of remissions which, however, do not resemble the relapses of the latter diseases in time, duration, or symptoms. Moreover, the examination of the blood revealing the presence of the plasmodium, and the effects of the administration of quinine, are distinctive.

In this country Yellow Fever is unknown, but the early vomiting, profound prostration, lower temperature, regular occurrence of icterus and black vomit with slight enlargement of the spleen, as well as the high mortality, form a clinical picture which could not long be the cause of error.

PROGNOSIS.

The rate of mortality increases to some extent with advancing age, but not at all to the same extent as in Typhus Fever. Particularly unfavourable conditions are jaundice with cerebral symptoms (*e.g.*, coma or delirium), hæmorrhagic manifestations (*e.g.*, purpura, bleedings from mucous surfaces), convulsions, severe diarrhœa,

collapse and pneumonia. The convulsions may be due to meningeal hæmorrhage, or to suppression of urine and uræmia, both of which are serious complications.

TREATMENT.

The usual indications for isolation, confinement to bed, and disinfection must be followed. The patient requires plenty of fresh air, a liberal supply of simple drinks, and a nutritious diet the character of which must depend on the condition of the tongue, and the state of the appetite.

During the acute stage tepid sponging is to be recommended with the application of ice to the head. The attack being of short duration, and the effects of the "toxins" on the tissues of only moderate severity the administration of cold baths is unnecessary.

Internally a saline may be given, and such complications as vomiting, diarrhœa, or dysentery treated on the usual lines.

Special attention must be drawn to the necessity for stimulation by alcohol, strychnia, fomentations, &c., at the time of the crisis, in order to prevent or overcome collapse, and to the advisability of good feeding from the earliest moment in convalescence to prevent ophthalmia, as well as to sustain the system against the subsequent relapse.

Gabritschewsky has produced a bacteriolytic serum from horses with which he is stated to have obtained a marked diminution in the occurrence of relapses. The serum, however, is as yet purely an experimental remedy.

DIPHTHERIA.

Diphtheria is an acute specific infectious disease due to invasion usually of the fauces, nose, naso-pharynx, or respiratory tract by the Klebs-Löffler bacillus. Locally a membranous exudate is formed, which in certain situations, *e.g.*, the larynx, trachea or bronchi may mechanically lead to serious symptoms of obstruction. In other regions the main evidence is that of a systemic disease arising from the absorption of toxins produced at the site of the membranous formation.

The toxæmia leads to the enlargement of neighbouring lymph glands, to the production of an irregular pyrexia during the early days of the attack, and to the degeneration of various tissues more especially the heart, muscles, and nerves. The degenerative changes in the kidneys and heart take the form of cloudy swelling and fatty metamorphosis of the cells. In addition interstitial exudation or proliferation takes place, giving rise to acute interstitial nephritis, or acute myocarditis, chiefly of a focal type.

ETIOLOGY.

The disease is endemic in the larger towns. In some localities it is persistently more prevalent than in others: this is seen not only in different towns and districts, but in separate divisions of the same town.

Though damp, dirt, want of sunlight and free ventilation, the presence of decaying organic refuse, or insanitary environment, may act as predisposing factors by retaining the specific

bacillus, or by deteriorating the health of the individual, and leading to the development of catarrhal sore throat, there is no definite relationship between these conditions and the prevalence of the disease. Attacks are met with in all classes of the community, but conditions of poverty, uncleanness and overcrowding must be recognised as offering more frequent opportunities for infection.

In temperate climates, to which the geographical distribution of the disease is largely limited, a seasonal epidemicity is noticed, an increase taking place regularly during the cold wet days of autumn. It is possible that the greater frequency of catarrhal affections of the throat and respiratory tract at this time, acts as a potent predisposing factor. Undoubtedly local changes produced by Scarlet Fever, Measles, Pertussis, the presence of adenoids, &c., induce a more or less marked predisposition. Post-scarlatinal Diphtheria is a troublesome complication and sequela in some infectious fever hospitals, and post-morbillic Diphtheria is characterised by unusual severity with a greater tendency to implication of the larynx. The presence of an excess of lymphoid tissue helps to explain not only individual susceptibility in some cases, but also the tendency to suffer from repeated attacks.

No age is exempt from the disease, but the majority of the patients are between 1 and 5 years old. During the first twelve months of life there seems to be a distinct relative immunity, and after the tenth year there is a marked decrease in the number of individuals affected.

Usually there is found to be a slight pre-

ponderance of females over males, and this has been attributed to such habits as kissing, and to the domestic duties of the sex necessitating a more intimate connection with children, and the consequently increased risk of exposure. The slight excess in the female population may also be concerned. In any case it is almost certain that no difference in immunity exists between the two sexes. Diphtheria may be spread by ærial transmission, but a more or less intimate contact is probably necessary for this method of infection. There can be little doubt that schools play a very important part by bringing numbers of children into close proximity. It is readily conveyed by fomites, infected instruments, toys, etc.

The marked infectiousness of the breath is a cogent reason for the discouragement of the indiscriminate kissing of children. In addition, it points to the necessity of preventing all acts by which infected saliva may serve as the medium of transmission. In this connection the danger from "cleaning" slates with saliva, from wetting teats by inserting them in the mouth, etc., and from coughing, must be specially mentioned, whilst sucking at a tracheotomy tube, or blowing down it to remove obstruction, is only likely to be a futile proceeding, and is referred to merely to be absolutely interdicted.

The probabilities of food, as opposed to feeding utensils, becoming infected are remote. Localised epidemics have arisen through the agency of milk, they are, however, rare, and are more likely to be connected with infection from a previous case, than from any diphtheritic affection of the cows from which the milk was

obtained. It must be remembered that milk serves as a suitable medium for the growth of the bacillus. Certain of the domestic animals may suffer from diphtheria, the liability of cats to spread the disease being probably the most marked.

It is important to note that after all clinical evidence of an attack has disappeared, the bacillus may remain locally, without pathological signs, for a variable length of time. Moreover, individuals may harbour the micro-organism without having themselves suffered from an attack. These occurrences are relatively more common in those who have been exposed to infection. Under such circumstances the individual concerned is said to be a "carrier" of infection, and it is highly probable that this is a not infrequent means of the disease being introduced into various communities.

INCUBATION PERIOD.

The incubation period of diphtheria cannot be definitely fixed. Even if an average time of one to four days be stated, it must be admitted that much longer intervals may elapse, without apparent re-exposure, before clinical manifestations are noted. It may be that slight feverishness, malaise, anorexia, nausea, headache, or general pains are complained of before localising symptoms arise, and this is especially the case when the site of the membranous formation is not visible. Usually, however, when the throat is affected, there is from the first a complaint of soreness in that region, if the child is old enough to express its feelings. It is nevertheless a good rule in children, to make a routine examination

of the fauces, in all cases of inexplicable indisposition.

When the membrane occupies other situations the earliest indications of the attack may take the form of huskiness, a croupy cough, slight stridor, unilateral nasal discharge, or nasal obstruction.

SYMPTOMS AND COURSE.

In almost every instance, whether the symptoms be general or local, the onset takes place gradually, rigors, and even convulsions, being sufficiently rare to almost exclude the diagnosis of this disease *per se*. In only a minority of the cases does the early nausea proceed to vomiting unless a contributory cause, *e.g.*, examination of the throat, or the administration of some drug, be added. Some dysphagia is the rule, but pain and discomfort are not infrequently less than what is felt in ordinary acute tonsillitis. The tongue is more or less coated, and the bowels are not specially affected.

In the faucial type of the disease, which constitutes the majority of the cases, the tonsils are seen to be more or less swollen and congested. The formation of membrane is usually more marked on one side than the other, and is very rarely unilateral save at the onset of the attack. In some instances congestion and swelling are very slight, in others the region immediately surrounding the area covered with membrane is deeply congested and œdematous. The inflammatory signs, however, evidently diminish as the distance from the implicated fauces increases, and there is no generalised inflammation of the soft palate, pharynx, &c., (unassociated in

severity with the amount or character of exudation) such as is seen in Scarlet Fever: as the disease spreads, the amount of swelling, and exudation, may attain any degree.

Since the introduction of bacteriology as an aid in diagnosis, the existence of inflammatory signs without membrane has been demonstrated, but such cases are rather remarkable for the absence of any marked associated swelling, as well as for the manner in which the redness of the throat persists for considerable periods, without shewing alteration from day to day.

When membrane is formed it may be seen to arise as isolated points, which steadily increase in size, and coalesce so as to form a well defined pellicle, which may cover the tonsils more or less completely, and spread on to neighbouring structures, *e.g.*, the palate, uvula, faucial pillars and pharynx. On the other hand isolated patches may be seen in any of these situations.

The typical membrane is whitish or creamy in colour, raised above and apparently lying on, but intimately adherent to, the mucous membrane, from which it cannot be removed without force, and the production of a raw surface, with bleeding. In the course of a few hours the membrane, after avulsion, has re-formed.

If the disease is unchecked, the membrane continues to increase in extent and thickness, though after a few days disintegrative changes not infrequently arise in it, the somewhat smooth surface giving rise to a more ragged, dirty, pultaceous and broken down appearance. The ulcerated surface which underlies it heals slowly, and readily gives rise to capillary oozing.

It must not be imagined that the above char-

acters can be detected even in a majority of the cases. In some instances the exudation from the first seems pultaceous, but grows steadily and cannot be wiped away by swabbing. Occasionally, even, the clinical appearances are indistinguishable to the naked eye from follicular tonsillitis as produced by septic micro-organisms. In other cases the membrane has a yellow, wash-leathery appearance, or its surface may be dark as from an admixture of blood within or below it. Under these circumstances the surrounding inflammation is often intense, the disease being more than usually virulent.

The adjoining lymph glands are implicated early, being swollen and tender. This is a point of diagnostic importance. As the disease progresses the glandular infiltration may become excessive, producing extensive œdema in the whole submaxillary region, and spreading down the neck even on to the upper part of the chest. The œdema is remarkable for its bogginess, and lack of induration or acute inflammatory characters. In this respect it stands in marked contrast with the brawny "tippet-neck" met with in cases of Scarlet Fever. Moreover suppuration of the glands in Diphtheria is unusual, and only occurs as a late manifestation.

In faucial and pharyngeal attacks pyrexia is present during the first few days, its height varying largely according to the acuteness and severity of the attack, and the amount of associated inflammatory mischief. It may reach 102°F. to 104°F., but more commonly it fails to attain these heights, and it may even be very slight throughout the attack. It is important, however, to note that after three or four days, in

uncomplicated cases, the temperature falls, though no improvement may be manifested in the condition of the throat.

Under these circumstances the temperature is normal or subnormal, whilst the examination of the throat reveals an extensive formation of membrane, which may be loosely adherent or exfoliating in some situation, and undergoing necrotic changes in others from the action of septic or putrefactive organisms. As a rule in Diphtheria, with attacks of any severity, there is an associated infection with septic microorganisms. In some cases this is so evident as to produce a septic type of attack, in which fever is not only high at the commencement, but may persist after the lapse of the time stated.

The glandular infiltration and œdema may become enormous, the breath with extensive faucial implication after a few days becomes horribly offensive, marked pallor is noted, the face is puffy, and the skin covering it has a waxy appearance. Subsequently serious bleeding may take place from the nose, or mouth, petechiæ or ecchymoses may appear in the subcutaneous tissue, and extensive hæmorrhages may arise as the result of slight mechanical injury (hæmorrhagic diphtheria).

The pulse varies in rapidity and characters with the severity of the attack. In mild cases it may show little alteration in speed, force, or fullness. In more acute toxæmic cases it may at first be full and forcible, soon becoming soft, rapid, and feeble, from the tendency to vascular hypotension, and to degeneration of the cardiac muscles caused by the toxins absorbed. In these cases also the heart is at first forcible and rapid,

but later the apex beat becomes diminished in intensity, and the first sound possibly indistinct. Bradycardia during the acute stage, or in severe cases, is of very grave import. In some instances there is also marked irregularity.

Albumin makes its appearance in the urine after two or three days' illness, the rapidity of onset, and the degree attained, being largely connected with the type of the attack, its acuteness, and the regions involved. Rapidly spreading affections of the pharynx and adjoining regions, with much glandular infiltration, generally show early and marked albuminuria; on the other hand, membrane may continue to spread for some time in the larynx, trachea, bronchi, or even in the nasal cavities without much albumin appearing in the urine.

In mild attacks the amount of urine and its appearance may show little variation from the normal. In severe toxæmic cases, on the contrary, the amount becomes greatly diminished, and the degree of albuminuria may reach such a degree as to cause solidification on boiling. In many of these cases the amount of urine undergoes steady diminution till complete suppression occurs. At the same time the pulse is small and feeble, evidences of cardiac failure become more marked, and vomiting frequently supervenes as the precursor of a fatal termination. Anasarca rarely results from the nephritis which is associated with Diphtheria, but pallor and prostration are noticeable features of an attack of Diphtheria of any severity or duration.

Recovery may begin at any stage, and is manifested by slowing of the pulse and improvement in its characters, diminution of the feelings of

prostration and weakness, lessening of the soreness of the throat, and gradual disappearance of the inflammatory swelling and superimposed membrane, as well as of the glandular infiltration.

Even in mild cases there is always a risk of paralytic sequelæ from the degeneration of nerves produced by the toxæmia, but the probability of occurrence, and the extent of the muscles involved, is greatly increased in severe cases, or in those of even moderate severity in which the attack does not quickly subside, or undergo early abortion from treatment. Paralytic symptoms in convalescence are also greatly aggravated by want of confinement to bed during the earlier period of the attack.

Involvement of the larynx usually takes place secondarily to a faucial or naso-pharyngeal attack, and occasionally it succeeds the intrapulmonary form where the disease has originated in the bronchi. In the great majority of cases it arises before the end of a week's illness. Occasionally the larynx may be primarily affected.

The development of huskiness, a croupy cough, or stridor, in association with the appearance of a membranous exudation about the fauces, may be accepted as clinical evidence of its diphtheritic nature. In other affections these symptoms only arise when the faucial inflammation reaches a very marked degree.

In primary diphtheritic laryngitis or "membranous croup," there may at first be an almost complete absence of pyrexia, glandular enlargement or signs of toxæmia, though possibly the child may have been unusually pale, or out of sorts for a short time previously. In other

instances a croupy cough develops without warning, and is followed by stridor. With these symptoms of stenosis, even without the supervention of broncho-pneumonia, there may be an associated remittent pyrexia, which may be maintained so long as the evidence of obstructed breathing persists, and even after it has been relieved by intubation or tracheotomy.

If the disease be not arrested the stridor steadily increases, sooner or later giving rise to dyspnœa, with inspiratory retraction at the suprasternal notch, the supraclavicular regions, and across the lower part of the chest and the epigastrium. At the same time restlessness increases, the child tosses about struggling for breath, each inspiration being accompanied by a crowing sound produced in the larynx. The veins of the neck become engorged, the lips cyanotic, the alae nasi expand with each inspiration. If unrelieved by intubation or tracheotomy, along with increasing restlessness, the skin becomes bathed in perspiration, and death follows from asphyxia and cardiac dilatation. In some rapidly progressing cases, the fatal termination may occur even within a couple of days from the first indications of the larynx being affected.

Similar symptoms are noticed when the trachea and bronchi are involved, though possibly the inspiratory stridor may be less pronounced, and be accompanied by laboured expiration. Under both conditions it may be impossible to detect the breath sounds on auscultating the chest, though the loud noise produced at the larynx is everywhere audible. The diagnosis of intrapulmonary diphtheria can only be confirmed,

either by the exfoliation of casts from the bronchi, or by observing the incomplete relief afforded by operative interference.

When tracheotomy is performed the presence of membrane is noted in the trachea, or after opening the trachea there may still be evident obstruction at a lower level. Even if no definite signs of obstruction are present, intrapulmonary diphtheria is always to be suspected if the patient very slowly, or only incompletely regains a good colour, when there is undoubtedly a free passage for air into the trachea. In these cases, in the course of the next twenty-four or thirty-six hours after operation, an absence of secretion, or more especially a secretion of dirty colour, and very sticky appearance, is a sign of bad omen, and may be followed by a return of dyspnoea, which is then unrelievable by further operative interference, and which, increasing, soon brings about a fatal termination.

Nasal diphtheria may be a very mild affection when the process is limited to the nasal passages, or an acutely spreading virulent infection, when the nasopharynx is also implicated.

The affection may be unilateral, but more frequently the formation of membrane takes place unequally on the two sides.

If the disease has spread from the fauces its detection offers no difficulty. There will probably be nasal obstruction, with a serous discharge from the nares, which later becomes purulent, and possibly blood-stained with excoriation of the nares. Finally, membrane may be visible on inspection of the nasal passages. Epistaxis is sometimes frequently repeated, and may even constitute a dangerous complication. At times

large casts are exfoliated, blown out, or removed. This occurrence is generally evidence of the termination of the attack, and may be followed by rapid improvement. Lymphatic absorption, however, is so free that a guarded opinion must always be expressed. This is more especially the case when the nasopharynx is implicated, since paralysis is possibly a more common sequela of such attacks than of any other form.

In some instances diphtheria seems to produce a chronic rhinitis, the affection persisting with little or no discharge, with excoriation of the nostril, possibly with a tendency to repeated epistaxis, one side being more markedly implicated than the other. Attacks of this description, their true nature being unsuspected, may be potent factors in spreading the disease. A diagnosis can only be made as the result of a bacteriological examination.

Fibrinous rhinitis, in which the membrane is limited to the nasal passages, without implication of the nasopharynx, is apparently, in all cases, a mild form of diphtheria, though in the experience of different observers it is remarkable how seldom it is responsible for the production of attacks of the ordinary type.

The middle ear may be infected by the Eustachian tube from diphtheritic inflammation of the throat, as after other naso-pharyngeal affections. The specific bacillus is sometimes present in the aural discharge which proceeds from the otitis media thus produced.

Diphtheritic involvement of the conjunctiva, of the vulva, or of a wound in the skin, is usually associated with a known channel of infection, and does not call for special consideration beyond

drawing attention to the urgent need for local treatment, as well as the injection of antitoxin. This urgency is particularly marked when the ocular conjunctiva is affected, on account of the danger of panophthalmitis and loss of vision.

Excluding the mechanical effects of the presence of membrane in the larynx, bronchi, &c., and nose, the complications and sequelæ which arise in Diphtheria are the result of the associated toxæmia. One of the earliest is the production of albuminuria from degenerative changes in the kidneys as already mentioned. It may be noted as early as the first or second day of the attack, but more commonly its appearance is deferred till the third or fourth day. The earlier onset is naturally associated with the cases shewing a more acute absorption of toxins, as evidenced by high temperature, extensive membrane in the naso-pharynx, much inflammation of the throat and glandular infiltration, and forcible beating of the heart with full throbbing vessels. Its percentage occurrence has been variously estimated at from $\frac{1}{3}$ to $\frac{3}{4}$ of all cases, being highest in children under ten years of age. The amount of albumen may attain any degree. In mild cases it may be very slight and transient, but it usually lasts for several days, and rarely persists longer than two weeks.

In the severest cases a steadily increasing toxæmia may lead to death from cardiac failure before the end of the first week. More commonly, however, the evidence of serious involvement of the heart is deferred till the tenth or some subsequent day. It may be that the throat is then much improved, or even quite recovered, but immediately after swallowing, or quite independ-

ently, the patient suffers from vomiting. At the same time pallor becomes more marked, the pulse, which may be either slow or rapid, is feeble and often irregular, and auscultation of the heart reveals alteration in the rhythm or relative loudness of the sounds at the apex. Usually the mental condition remains quite clear, active delirium being rarely met with, the extremities are cold, and the temperature is sub-normal. Under such circumstances a fatal termination can be predicted almost with certainty. In these cases of cardiac paralysis there is degeneration of the cardiac muscle and of the vagi nerves. The relative part played by each factor is undetermined.

Even in milder cases the degeneration of muscle and nerves introduces an element of danger, which must be constantly kept in mind for two months or more, since any undue exertion during that period may result in sudden death from syncope. Usually indications are to be found in an altered cardiac rhythm, or in the presence of weakness or relative sharpness of the first sound at the apex. There may be reduplication of the second sound and the production of a gallop rhythm. Occasionally dilatation arises, with or without evidence of mitral regurgitation, but this is a much rarer manifestation.

Besides the heart, paralysis may affect other muscles from implication of their nerve supply. It is possible that, occasionally, paralysis of the soft palate may arise within the first ten days of the attack, but with this exception it may be said that symptoms of post-diphtheritic paralysis are always in abeyance till after the lapse of that period. They may make their appearance at

any time during the first ten weeks, the more usual average being three to four weeks.

The occurrence of paralysis shows no constant relative proportion to the severity of the primary disease. There can be little doubt that it is more prevalent in severe than in mild attacks, but it must be remembered that in many instances of the former type, death ensues before the time for the supervention of this complication is reached. On the other hand, the length of time the toxæmia is permitted to exist must be an important factor, and this is not infrequently more extended in milder cases.

It has even been suggested that, as the result of antitoxin treatment, the relative prevalence of paralysis has been increased from 14 per cent. to 17 per cent. of all cases. It is, however, tolerably certain that the treatment can only have produced this effect by increasing the length of life in the more severe attacks.

The toxins of Diphtheria show a special tendency to pick out certain nerves, thus giving rise to distinct types of paralysis. When the palate is affected alone, the paralysis usually lasts from ten days to a fortnight. The velum palati is seen to droop, there is loss of the palatal reflex, the voice is nasal, and fluids tend to regurgitate through the nares.

In many instances palatal paralysis is associated (1) with paralysis of the ciliary muscles producing deficient power of accommodation and inability to read; (2) with paresis of the external recti leading to strabismus, or more commonly inability to move the eyeballs outwards; (3) with loss of the patellar tendon reflexes. The effect of an attack of Diphtheria on these

reflexes varies greatly, if the legs are unaffected they may be lively throughout, or they may be lost in convalescence, and be weeks or months in returning. The reflexes are also not uncommonly temporarily exaggerated previously to disappearance.

The foregoing forms of paralysis, excluding the various evidences of the heart being affected, constitute the commonest manifestations, and represent the mildest types of the complication. In more severe cases the diaphragm may be paralysed, inspiration being then unaccompanied by protrusion of the abdomen, and cough being ineffectual, husky, as well as totally lacking in explosive characters. At the same time there is usually a profuse secretion of frothy mucoid expectoration, and a great tendency to the development of hypostatic pneumonia.

More rarely the intercostal muscles are implicated, the simultaneous affection of both groups of inspiratory muscles being almost of necessity fatal. For a short period artificial respiration might maintain vitality.

When the pharyngeal muscles are paralysed there is dysphagia, any attempt to swallow being accompanied by the passage of food into the larynx, with the production of spasm of the glottis. Its repetition, with diminution of the cough reflex, may even lead to "deglutition pneumonia."

In paralysis of the muscles of the extremities, the legs are decidedly more frequently implicated than the arms. If the patient is able to walk there is dropping of the foot, weakness in flexing the thighs, and possibly inco-ordination. In severer cases there may be almost complete loss

of power. At the same time there is frequently some anæsthesia. The limbs are rarely affected during the first month. After paresis develops it may increase up to the end of the second month, recovery being completed, after a period of apparent stability, in from six to eight months. It is stated that there is no reaction of degeneration, and that the electrical excitability of the muscles to faradism is variable, and exhibits no relation to the voluntary power.

Paralysis of the facial muscles, and of the bladder and rectum has been described, but is very unusual in any of these situations.

Histological evidences of changes in the central nervous system are possibly not infrequent, though clinical manifestations are very rare, and are limited to such altered mental states as restlessness and irritability, or drowsiness and apathy in severe cases. Of the few instances of hemiplegia which have been met with, the ascertained cause has generally been connected with the circulatory system, *e.g.*, thrombosis or hæmorrhage.

An attack of Diphtheria only produces a temporary immunity. If the disease is at an early period aborted by the injection of antitoxin, a passive immunity is produced, the effect of which has probably always passed off by the end of three weeks, and may be of much shorter duration. When the attack terminates by natural recovery, that is to say when an active immunity is produced, the effect is considerably prolonged.

In laryngeal cases a recurrence of stridor is sometimes met with two to three weeks after the primary attack. In the only two cases of this

description coming within my own experience, the cause was apparently a true relapse, subsidence of the symptoms and recovery following a further injection of antitoxin. It is, however, said to be sometimes due to abductor paralysis. A secondary angina of a non-diphtheritic nature has been described about this time, which may even be accompanied by exudation. In the treatment of the latter condition local measures are recommended, the re-injection of antitoxin having occasionally given rise to rigors, vomiting, and collapse, with unusually marked and early development of generalised urticaria.

DIAGNOSIS.

The detection of exudation on the tonsils raises the suspicion of Diphtheria, but the difficulty is to differentiate the various conditions under which such exudation may occur. In addition to the clinical history, the appearance of the throat, the associated signs or symptoms (*e.g.*, temperature, pulse, condition of neighbouring glands, and absence of an exanthem), two points concerning the exudation must be particularly noted, *viz.*, (1) the inability to remove it by swabbing and (2) its steady growth in thickness and extent. Neither of these features is pathognomonic, but their observance often gives valuable positive or negative evidence.

In examining the throat a good view must always be obtained on the first attempt, and all preparations made in case the child should struggle.

Tonsillar crypts must be examined by depressing the base of the tongue so as to cause slight retching.

On rare occasions a scarlatiniform erythema

may be present, but under these circumstances it is generally ill-defined and possesses a different distribution from that met with in Scarlet Fever. The erythema is more common in cases treated by the injection of antitoxin, and not infrequently it is best seen in, or limited to, the neighbourhood of the injection. In the differential diagnosis, however, the mode of onset of the attack, the absence of a characteristic appearance of the tongue, the relatively slow pulse rate, and possibly a history of infection may render valuable aid.

The more common error is to mistake a case of Scarlet Fever for one of Diphtheria owing to the presence of superficial necrotic patches or the formation of membrane about the fauces, and neglect in examining the skin, &c. Occasionally the two diseases may be co-existent, but in the great majority of the cases of undoubted Scarlet Fever the membrane formed is of a non-diphtheritic nature.

When exudation is limited to the tonsillar crypts, the probabilities are greatly in favour of the diagnosis of simple follicular tonsillitis. Occasionally, however, the diphtheritic affection may assume this form. A high temperature (*i.e.*, 102° F. or over), rapid pulse, hot skin (either dry or with profuse sweating), feeling of severe illness, absence of glandular infiltration, marked faucial congestion and dysphagia, are against the diagnosis of diphtheria in such cases. A bacteriological examination, however, is always advisable, and early re-examination must never be neglected. If the exudation spreads over the intervening areas but is of a pultaceous character, and readily removable by swabbing, the proba-

bilities of its non-diphtheritic nature are practically assured.

The acute inflammatory and usually unilateral affection known as quinsy, in which the swelling is so frequently seen to cause a bulging of the soft palate on the side attacked, should not occasion any difficulty even though there be exudation on the tonsils, or isolated patches of clean, white membrane on the inflamed, and œdematous surface. These patches are only loosely adherent, present an appearance of coagulated egg-albumen, and do not exhibit a steady growth. They are the results of streptococcal infection.

Membrane may also be produced on the fauces and adjoining parts by the pneumococcus. This is also somewhat loosely adherent, presenting the appearance of lying on the surface, and not being due to a "necrosis" of the mucous membrane. There is, further, an absence of associated signs of inflammation, and of glandular infiltration. Finally, evidences of the opportunity for infection by this micro-organism, *e.g.*, pneumonia, are usually present.

In herpetic sore-throat a mistaken diagnosis of Diphtheria has been made, when the vesicles by their rupture have given rise to whitish ulcerations, and more especially when these have coalesced. The affection, however, is always most marked on the palate, isolated round spots are still visible, whilst the lack of steady growth and the absence of glandular infiltration, though the ulcerations remain for some days, constitute a totally different clinical course. Herpes, in other situations, though favouring the diagnosis of this disease, is not conclusive evidence against Diphtheria.

The situations of the whitish ulcerations in aphthous stomatitis, their size, appearance, and course are sufficiently distinctive.

Occasionally, in the secondary stage of syphilis with general faucial congestion, a thin film of greyish-looking membrane covers the ulcerated fauces. There is usually a history of syphilitic infection, and an absence of marked albuminuria or of glandular infiltration, though the attack has been in progress for a variable number of days, or even weeks. The membrane is seen to retain its filmy character, altering little from day to day, and thus exhibiting a clinical course quite different from that met with in Diphtheria.

In the tertiary stage of Syphilis the history, the relatively slow course, the amount of swelling, exudation, or ulceration, and the coincident slight constitutional symptoms should readily prevent error.

In Vincent's angina the lesion is usually limited to one tonsil. There is no glandular infiltration, no toxæmia, and the exudation is of a pultaceous character. The affection is more chronic, gives rise to deeper ulceration, and microscopical examination reveals the presence of the bacilli and spirilla.

In Typhoid Fever want of attention to the throat may cause large masses of dirty mucus to collect on the fauces, but swabbing soon demonstrates its nature.

The application of a caustic produces a local eschar, which may occasion suspicion if the history is not known. There is, however, a complete absence of steady growth, whilst the presence of pyrexia, glands, or constitutional

symptoms, depends on the condition for which the caustic was applied.

With symptoms of laryngeal obstruction a diagnosis may be quite easy, or a definite conclusion impossible. In all cases when membrane is present about the fauces, pharynx, or epiglottis the diphtheritic nature is assured, save in those severe instances of inflammation with necrotic changes, *e.g.*, in Scarlet Fever. In the absence of any visible membrane a diagnosis may be surmised from the history of onset, the course, or the associated symptoms, and may be confirmed by the bacteriological examination of a swab taken from the pharynx, or by the appearance of membrane brought up by coughing or discovered by operative interference. It is advisable to accept every case of "membranous croup" as due to the Klebs-Löffler bacillus, at least for purposes of treatment and prophylaxis.

In infants and children a simple, catarrhal laryngitis may give rise to obstructive symptoms. Usually in these cases there is, at least in the early stage, greater huskiness, with a tendency to intermission in severity, a more decided relief from ordinary treatment by expectorants, warm local applications, and a moist warm atmosphere, as well as an absence of steadily increasing difficulty in breathing. If the temperature is distinctly raised (*e.g.*, 101°F. or 102°F.), or coryza and conjunctivitis are present with a barking cough, the question of Measles arises. In convalescence from Measles it must be remembered that the development of laryngeal stridor is very possibly the result of diphtheritic infection, since that disease undoubtedly acts as a predisposing factor.

Rachitic children are liable to spasmodic attacks of stridor, even without any previous signs of laryngitis (*laryngismus stridulus*), or from very slight inflammatory changes (*laryngitis stridulosa*). In the former case the attacks come on suddenly especially in the night, or after excitement and crying. They are of short duration, and may be immediately fatal, but generally subside completely. There is, however, a marked tendency to recurrence.

When the laryngeal obstruction is due to œdema glottidis, malignant disease, laryngeal paralysis, adductor spasm, or hysteria, the history or examination causes little difficulty to be experienced.

Speaking generally, with regard to the diagnosis of Diphtheria, in all cases of doubt the physician should at once call in the aid of bacteriology by submitting a swab from the throat or nose for examination. It is, however, imperative that he should retain a clear idea of the clinical course, and that he should on no account delay the administration of anti-toxin where harm is likely to follow. It must, further, not be forgotten that occasionally in undoubted cases of Diphtheria, the examination of a single swab as usually conducted, does not shew the presence of the bacillus.

PROGNOSIS.

The mortality from Diphtheria is highest in children under five years of age. The maximum is reached in infants under one year, but at that age the morbidity is less. It is only little less fatal during the second year. The influence of individual predisposition, and of epidemic type

must be admitted, but it is difficult to imagine any difference in relative immunity as regards the sexes, though females always seem to shew a slightly higher rate of mortality.

The severity of a case must be judged from the local appearances and the constitutional symptoms. In mild cases the membrane is very limited in extent, clean looking, and whitish or greyish in colour, with slight inflammatory redness and swelling, and little glandular infiltration. The temperature also is only moderately raised, the pulse slightly accelerated, and the subjective feelings of illness not pronounced. In cases of this type after a few days the throat may begin to clear, and the constitutional symptoms to slowly improve, recovery following without the development of sequelæ. A close watch, however, must be kept on the heart for several weeks, and all acts of sudden exertion absolutely forbidden.

More serious cases are to be recognised by somewhat rapid onset, and progress. The temperature at the onset reaches 102°F to 104°F, the pulse is considerably accelerated, and of a full bounding character, the heart's action being laboured, and prostration very decided. In addition the throat shews more marked soreness, congestion and swelling, the membrane is more or less deep yellow in colour, spreads rapidly, or early presents discoloured patches probably from some blood effusion. The submaxillary glands are tender, and undergo early enlargement, albumen appears in the urine on the second or third day, and quickly increases in amount. A large proportion of such cases, even though evidence of improvement in the local and general

conditions be obtained by the end of three or four days' illness, are sure to suffer later in some degree from heart failure or paralysis. The longer the toxæmia persists and the more severe the symptoms arising from it, the greater is the liability to serious complications, and the risk of a fatal termination. The presence of much external swelling, even though little membrane is visible, is an indication of high virulence. Evident superadded septic infection with foul throat, and marked inflammatory swelling of the glands and surrounding tissues, though not necessarily fatal, is of grave significance.

In hæmorrhagic attacks the patients practically always succumb.

The value of albuminuria as a prognostic factor has been much debated.

The appearance of more than a trace of albumen in the urine should at any rate be looked upon as a danger signal. Though recovery may occur even after large amounts have been noted, and though there is no definite relationship between the quantity of albumen in the urine and the rate of mortality, it nevertheless serves as a valuable index of the degree of toxæmia.

Vomiting arising after the end of the first week is a grave symptom, and when coupled with marked pallor, and signs of cardiac paralysis or failure, is practically always fatal. As an earlier symptom it is especially associated with evident toxæmia, sore throat, and such measures as swabbing or syringing the throat.

Syncopal attacks from failure of the heart muscle or cardiac paralysis may occur early or late. The earlier they arise and the more independent they are of any excitement or undue

muscular exertion, and the more likely they are to be fatal. Recovery is not infrequent when they occur during convalescence, but even then sudden death is only too common. It is the possibility of this accident which necessitates a constantly repeated examination of the heart during convalescence, with prolonged rest in the recumbent position, so long as signs of that organ being affected are present. Care should even be exercised for a period of two to three months.

In laryngeal attacks there is a danger of mechanical obstruction leading to asphyxia, and of the supervention of broncho-pneumonia. Bronchitic signs are not uncommon, and in a considerable percentage of the cases broncho-pneumonia is the ultimate cause of death. This complication is apparently more often due to the diphtheritic process spreading from the bronchioles into the alveoli, than to operative interference. With evidence of intra-pulmonary obstruction recovery is very unlikely, nevertheless since the introduction of antitoxin, the mortality from all cases of laryngeal obstruction requiring mechanical relief has been reduced to about 30 per cent.

From pharyngeal, diaphragmatic, and other forms of paralysis recovery is possible, so long as suitable treatment is efficiently carried out, and the heart not materially involved.

TREATMENT.

The essential treatment of Diphtheria consists in the early administration of a sufficient dose of antitoxin. It is true that, in mild cases in adults, the disease may pursue an uninterruptedly

favourable course. Progress, however, is so difficult to forecast, and the dangers of a continued absorption of toxins are so serious, that in every case it is advisable to bring the disease to a speedy termination. In children this course is imperative. Even in doubtful cases if the local and constitutional symptoms are at all severe, it is advisable not to delay, since the mechanical results of membrane formed, or the tissue changes arising from the toxins absorbed, may readily reach such a degree as to jeopardise the patient's recovery, even though later the disease be aborted by the increased dose of antitoxin necessitated. The time at which the injection of antitoxin takes place may be regarded as a factor in prognosis, since it is found that when administered on the day of onset, recovery is the almost invariable rule, whereas when delayed to the second and third days the mortality shews a steady increase, and even cases which recover exhibit a larger percentage of the various complications. After the third day, taking a large number of cases, the beneficial influence as regards its effects on the mortality and complications is greatly reduced, and after the fourth day it may be practically said to disappear. Since the introduction of antitoxin treatment, the death-rate per attack has been reduced more than fifty per cent, falling from 30—35 per cent. before, to 12—17 per cent. after. Moreover, when the injection is performed early a smaller dose of antitoxin is needed, so that whereas, for example, 2000 units may be sufficient on the first day, even double that amount may give less satisfactory results on the second day. Under these circumstances it is an

undoubted disgrace to the profession that, as reported by Dr. A. Knyvett Gordon, the Medical Superintendent of the Monsall Fever Hospital, Manchester, only 13·4 per cent. of the admissions for Diphtheria take place before the fourth day of the disease, and that *antitoxin has hardly ever been administered previous to admission*.

It is doubtful how far antitoxin may annul the effects of toxins, which have already entered into combination with the various tissues. It is probably useless for the repair of tissues already affected, and reports of its value in the paralytic sequelæ are generally received with scepticism.

The dose to be given necessarily varies with the time at which it is administered, with the severity of the disease as judged by the extent of the local mischief, and the degree of constitutional disturbance, as well as with the presence of urgent symptoms. In mild cases with little membrane, slight glandular infiltration, and very moderate indisposition, 2000 units will usually be found sufficient. If the inflammatory or constitutional symptoms are well marked, a dose of 4000 units is advisable even on the first day, whilst if delay has arisen before seeing the patient, doses of 6000 to 8000 units are to be preferred. In cases of the septic type the simultaneous injection of anti-streptococcic serum has been recommended.

In laryngeal attacks it is customary to give relatively large doses on account of the urgency of the symptoms. It may here be mentioned (1) that laryngeal complications are not to be feared after a sufficient dose of antitoxin has been injected, if they have not previously been noted, (2) that if there be no stridor at the time of the

injection operative interference will almost certainly be avoided, (3) that where intubation or tracheotomy is necessary the probability of recovery by using antitoxin will be enormously increased, the mortality according to numerous observers having fallen from 70 per cent to 35 per cent. or lower, (4) that in cases where stridor is well marked, improvement may be expected after the expiration of 36 to 48 hours from the time of the injection.

In intra-pulmonary attacks, and in those of the severe toxæmic or hæmorrhagic type, very large doses have been recommended, *e.g.*, 20,000 to 30,000 units, and in these forms better results have been reported from intravenous injections.

In all cases the dose must be judged from the type of the attack, and not from the age of the patient. If no improvement in temperature, pulse, &c., is noted at the end of twelve hours, a further injection must be given. The method of administration is extremely simple; an aseptic needle and syringe is used, of sufficient capacity to receive the required amount of antitoxin, and the latter, under aseptic precautions, is injected into the subcutaneous tissue, a site being chosen where this tissue is lax, and where the temporary discomfort caused will not interfere with the recumbent position. The patient must be held firmly, the needle inserted smartly, and the fluid injected slowly.

After the antitoxin has been administered, in the course of a few hours, the constitutional symptoms improve, there is a fall in the temperature and the pulse rate, and the throat feels easier. After the first day the membrane ceases to spread, and towards the end of the second day looks

cleaner, the swelling of the throat being then also less, and the glandular infiltration diminishing. By the third day the amount of membrane is evidently smaller, and there follows a rapid disappearance of the exudation, with the subsequent slower healing of any ulcerated surface.

There are no contra-indications to the use of antitoxin which may not be overridden by the necessity for its administration. Abscesses at the site of injection are due to deficient antiseptic precautions. Nephritis has been stated to occur, but since this affection arises as a complication of Diphtheria, the connection is difficult to prove. When given as a prophylactic measure temporary albuminuria has been noted some days later. On the contrary there can be no doubt but that its injection, by preventing the further action of the toxins on the tissues, must diminish the tendency to the albuminuria or nephritis caused by such toxæmia.

In a few cases giddiness, convulsions, collapse and syncope have been described as following the injection, and in rare cases even death has occurred. In the latter case the constitution of the individual has been at fault, *e.g.*, status lymphaticus.

Certain well-recognised sequelæ may follow the injection of antitoxin, usually after an interval of seven to ten days, the serum and not the specific antidote being probably responsible for their production. The symptoms and signs include rashes, pyrexia, joint pains and feelings of indisposition. The rash is most frequently of an urticarial character. In other cases an erythema of polymorphic, scarlatinoid, or morbilliform type appears. Vesicular and purpuric

eruptions have been described but are uncommon. The rashes often make their first appearance, and are most marked about the site of injection, they may be scanty or profuse, and their distribution over the body shews no definite arrangement. They are generally accompanied by itching, which is occasionally almost intolerable, but rarely lasts longer than two or three days. In some cases there is coincident puffiness about the face, and in other situations.

Pyrexia is usually of only moderate degree (101°F. or 102°F.). It is highest during the appearance, and period of maximum intensity of the rash, or whilst there is an accompanying synovitis, and subsides gradually in the course of two or three days. The pains in the joints are of the same evanescent description, and in some cases are associated with signs of effusion.

The serum treatment of Diphtheria and its effects, have been first dealt with on account of the primary importance which must be attached to it, but it will be readily understood that the necessity for isolation, for prophylaxis, for nursing, and for the management of special symptoms and complications demands careful consideration.

From the account of the disease it will be gathered that confinement to bed in a spacious well-ventilated room or ward is indicated, arrangements for isolation being identical with those adopted for Scarlet Fever. As regards the diet there are no special contra-indications, so that its characters will depend on the patient's condition, his ability to swallow, either from sore throat, or paralysis, and the presence or absence of a furred tongue and anorexia, so usual

in this as in most acute diseases. A liberal ordinary diet is to be given as soon as the indications permit.

In all, save the mildest cases, local treatment of the throat is most important, the principle to be followed being the regular, free, and frequent cleansing with a mild antiseptic lotion. Attempts at disinfection by local cauterisation or swabbing with strong antiseptic lotions (*e.g.*, 20—30 per cent. carbolic acid in glycerine) are not to be recommended. The latter measures are not only ineffective, but entail considerable exhaustion, and in addition are not free from the risk of producing a breach of surface, and thus permitting further absorption. In children, at any rate, syringing and douching can be much more readily performed than swabbing (see Scarlet Fever). The local treatment of the nose and ears is also essentially the same as that described for rhinitis, and otitis media in Scarlet Fever. If epistaxis arises the irrigation must be temporarily stopped, and if at all profuse completely abandoned, local efforts being limited to frequently wiping the nares gently, after the hæmorrhage has stopped.

As a medicinal remedy Perchloride of Iron long retained a reputed value and even yet has probably more advocates than any other drug. Quinine, Liquor Chlorig and a large number of other remedies have their supporters, but it cannot be said that any one of them is invariably, or even usually, followed by evident beneficial results.

Preparations of Iron, and nutritious feeding with change of scene are indicated in convalescence, but even then the first consideration must

be given to the management or prevention of the various paralytic sequelæ.

With cardiac failure and the frequently associated vascular hypotonus, the patient must lie flat in bed, without a pillow under the head, the foot of the bed being raised. Neither by active nor passive movement must he be permitted to leave the recumbent attitude, and all exertion must be forbidden. Fomentations or stupes may be applied to the præcordial region, and alcohol, strychnia, and digitalis administered. Grave doubts have been expressed as to the value of these drugs in this condition, and better results have been described from 1 in 1000 Adrenalin Solution. The administration of the drug should be begun early, at first five to ten minims three times daily, and if necessary later increased. Atropine also has been recommended.

When the amount of urine excreted is diminished, hot drinks and citrate of caffeine should be tried, with the application of counter irritants to the loins. Cardiac stimulants (*e.g.*, digitalis and alcohol), and adrenalin must also be given, since the condition of the heart and circulation seems to be a most important and serious factor. From the onset of anuria a fatal termination soon follows.

The various forms of paralysis are self limited, and in cases which recover these sequelæ pass away completely. The administration of Strychnia seems to be the only satisfactory medicinal remedy, and the nervous system under these circumstances is more than usually tolerant to this drug. Time must of course be allowed for regeneration, and it is doubtful how far assistance in this respect can be rendered. The mainten-

ance, so far as possible, of the tone and condition of the muscles is probably all that can be attempted, and for this purpose massage is our most effective means. Galvanism has been recommended during the early stages, and faradism during the later period, but it is doubtful if any improvement is obtained by their use.

With regurgitation of fluids in palatal paralysis, the food must be given of a more solid or semi-solid nature. Some writers recommend the sucking of fluids through a tube with the head forwards.

In pharyngeal paralysis all feeding must be performed through the nasal or œsophageal tube, if such measures as those just recommended in palatal paralysis do not prevent the occurrence of attacks of coughing.

When the diaphragm is paralysed the foot of the bed should be raised, and the position of the patient frequently changed.

In all cases of paralysis the importance of rest in bed, nutritious feeding, and plenty of fresh air cannot be over-estimated.

With laryngeal stridor relief must be sought from intubation or tracheotomy. Unless there is a probability of recovery without operative interference, it is advisable not to wait after signs of distress (*e.g.*, anxiety, restlessness, marked retraction and inspiratory stridor) have manifested themselves. Naturally much will depend on the speed with which medical assistance can be obtained if required, and on the operative skill of the practitioner. When an attack of urgent paroxysmal dyspnoea has occurred, it is not advisable to delay operating unless assistance is close at hand. With a good light, plenty of

time, and only slightly distended cervical veins, tracheotomy may be considered as a comparatively easy operation. With the reverse conditions careful dissection may be an absolute impossibility, and it is then often necessary to perform the operation by the sense of touch alone. Some practitioners adopt the latter method by preference in all cases. The child is firmly held, with the arms to the side, in a sheet wound round the body; a small roll or pillow is placed under the neck, and the head kept still by an assistant so that the chin is maintained in the middle line opposite the suprasternal notch. The operator with his finger on the cricoid cartilage cuts through skin and subcutaneous tissues down to the muscles *in the middle line*, and, still retaining the index finger of the left hand as a guide, pushes the knife through into the trachea at the lower end of the wound, and cuts upwards. Others prefer to steady the trachea between the thumb and first finger so as to prevent it slipping aside when pushing the knife into it, and then cutting up between them. An escape of air shews that the trachea has been opened. Should there be any difficulty in finding the opening, or in inserting the dilators, the process must be immediately repeated, a free incision being made without wasting too much time in searching. The trachea, being very mobile laterally, may have been nicked on one side and not properly opened; thus on account of a slight escape of air much valuable time may be lost in trying to find an opening. If the breathing has ceased there is not a second to lose, and if there is obstruction to the exit of air one may be sure that a freer opening will be

necessary. On the other hand it must be remembered that so long as the incision is made *in the middle line* no serious damage is likely to be done. Even if the trachea be transfixed, and an œsophageal fistula produced, feeding by an œsophageal tube for a couple of weeks will readily overcome the accident. If the breathing has ceased when the trachea is opened artificial respiration must be tried at once.

With the free entrance of air into the lungs bleeding quickly stops, the engorged veins subside, the colour returns to the patient's face, and after a short period of apnœa from the primary full inspiration, regular breathing is established. In America and on the Continent, much more than in this country, intubation has to a large extent displaced tracheotomy as the selected operation for the average case. In purely laryngeal cases it is strongly recommended, the difficulty however is to diagnose such a condition. Manifestly a great advantage is the avoidance of an external wound, but the operation is unsuitable when there is much faucial swelling, or with membrane in the trachea, and there are also drawbacks to its use in general practice. In the first place a skilled operator is desirable, and even after the tube has been inserted, there is the risk of its spontaneous extrusion, or of the lumen becoming blocked. With the former it is said that there is always sufficient time to obtain assistance, and it is stated to be prevented by using a large sized tube. The second objection is only met with apparently in about one per cent. of the cases, and, as a prevention against asphyxia, tubes with lateral openings have been designed. Ulceration

within the trachea, or larynx, from the presence of the tube, may give much trouble and even ultimately necessitate a tracheotomy, occasionally with permanent retention of the tube.

PROPHYLAXIS.

In addition to the necessity for isolation and disinfection it must be remembered that Diphtheria can be readily inoculated by infected instruments.

Particular attention must also be drawn to the necessity for free ventilation. It is not uncommon for young nurses who have possibly been working in the Diphtheria ward for some time, to contract the disease when they attend to a laryngeal case enclosed in a tent.

Individual predisposition must also be taken into account. Some persons, even without excess of lymphatic tissue about the throat, are particularly prone to contract Diphtheria, and this liability may be a family feature.

In convalescence also from coryza, Measles, Scarlet Fever, Whooping Cough, and with various forms of tonsillitis and sore throat, the predisposition to the disease is markedly increased, and special care is then needed to prevent exposure. The same may be said of young children in general, on account of the high mortality met with amongst them. When exposure has already taken place a prophylactic injection of 500 c.c. of antitoxin is advisable, the individual then being removed from the infective surroundings. If, however, such removal is impossible a similar prophylactic injection

should be repeated at the end of three weeks, but in the meantime a careful daily examination must be made, and instructions given to watch for, and report, the earliest symptoms which might indicate the supervention of an attack, since there is no doubt that infection, with the production of the disease, may occur within that period.

PERTUSSIS (WHOOPIING COUGH).

Whooping Cough is a specific infectious disease which commences insidiously, often with symptoms of coryza. It is accompanied by a troublesome cough which after a few days assumes a peculiar paroxysmal character. Frequently the acts of inspiration which occur after each paroxysm of coughing, give rise to a loud stridulous noise or whoop, produced by an adductor spasm of the intralaryngeal muscles closing the glottis.

ETIOLOGY.

The disease is especially met with in temperate climates, is endemic in the larger towns of this country, but occurs in localised epidemics which usually increase in magnitude during the winter months, and attain their maximum in spring.

Young children are chiefly attacked, and the disease is most fatal to them. This can be readily accounted for by its prolonged course, with the difficulty in poorer families of closely superintending their every movement, and thus guarding them from deleterious agencies, as well as by the nature of the commonest complications, viz., broncho-pneumonia, atelectasis pulmonum, etc., diseases which are specially fatal in very young children.

The micro-organism has not been isolated with certainty, though there is no lack of reported successful investigations by several observers. It is most readily transmitted by the air, close proximity to the patient being probably requisite, and constituting the usual method of transference.

Apparently the sputum, mucoid discharges from the nose, mouth and respiratory tract, as well as possibly the breath, are most infectious, and the microbe may be conveyed by fomites, particularly by fabrics, which have been infected by sputum.

The infectious character of the disease is probably most marked during the catarrhal stage, but it is believed to exist so long as the whoop is present.

The period of incubation has been variously estimated at from five to fourteen days.

SYMPTOMS AND COURSE.

The onset of the attack takes place gradually. There may be coryza, or the catarrhal stage may be absent. Usually there is malaise, very slight pyrexia, anorexia, and a dry cough which steadily becomes more troublesome, and is especially marked at night. On examination signs of bronchitis may be very slight or totally wanting. In the milder cases pyrexia, anorexia, and malaise are not only very slight, but also of temporary duration.

After about seven to ten days the cough becomes more definitely paroxysmal, and there follows the characteristic inspiratory spasm with stridulent whoop. The attack of coughing is usually terminated by the child bringing up some glairy mucus or mucopurulent secretion, or by vomiting. In mild cases this condition continues for four to six weeks, there being few paroxysms during each day, and these short in character, and unaccompanied by anxiety or distress on the part of the patient. Between the paroxysms the patient may look and feel quite well.

In more severe cases the paroxysms are frequently repeated, the child is conscious of their coming on, and in its anxiety rushes for assistance. Violent expiratory efforts succeed one another till there is marked cyanosis, and venous turgescence, whilst the inspiratory spasm of the intralaryngeal muscles may be so decided as to produce considerable retraction of the walls of the chest. Moreover after the paroxysm has subsided the child is exhausted, and the face may remain puffy, and the eyes watery and congested between the attacks.

Even in cases of moderate severity the expectoration of mucopurulent secretion at the termination of the paroxysm, may so persistently be accompanied by vomiting, that nutrition is seriously interfered with, and there is grave risk of exhaustion and marasmus.

During the paroxysmal stage the temperature is usually normal unless some complication is present.

The commonest and most fatal complication is broncho-pneumonia, and, at any rate in fatal cases, it is generally found associated with atelectasis and emphysema. Pleurisy and pericarditis are rare.

From the cardiac dilatation and venous congestion induced by severe paroxysms of coughing, various hæmorrhages may arise, *e.g.*, epistaxis, effusions of blood into the conjunctivæ, or beneath the meninges. The last-mentioned complication leads to convulsions, but is not the only cause of their occurrence, since both generalised and localised convulsive attacks have been described without further evidence of meningeal hæmorrhage.

The expiratory efforts may lead to ulcer of the frenum linguæ. In rare instances the spasm of the glottis may be so complete as to produce obstruction and death from asphyxiation, but it is remarkable how serious the stridor may be, and yet end in recovery.

It should be mentioned that occasionally in very severe attacks, and especially when bronchopneumonia has supervened, the whoop may disappear.

The attack of Pertussis may be the cause of a chronic bronchitis. In some instances bronchopneumonia develops but fails to undergo resolution, and thus leads to the production of bronchiectasis or chronic fibroid pneumonia. In other cases the disease may be followed by caseation of the bronchial lymph glands, or by acute tubercular phthisis.

Relapses and second attacks are very rare.

DIAGNOSIS.

As a rule the diagnosis presents no difficulty, the clinical history, the paroxysmal cough, and the characteristic whoop being sufficiently distinctive features. It must, however, be remembered that the paroxysmal cough may remain for long periods after the attack is over, or that a subsequent bronchitis may assume these characters. Moreover a similar cough may be noted in some cases of chronic bronchitis, with numerous and generally distributed râles, and apparently with some emphysema and dilatation of the smaller bronchi. Under the latter circumstances, however, the whoop is usually absent.

Even in undoubted cases of Pertussis the whoop may be absent (1) in young children, either

in very mild or in severe suffocative attacks, (2) in older patients, (3) when pulmonary complications supervene, and (4) at the beginning or end of the disease.

PROGNOSIS.

The prognosis must be largely judged by the number and severity of the paroxysms. Infants under two years of age frequently succumb, most commonly from broncho-pneumonia, but occasionally from asphyxiation, exhaustion, marasmus, or convulsions.

Chronic ill-health and rickets increase the gravity of the prognosis. The social position of the parents, and their ability or inability to provide suitable surroundings, constant attention, and effective protection against harmful influences, are most important factors. On this account, in poorer families, the occurrence of the attacks during inclement, cold, or changeable weather exerts a marked influence on the mortality.

TREATMENT.

The patient must be kept in an equable warm temperature. Exposure to cold and damp increases the number and severity of the paroxysms, and delays the progress of the disease. In summer, mild cases need not be confined to the room, or house any further than as a prophylactic measure against the disease spreading to other children. In winter, the child must always remain indoors in a warm well-ventilated room, so long as the cough is troublesome. Severe cases must be treated in bed, a room temperature of 65°F being preferable. At the same time the air is rendered less irritating by impreg-

nating it with steam from a bronchitis kettle, to the contained water in which some carbolic acid lotion may with advantage be added. As a substitute for the last-mentioned measure the same result may be obtained by vapourising crystals of carbolic acid periodically into the atmosphere; this is effected by sprinkling them on a few live coals held on a shovel, or by placing them in a receptacle over a small spirit lamp.

The diet must be light and nutritious, and the greatest care must be taken not to unduly excite the patient by medical or nursing attentions, since crying, struggling, and even fear will frequently induce a paroxysm.

Medicinally numerous drugs have been recommended, chiefly belonging to the classes of antispasmodics and sedatives. The most valuable are chloral, bromides, belladonna, and bromoform. The last-mentioned drug on account of its high specific gravity requires care in dispensing, and the mixture must be well shaken each time before the dose is administered.

Formula.—Bromoform, $\frac{1}{2}$ drachm.
Tincture of Senega, $3\frac{1}{2}$ drachms.
Syrup of Oranges, $\frac{1}{2}$ ounce.
Water (added gradually and well shaken) up to 6 ounces.
Dose : 2 teaspoonfuls to 1 tablespoonful.

If there is much bronchial secretion the addition of one to five grains of Alum, to each dose of the mixture given, has been strongly recommended. When whooping is unduly persistent quinine, antipyrin, or liquid extract of grindelia should be tried. Of the latter 10 grains may be

given every four hours to an infant, whilst in the case of the other two drugs one grain of each may be given twice daily to a child one year old, and a grain added to the daily amount for every year of life up to five.

Not uncommonly the greatest benefit is obtained by a change of air and scene with liberal feeding. These measures are always advisable in convalescence, and are to be supplemented if necessary by preparations of iron, and cod liver oil.

MUMPS (ACUTE SPECIFIC PAROTITIS).

Mumps is an acute specific disease characterised by inflammatory swelling of the salivary glands. The parotids are most commonly affected, but sometimes the submaxillary glands are also implicated, and very occasionally the latter are alone inflamed. The attack practically always terminates favourably, there is, however, in boys a considerable liability to the occurrence of inflammation of the testis as a sequela.*

ETIOLOGY.

The disease is endemic, but occurs in localised epidemics, which are most prevalent in the cold and wet seasons. Older children and adolescents from ten to fifteen years of age are especially affected, but attacks are also seen occasionally in adults. The morbidity is said to be greater in males than females.

Transmission generally takes place æerially in the immediate surroundings of the patient, probably through the agency of the breath. It is possible, though not clearly proved, that the disease may be conveyed by fomites.

The infectious character is most marked during the acute stage, but it is believed to be retained in some cases for two to three weeks.

The incubation period is long, on an average about three weeks (varying from fourteen to twenty-five days).

* An acute orchitis has been described as occurring, without the previous development of parotitis.

SYMPTOMS AND COURSE.

In every case the invasion takes place gradually. There may be a prodromal fever with malaise for one or two days, but usually the earliest symptom is an aching pain in the parotid region of one side, which is made worse by every movement of the jaw, *e.g.*, opening the mouth for eating, and speaking, and which gives rise to a variable degree of dysphagia. The parotid swelling soon becomes distinctly visible, and by its steady increase in size produces a large, tense, tender mass at the angle of jaw, the surface of which is smooth, and not infrequently shiny. The mass fills up the space between the inferior maxilla and the mastoid process, and gives rise to evident eversion of the lobule of the ear. Its outline cannot be definitely circumscribed by palpation, but a continuation of the swelling can always be detected passing over the vertical ramus of the lower jaw on to the cheek from implication of the socia parotidis. When well marked the inflamed gland greatly interferes with the patient's ability to open the mouth, and the attempt to do so causes much pain. In addition deglutition is often very painful, and the head is held fixed with the chin forward. When the submaxillary glands are affected, the tender swelling spreads forward under the jaw. In some cases there is an associated enlargement of the cervical lymph glands.

However severe the inflammatory mischief may be the various salivary glands never suppurate, and this constitutes an important diagnostic factor. Moreover though the disease usually commences on one side, preferably the right, the

other side almost invariably becomes affected after a few days.

In the great majority of cases pyrexia is of only moderate degree (*e.g.*, 101°F to 102°F), and constitutional symptoms slight. The tongue is furred, the salivary secretion unaltered in amount, though it may be either diminished or increased, and the bowels are regular or somewhat constipated. The pulse and urine shew the usual febrile characters. In rare instances the temperature is much higher, *e.g.*, 104°F, and the constitutional symptoms severe. Delirium, meningitis, nephritis, and hyperpyrexia have been described as complications, but attacks of this description are quite exceptional.

After three or four days the pyrexia and indisposition gradually subside, and subsequently the swelling steadily diminishes and disappears. Some observers have met with temporary deafness, with or without tinnitus, as a frequent complication of Mumps. It is more marked in those cases in which otitis media arises, from the inflammatory process in the nasopharynx spreading along the Eustachian tube, and under these circumstances permanent deafness has been said to be a not uncommon sequela.

Epigastric tenderness and pain, and in some instances vomiting and temporary pyrexia, have been attributed to inflammation of the pancreas.

In a percentage of the cases during convalescence, especially about the end of the first week, older male patients suffer from Orchitis. This is manifested by pain, tenderness, and swelling accompanied by general malaise and moderate pyrexia. In rare instances the temperature has been high and constitutional symptoms severe.

Under suitable treatment the condition disappears in the course of a few days, but it may give rise to atrophy of the testis. In girls, as an exceptional occurrence, a corresponding inflammation of the breast has been described, and it is said that these sequelæ are more likely to arise in patients who have not been confined to bed during the acute stage.

PROGNOSIS.

The prognosis of Mumps, as already indicated, is almost invariably good. Hyperpyrexia and cerebral symptoms, *e.g.*, convulsions, or signs of meningitis, etc., are grave, but fortunately very rare.

Second attacks are very uncommon occurrences. Relapses have been described, but it must be remembered that occasionally the inflammatory process is very tardy in spreading from one side to the other.

DIAGNOSIS.

The presence of fever, and malaise, with a characteristic swelling of the parotid glands which begins on one side, subsequently affects both, and disappears in the course of a few days without suppuration, is sufficiently distinctive to almost exclude the possibility of error. It is important to remember, however, that parotitis may occur as a complication or sequela of various diseases, *e.g.*, typhoid and typhus fevers, severe abdominal affections chiefly of a septic nature, and pyæmia. In these cases not only is there evidence of the primary disease, but the affection of the parotid glands is usually limited to one side, and frequently passes on to suppuration. Infection under these circumstances may be

metastatic, but in many instances it is believed to reach the gland by Stenson's duct, and the risk is said to be diminished by regular attention to the mouth.

Rest is to be enforced during the acute stage, but the necessity for confinement to bed must be judged by the severity of the attack and the constitutional symptoms.

The diet may be fluid or semi-solid when there is dysphagia, or anorexia, but in other cases light nutritious food of any kind is permissible. The bowels should be moved at the onset by laxatives, the mouth regularly cleansed, vomiting or other complications treated on the usual principles, and local tenderness and swelling in the neck relieved by fomentations.

There is no need to take special precautions for isolation and disinfection, beyond excluding susceptible persons from the sick room.

EPIDEMIC INFLUENZA.

Influenza is an acute specific infectious disease generally coming on more or less suddenly, and characterised by pyrexia of three or four days duration with marked prostration. Usually there are catarrhal symptoms, more particularly cough and signs of bronchitis, but different organs may apparently receive the brunt of the affection, and give special features to the attack. Convalescence is very gradual, and there is a great liability to numerous and varied sequelæ.

ETIOLOGY.

The occurrence of epidemics of this disease is seemingly uninfluenced by any considerations of climate, season, or geographical location. Periodically a widespread prevalence is noted over extensive areas, and at such times individuals of all ages are affected. The epidemic character is so marked a feature, even without evidence of exposure in many cases, that the disease was formerly attributed to unknown atmospheric conditions. It is, however, generally accepted that an attack is always due to invasion by Pfeiffer's bacillus.

Transmission probably takes place directly by ærial convection, more especially from close proximity to one suffering from the disease, the infection being given off by the breath, or in the mucous discharges. In addition it is very possibly conveyed by fomites. The spread of the disease would thus conform to the paths of human intercourse, but these intercommunicate

so extensively as to be practically universal. Most of the great epidemics have originated in eastern Europe and travelled westward.

Some observers have stated that various domestic animals, particularly the cat and dog, may suffer from the disease, or act as 'carriers.'

An attack confers a very temporary immunity, so that a recurrence with each succeeding epidemic is not an uncommon feature.

INCUBATION PERIOD.

The period of incubation only lasts two or three days.

SYMPTOMS AND COURSE.

The onset of an attack takes place somewhat suddenly with headache, shivering, general pains, and early prostration. There may even be vomiting, vertigo, and syncope. It is, however, not infrequent for the invasion to occur gradually.

The headache may be general, and is often associated with severe pain in the eyeballs. The facial aspect is dull, and there may be stupor, or sleeplessness and restlessness. The tongue is slightly coated, often with clean red papillæ visible ('stippled'), the appetite diminished or lost, and the bowels unaffected or constipated. The urine in general only shews the ordinary febrile characters, *e.g.*, darkness in colour, and higher specific gravity from concentration, through diminished excretion of water.

The temperature range varies considerably according to the severity of the attack, most commonly it is between 101°F and 103°F. It is of the remittent type and lasts three or four days.

At the end of that period it subsides rapidly, attacks of profuse sweating supervene, and convalescence begins.

As regards the skin there is throughout the attack a tendency to sweating, and there may be noted sudamina, generalised erythema, or herpes, the latter being especially met with about the face.

The foregoing description befits an ordinary attack of the 'febrile type.' Certain symptoms, however, may obtain undue prominence, and give special features to the attack. It has frequently been noted that the tendency to the manifestation of a certain type is markedly influenced by the prevailing epidemic, still it must not be assumed that the disease, in any one attack, shews only the symptoms which are mentioned as occurring in a particular type, the classification arises solely by undue prominence of certain symptoms.

In the 'catarrhal' form there is an associated coryza and bronchitis. Otitis media with its sequelæ may arise as a complication, and the disease may be indistinguishable from the severe coryza of a 'common cold' save by the more marked and prolonged prostration, the prevailing epidemic, or a bacteriological examination.

In the 'bronchitic' form there is rapid breathing with tightness on the chest, the cough and the physical signs of bronchitis are worse, and there is an expectoration of glairy mucus. Further, broncho-pneumonia is a not infrequent complication; it usually assumes a wandering character, with well-defined small moist râles on auscultation. At the same time the pulse is rapid, and often of poor quality, the colour

readily takes on a slightly cyanotic tinge, and the temperature is remittent, maintaining this character beyond the usual period. Broncho-pneumonia is a very fatal complication, more especially to older and younger patients. It may lead to pleurisy, empyema, or pericarditis.

In the 'gastro-intestinal' form there may be severe vomiting, marked diarrhœa, or intense and localised abdominal pain.

Usually the pulse-rate varies with the height of the temperature and the severity of the constitutional symptoms. In the 'cardiac' form, however, the weakness and rapidity of the pulse is more than ordinarily marked, and there may be irregularity in force or rhythm. In severe cases dilatation of the heart occurs.

In the cerebral form headache, delirium, insomnia, or stupor are prominent symptoms, and there may be retraction of the head from contraction of the post-cervical muscles, or strabismus without further evidence of meningeal irritation.

It is important to recognise that mild cases may occur in which feverishness and prostration are only slight, both in duration and severity. Some observers have even described apyrexial attacks, in which pains and depression constituted the sole manifestations.

The prominent clinical features of an attack of Influenza are the accompanying prostration, with pains and aching in various situations, followed by a slow convalescence, and the liability to the occurrence of various nervous sequelæ, *e.g.*, neuralgia, neuritis, mental depression, melancholia, and even insanity. After the completion of the attack the patient may be months in

regaining his former vigour, various forms of neuralgia being sometimes particularly obstinate. Moreover it apparently undoubtedly gives rise to a predisposition to the development of acute tuberculosis, a history of Influenza, persistent ill health or weakness afterwards, and finally evidences of pulmonary Phthisis being a not uncommon occurrence.

Lobar pneumonia may develop during convalescence.

DIAGNOSIS.

As already stated, save in times of epidemic prevalence, it may be impossible to distinguish an attack of Influenza from a 'common cold' except by bacteriological examination.

The diagnosis rests on the acuteness of onset, the self-limitation of the attack after three or four days, the absence of localising signs, and the presence of sweating and marked prostration.

Acute Rheumatic Fever may give rise to difficulty, but the gradual onset of the attack should prevent a too hasty opinion being given, whilst the occurrence of polyarthritis with migratory characters is distinctive.

The great danger is the making of a diagnosis of Influenza in any acute illness because of the apparent absence of signs to incomplete examination, or owing to the necessity of satisfying the importunate enquiries of friends before distinguishing features have developed. So long as the medical practitioner does not rest contented in his own mind, when the attack has evidently exceeded the usual limit for Influenza, and does not neglect to thoroughly examine his patient regularly, taking note of every variation in condition, the practice has much to recommend it,

and may indeed at times be necessary. The provisional diagnosis, however, must not be maintained more than four days. Further, in the absence of an epidemic the practitioner should recognise that the probabilities are against his suspicions, diseases such as coryza, enteric fever, pneumonia, gastro-enteritis, or meningitis being more likely occurrences. As regards pneumonia it is of course to be remembered that the croupous form may arise as a sequela during convalescence from Influenza, and that an 'influenzal' or 'wandering type' with irregular course, marked prostration, numerous and persistent small râles, with or without diminished resonance and bronchial breathing, may apparently occur independently of that disease.

PROGNOSIS.

Influenza is especially fatal to the very young and the aged, to those debilitated by chronic alcoholism, or suffering from chronic affections of the heart, lungs, or kidneys. Particular mention must be made of those afflicted with chronic pulmonary diseases, *e.g.*, bronchitis, from the increased risk of inflammation of the lungs, and with cardiac affections from the marked tendency to cardiac failure caused by the toxæmia.

The development of pneumonia in any patient seriously aggravates the prognosis, but even in the presence of such a complication, the key lies in the condition of the heart and pulse. During the attack and in convalescence the predisposition to tuberculosis must be kept in mind.

TREATMENT.

The patient must be confined to bed from the beginning of the attack, his strength being

maintained by an abundance of nutritious food in a form suitable to his condition, and by a plentiful supply of fresh air. Both for prophylaxis and treatment, quinine has been highly recommended. When bronchitis is present the temperature of the room should be maintained at 65°F, and with troublesome cough the atmosphere is to be impregnated with steam. Stimulant expectorants, *e.g.*, Ammonium Carbonate, Squills, Senega are indicated if there is sticky expectoration, but if the cough is ineffectual codeia or heroin are useful.

Pneumonia, vomiting, diarrhoea, and other complications are to be treated on ordinary principles.

Headache, neuralgia, or general pains should be relieved as far as possible by local applications, *e.g.*, ice to the head, or stupes to other affected regions. Antipyretic drugs, *e.g.*, phenacetin, antifebrin, antipyrin, salicylates are valuable, but must be used with care on account of their action as cardiac depressants, and whenever possible should be given in conjunction with caffeine. Opium should only be tried when other remedies fail, but the compound ipecacuanha powder in ten grain doses is frequently of service early in the attack. For obstinate neuralgia, quinine and arsenic are beneficial.

In convalescence the recuperation of the patient's vitality must be brought about as speedily as possible by a liberal diet, and a change of air and scene, but without undue or too early exertion. At this period cod liver oil, preparations of iron, and glycero-phosphates are valuable.

CORYZA ("COMMON COLD").

Coryza is an infectious disease which commences insidiously with symptoms of catarrh and feverishness. The acute condition lasts three or four days, the temperature subsiding gradually. The catarrhal symptoms persist after the pyrexial period, disappearing usually after seven to ten days, but not infrequently giving rise to bronchitis which may remain for a much longer period, and even be the foundation for the chronic form of that affection.

ETIOLOGY.

The disease is met with especially in temperate climates, being endemic and very prevalent during the winter months, and the colder and changeable seasons of the year.

Predisposition to attack is seen at any age, but undoubtedly is more markedly exhibited by some individuals than by others. Adenoids, and the presence of lymphatic tissue about the throat producing rhinitis, temporary nasal obstruction, tonsillitis, etc., seem to act as marked predisposing factors.

It is generally held that the existing cause is most commonly a chill when the surface of the body is damp from perspiration, but though such an occurrence must be admitted as a possibility, it is probably far from being the invariable rule. In many instances the infectious nature can be traced in families, and exposure to infection in rooms or vehicles may be as necessary a factor as chill.

Recently various micro-organisms have been described as etiologically connected with the disease (micrococcus catarrhalis, bacillus septus, Friedländer's streptococcus), but a definite opinion cannot as yet be expressed. It may be that the disease, as regards its infectivity, is comparable to some extent with pneumonia, the micro-organism being frequently present without revealing its existence, owing to the necessity of some constitutional, or local change being produced to permit of its pathogenic action. It is further possible that more than one affection is at present included in the term 'coryza,' or 'a cold,' and that in this manner differences in modes of onset, symptoms, course, and duration might be explained.

The infectious character of the disease seems to be most marked during the early period of the attack, but probably persists so long as there are symptoms of catarrh.

The incubation period is about three days.

SYMPTOMS AND COURSE.

The invasion of an attack takes place gradually, often with rawness, and soreness about the fauces, larynx, and nasopharynx. There are malaise, a feeling of chilliness, pyrexia of only moderate degree, and general pains. Sciatica, lumbago, and other evidences of neuritis are sometimes troublesome symptoms, but the headache, pain at the back of the eyes, or aching in the eyeballs, and the feeling of general weakness are rarely such marked features, even if present, as when occurring in Influenza due to Pfeiffer's bacillus. Frequently the tongue is clean

throughout, though it may be slightly furred. The appetite often remains but little altered.

Sometimes at the onset, but more frequently after one or two days there is sneezing, running at the eyes with slight conjunctivitis, and the appearance of herpes especially about the mouth, nose, cheeks, or chin. Often rhinorrhœa develops, the discharge being at first clear and mucoid, but later mucopurulent.

The catarrh always seems to spread from its point of origin backwards, and even forwards along the respiratory tract, so that laryngitis, tracheitis, and bronchitis are almost to be considered as symptoms rather than as complications. At first the cough is dry, and inspiration is accompanied by a feeling of irritation in the chest, and production of sibili. Later a mucoid secretion is present which becomes definitely mucopurulent.

The inflammation in the fauces and nasopharynx only occasionally leads to otitis media, but temporary deafness from blocking of the Eustachian tube is not uncommon.

After three or four days the pyrexia, neuralgia, and malaise disappear gradually, and improvement slowly follows. In warm weather, or under suitable hygienic conditions recovery is usually rapid and complete. In winter, however, especially with repeated exposure to cold inclement weather, or to changeable and dusty atmospheres, progress is less satisfactory, and the attack not only disappears much more slowly, but not infrequently lays the foundation for a chronic bronchitis.

It will readily be understood that, as in other infectious diseases, the severity of the attack,

and prominence or extent of particular symptoms, shew considerable variation.

The predisposition to the disease is very widespread amongst the community, and unfortunately no immunity is conferred by an attack, so that there is great liability to its repeated contraction.

DIAGNOSIS.

The diagnosis of Coryza offers no difficulty. The symptoms may be the manifestation of an attack of Influenza, but this disease would be recognised by the existence of an epidemic, by its more sudden onset, by the more intense pain or greater prostration, and finally, if necessary, by the result of a bacteriological examination of the discharges. In children the symptoms may be due to the invasion of Measles, under which circumstances the temperature will be found to be higher at first, falling on the second or third day, and often accompanied by a barking cough. In addition Koplik's spots should be looked for. The appearance of the characteristic eruption on the fourth day is distinctive.

PROGNOSIS.

The prognosis in this disease is good, unless complicated by broncho-pneumonia. It must, however, be remembered, as already stated, that bronchitis may become chronic.

It is probable also that whilst the presence of adenoids predisposes to coryza, a repetition of attacks of this disease may act as a factor in producing a hyperplasia of the lymphatic tissue in the nasopharynx, with the subsequent evils of deafness and otitis media.

TREATMENT.

During the period of acute symptoms, or marked bronchial irritation the patient should be kept indoors, a warm (65°F) equable temperature, in many cases also impregnated with moisture, being highly beneficial not only as a curative measure, but as a prophylactic procedure. Cleanliness, absence of dust, and efficient ventilation are, of course, necessary. Confinement to bed is only requisite in severer attacks with considerable pyrexia, pain, chilliness, or prostration. In most cases warm, light, easily digestible food of any kind can be given throughout the attack.

A hot bath, followed by immediate wrapping in blankets, the taking of gruel, or a pint of hot milk, and ten grains of Dover's powder is a very efficient means of beginning the treatment.

For the headache or general pains antipyrin, phenacetin, etc., are valuable. Menthol snuff, or the inhalation of eucalyptus or tincture of camphor is useful in the early stages. With rhinitis a mild antiseptic lotion in the form of a nasal spray should be used. With considerable swelling of the nasal mucous membrane, purulent discharge, and nasal obstruction, much relief may be obtained by inhalation of steam impregnated with menthol (one drachm of a 20 per cent. solution in alcohol to a pint of water). For bronchitis the aid of stimulant expectorants may be called in, to supplement the 'atmospheric' treatment. The greatest care must be exercised, even in convalescence, before permitting exposure and the risk of chills. Should broncho-pneumonia develop it must be treated on the ordinary principles.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.

This disease is classed among the specific infectious fevers, since it owes its origin to a particular micro-organism, the diplococcus intracellularis meningitidis (Weichselbaum). The microbe having gained an entrance into the body produces pathological changes, chiefly and primarily in connection with the central nervous system, both cerebral and spinal.

An attack is characterised by symptoms of meningitis coming on with more or less suddenness, and exhibiting considerable variety in their nature and severity

ETIOLOGY:

The disease usually occurs in epidemic form, the epidemics, however, have rarely been extensive, or affected large numbers of people. Most commonly the epidemic is characterised by paucity of numbers and well marked localisation, a liability to the contraction of the disease being not only noted for a particular district, but even for a certain institution or building.

The disease is said to be more prevalent in rural than in urban districts, and occurs especially in the colder months of winter and spring. In this country it is rare, but several small epidemics have recently been reported.

Attacks are met with at any age, but the majority of the patients are children or young adults.

The disease does not seem to be readily

transferred from the sick to the healthy in the manner usually associated with infectious diseases, and doubt has even been expressed as to its conveyance by fomites or ærial transmission. Unquestionably, few are attacked of the many exposed to the disease. When one remembers that the location of the specific microbe is practically limited to the central nervous system, one is not surprised at its slight infectivity. On the other hand it is probable that the purulent, mucopurulent, or even mucoid discharges from the ears, nose or pharynx, may harbour the diplococcus, and that infection must gain an entrance into the lymphatic spaces of the brain and cord, by one of these channels. In any case, the frequent demonstration of the micro-organism in those situations is sufficient justification for the necessity of adopting measures of isolation, and for the observance of the greatest care in the destruction, and prevention of dissemination of such discharges.

The most potent predisposing factors are apparently connected with the hygienic surroundings of the individual, since the disease is especially associated with conditions of poverty, uncleanness, dampness, insufficient air, and overcrowding on the one hand, or of bodily deprivation, fatigue, over-exertion, or mental depression on the other.

The repeated discovery of the micro-organism in the nasal and nasopharyngeal mucus, and the belief that it is from these situations that infection usually gains an entrance into the central nervous system, have naturally led to the view that a nasopharyngeal catarrh constitutes a powerful predisposing factor. In this connection the

presence of adenoids, and existence in a smoky atmosphere, or one deficient in sunshine have been specially incriminated by some writers, though their importance has been denied by others.

Though the disease, as already stated, is usually met with in epidemic form, sporadic cases do occur, and investigations have tended to shew that some of the cases of so-called posterior basal meningitis seen in children are also due to the same micro-organism.

The undoubted occurrence of sporadic cases has led to the surmise that the infective agent is always with us, and in a leading article in the *Lancet* (106, vol. i. p. 103) it is suggested that "some unknown atmospheric conditions cause it to assume increased virulence from time to time.

The diplococcus intracellularis meningitidis presents morphological characters in many respects indistinguishable from the diplococcus of pneumonia, it is however negative to Gram's stain, though its reaction in this respect has been said to be variable (*Therap. der Gegen.*, 1905). It is readily killed by drying or by disinfectants, and is difficult of cultivation, from the great tendency to be overgrown by other micro-organisms.

From observations made where the disease has been freshly introduced into a locality, it has been concluded that the incubation period lasts three to four days.

SYMPTOMS AND TYPES OF ATTACK.

According to the character and severity of the symptoms, three main types have been described (1) ordinary (2) malignant (3) anomalous.

(1) In the ordinary form the attack sets in suddenly with headache, chiefly occipital, chills, pains in the back, anorexia, and possibly vomiting or convulsions. In some cases headache precedes the more distinctive symptoms for a variable length of time. The temperature is usually about 101°F or 102°F , and the pulse in adults slightly increased in rapidity, but of good character. In children it is often rapid from the first.

Early in the attack retraction of the head occurs from contraction of the cervical muscles, and the contracted muscles are painful. The stiffness of the head is said to be more marked for flexion and extension, than for lateral movements. The headache, which is accompanied by pain extending down the neck and back, persists throughout the attack, and becomes more severe. Photophobia, and sensitiveness to external irritation and noises, make their appearance, and in children there is marked irritability and restlessness.

Contraction of muscles becomes more extensive, orthotonus or opisthotonus may arise, and the pain in the muscles of the back and limbs may be very severe, with much tenderness along the spine, or general hyperæsthesia.

In some instances there is muscular tremor with tonic or clonic spasms in the arms or legs; convulsions, however, are rare, save in children. Of other muscular contractions strabismus is common, and there may be facial spasm. The muscles of the eye and face may further shew paralysis, but paralysis of the muscles of the body and limbs is rare.

At the onset the patient usually manifests

symptoms of delirium, occasionally even of a maniacal character, later however, stupor and coma develop.

The temperature is of a remittent type, but the remissions vary greatly in degree. The course, therefore, shews no distinct type, and the pyrexia may even undergo temporary intermissions. Occasionally there may be little or no fever throughout the attack, whilst in other instances hyperpyrexia may arise.

The pulse which was at first full and strong, and slightly increased in rapidity, later becomes slower, sighing respiration is noted, and occasionally the breathing is of the Cheyne-Stokes type.

The bowels are usually constipated; in rare instances there is diarrhoea.

The urine may contain albumen, and there may be polyuria or glycosuria.

Herpes, in various situations, is a not uncommon complication. In addition the skin may shew various forms of erythematous or even bullous eruptions. The most characteristic appearance, however, is the formation of petechiæ, which may cover the entire skin, hence the term spotted fever. Usually they are less numerous and more limited in distribution than an exanthem.

An examination of the blood shews early and constant leucocytosis, though this was denied by Grawitz.

The vomiting which comes on early in the attack may persist, but more commonly subsides. In favourable cases, after five or six days, evidence of improvement is noted by a diminution in the muscular spasm, a reduction

of the fever, and a clearer sensorium. The disease on the other hand may last from a day or two to several months, and fifty per cent of the deaths are said to occur in the first five days. Convalescence is usually tedious, and various sequelæ may arise.

(2) In the malignant form the onset is always sudden, chills are more marked, muscular spasm and somnolence appear earlier, and there is frequently great depression. The temperature may be only moderately elevated, and the pulse is frequently feeble and slow. A purpuric rash is an almost constant feature, and there may be hæmaturia. Death takes place quickly, even within the first twenty-four hours.

(3) Under anomalous forms are included (a) abortive cases in which after a marked onset there is early subsidence and rapid convalescence (b) mild cases in which both onset and symptoms are of unusually slight degree, and accompanied by little or no fever (c) cases of the so-called 'intermittent' type in which the temperature shews recurring exacerbations at some period of each day or at longer intervals, and (d) chronic cases—lasting several months, and accompanied with marked marasmus.

As regards the nervous system headache may persist for long periods, and dementia or aphasia are occasionally noted. The paralysis of the cranial or other nerves may be permanent. Optic neuritis may lead to blindness, and the inflammatory process may spread along the nerve to the eyeball, whilst deafness may follow implication of the eighth cranial nerve. Otitis media also is not an uncommon complication, and cerebral abscess occasionally occurs. In

children chronic hydrocephalus sometimes develops as a sequela.

Pneumonia, which may be due to the meningococcus, is probably more frequently caused by the pneumococcus. The condition is naturally difficult to diagnose from meningitis as a complication of pneumonia. Pleurisy, pericarditis, parotitis, and arthritis also occur as complications. The last-mentioned is usually polyarticular, the joints being affected with pain and swelling. The exudation into the joints may be serous or purulent.

DIAGNOSIS.

The recognition of the disease is naturally assisted by the existence of an epidemic. In sporadic cases the suddenness of onset, and more especially the signs of general muscular rigidity or tremor from irritation of the spinal nerves, in addition to the symptoms of inflammation of the cerebral meninges, *e.g.*, fever, headache, delirium, cervical retraction, should cause one to suspect its presence. The onset with rigor, convulsions or vomiting may give rise to a temporary suspicion of Pneumonia, etc., but the symptoms enumerated should aid in the diagnosis. Examination will then frequently reveal the existence of Kernig's sign, *i.e.*, tonic contraction of the hamstring muscles preventing extension of the legs on the thighs, when the latter are flexed at a right angle with the trunk. This sign is of course met with in other forms of meningitis, and in all cases a conclusive differential diagnosis can only be effected by the discovery of the specific micro-organism in smears, or by cultivation, from the cerebro-spinal fluid obtained by lumbar puncture. The ma-

microscopical characters of this fluid are not in any way distinctive, it exists under increased pressure, may be clear, turbid, purulent or even bloody, with cells chiefly of the polynuclear type; by staining there is, however, generally little difficulty in demonstrating the diplococci within the cells.

It has been stated that at the autopsy the convexity of the brain is found to be chiefly affected whereas the Sylvian fossæ usually remain free, in this respect forming a marked contrast to the pathological condition met with in tuberculous meningitis. The anatomical appearances are, however, very similar to those met with in pneumococcic meningitis.

PROGNOSIS.

The mortality varies greatly according to the type of attack, it is higher for children than older persons. Recovery rarely takes place if there is deep coma, repeated convulsions, or high fever, and a sudden fall in the temperature is also of bad omen. An unfavourable prognosis must be given in the chronic cases, though these may undergo complete resolution.

TREATMENT.

Little can be done by way of treatment beyond rest in bed, quietness, the use of counter-irritation for pains, and the giving of nourishment freely. Repeated warm baths have been found of value, and where there is coma, or if convulsions arise, lumbar puncture should always be practised as a therapeutic measure, and repeated if necessary. The subsequent injection of antiseptics, *e.g.*, 1 per cent. Lysol, has been practised, but further experience of its effects is necessary.

Medicinally, preparations of opium or morphia for the relief of pain and restlessness give the greatest benefit, and during convalescence iodide of potassium to aid absorption of the inflammatory exudation is indicated. Vohryzek in the acute stage had good results apparently from repeated subcutaneous injections of Pilocarpin. Muscular atrophy, stiffness, and the different complications are to be treated on the usual principles. It is possible, if not probable, that the successes reported from the injection of diphtheria antitoxin have been merely coincidences.

To efficiently combat the disease, if not for prophylaxis, at any rate for treatment, our greatest hope lies in the discovery of a specific serum. Jochmann (*Deut. med. wchnschft.*, 106, p. 788) has prepared a serum from horses, which he finds most suitable for the purpose. The best results are obtained by injecting the living meningococci as well as their toxins, and the resulting serum obtained is found to be valuable for the identification of the meningococcus.

As a prophylactic measure Jochmann advises the subcutaneous injection of 20 c.cs. In forty cases of epidemic cerebro-spinal meningitis in men, which he treated with serum, he came to the conclusion that, if the case were obtained sufficiently early, then 20 c.cs. of the serum should be injected both subcutaneously and into the spinal theca. These injections are to be repeated once or twice with recrudescence of fever, and at the same time lumbar puncture must be performed whenever the symptoms indicate its advisability.

ANTHRAX.

Anthrax is a disease occurring most frequently in sheep and cattle, but not infrequently transmitted to man from the handling of infected skins, or the carcasses of animals which have been affected by it, or from eating the flesh of such animals in an uncooked or insufficiently cooked condition.

ETIOLOGY.

The disease is due to a specific micro-organism, the bacillus anthracis, a characteristic feature of which is its tendency to spore formation. One attack does not confer any immunity.

Infection in cattle usually takes place by the micro-organism obtaining an entrance along with the food. The animal soon appears ill, and weak, and loses its appetite. Externally, about the mouth, pharynx, or neck there may be evidences of glandular, or other form of local inflammation, on the other hand there may be no localising sign. The animal becomes indifferent to its surroundings, and may even die within twenty-four hours of the first indications of illness. The blood is dark in colour and fluid, and the bacilli can readily be demonstrated in it, as well as in various tissues, more particularly the spleen and lungs. Hæmorrhages may be found in the lungs, heart walls, or other situations.

The most characteristic naked eye appearance is the enormous enlargement of the spleen, hence the term splenic fever.

Infection takes place in man (1) by the skin or (2) through a mucous membrane, notably that lining the respiratory tract, or (3) the alimentary system.

(1) The bacilli gain an entrance by the skin either through infection of an open wound, or from puncture with an infected instrument. In a few hours to two or three days itching occurs at the site of inoculation, and soon there is local redness and indurated swelling, which rapidly increase and may become very marked. Usually vesiculation occurs on the surface of the swelling, and by the end of thirty-six or forty-eight hours a central black eschar is formed (malignant pustule), bordered by a number of vesicles from the fluid in which the micro-organism can be readily demonstrated and cultivated. The bacilli spread into the adjoining lymph tracts producing evident lymphangitis and lymphadenitis. At first there may be few or no general symptoms, or possibly only slight prostration, with very moderate fever. More commonly there is pyrexia, with malaise and symptoms of general toxæmia, which vary greatly in degree. In some cases progress is so rapid that death occurs in three to five days, whilst in other instances after that period the general and local conditions improve, and recovery ensues.

Occasionally, more especially when inoculation has occurred on the face, or upper part of the body, the local eschar may not develop. In its place there is marked œdema with severe constitutional symptoms. The œdema may become very extensive and may be followed by gangrene (malignant anthrax œdema). This form is practically always fatal.

It is important to note that in general anthrax infection, there is an evident tendency to hæmorrhagic effusions, to hæmolysis (the blood remaining dark and fluid after death), to collapse with cold surface and possibly high internal temperature, as well as to cyanosis.

(2) In the bronchial or pulmonary form, also known as wool-sorter's disease from its special association with that kind of work, infection usually takes place through the lower part of the trachea or by the large bronchi. The bacilli spread to the adjoining bronchial or mediastinal lymphatic system producing much œdema, with a tendency to hæmorrhages, and to the effusion of serous or hæmorrhagic fluid into the pleuræ or pericardium.

At first there is weakness, chills, possibly rigors, headache, dizziness, mental depression, and not infrequently insomnia. Soon a characteristic sense of constriction in the lower part of the chest appears, often with dyspnœa, palpitation, and attacks of flushing and perspiration. The symptoms increase in severity, the circulation becoming more feeble, and after continuing one to five days, the patient who may previously have had a dry, harsh cough, now brings up a bloody expectoration, examination of which reveals the presence of enormous numbers of anthrax bacilli. In some of these cases death may rapidly occur with no other symptoms than dysphagia and cyanosis, whilst occasionally constitutional symptoms of a general infection only have arisen (see above), the case being essentially one of anthrax septicæmia (anthracæmia).

Implication of the central nervous system with

the production of hæmorrhagic meningitis with much œdema, and associated clinically with marked headache, delirium, possibly convulsions, and finally coma, has arisen in rare instances without evidence of the source of infection. More usually these symptoms are met with as later complications of the bronchial form.

(3) Similarly the gastro-intestinal type of infection (mycosis intestinalis) may occur from direct infection through the intestinal mucous membrane; on the other hand, symptoms indicative of infection of this system may arise secondarily to the bronchial form. In addition to the evidences of constitutional toxæmia, *e.g.*, chills, headache, prostration, moderate fever, and pains in the legs and back, there is further, marked and persistent vomiting, with colic or diarrhœa, and possibly blood in the stools. Frequently there are petechiæ on the skin, and great enlargement of the spleen.

It has been pointed out that this form may arise as an epidemic owing to many persons having partaken of the infected meat.

DIAGNOSIS.

When suspicious clinical appearances suggest a diagnosis of anthrax, important corroborative evidence can usually be obtained from the occupation of the individual. The essential diagnostic sign, however, is the discovery of the bacillus either by directly smearing and staining a cover glass with blood or lymph from the inflamed spot, or by inoculation of a guinea-pig.

It is conceivable that carbuncle might cause temporary difficulty but, in addition to the fact that this affection arises chiefly in alcoholic and

diabetic persons, or in those suffering from Bright's disease or other chronic debilitating affection, there is clinically an absence of eschar or ring of vesicles, and bacteriological examination shews the presence of the staphylococcus.

PROGNOSIS.

Death is the usual result when the disease has passed beyond the condition of a local infection. The pulmonary, intestinal, and meningeal forms are practically always more or less rapidly fatal.

In malignant pustule the severity of the local inflammatory signs, as well as of the constitutional symptoms gives valuable prognostic indications.

PROPHYLAXIS.

Prophylactic measures include the careful separation and disinfection not only of infected skins, but of skins which are dirty, blood-stained, and suspicious of infection, either in their appearance or from their source of supply. In addition, the greatest care is requisite in securing free ventilation of the rooms in which the dangerous trades are carried on, and the workers must be educated (1) to the absolute necessity of washing their hands each time on ceasing to handle the skins even for a temporary stoppage of work, (2) to the danger of inoculation which attaches to the slightest abrasion of the skin, and (3) to the desirability of protecting the ordinary clothing by sterilisable overalls.

For preventing the infection of animals it is important that the carcasses of cattle, etc., which have died from the disease, should be destroyed by burning, or buried deeply and surrounded with lime.

TREATMENT.

In malignant pustule the object is to prevent the entrance of the bacillus into the circulation. For this purpose if infection is known, constriction of the circulation above the part, with free incision and the rubbing in of strong antiseptic lotion, *e.g.*, perchloride of mercury 1 in 1000, is advisable.

More commonly the local evidences of inoculation are present before inoculation is suspected. The diagnosis having been made the inflammatory focus should be freely excised and the wound thoroughly disinfected or cauterised.

In internal anthrax little can be done beyond a supporting and stimulant treatment. In some cases dyspnœa may be greatly relieved by the removal of pleuritic fluid by paracentesis, and it is important to remember that, occasionally, recovery may be seen even after the development of apparently serious symptoms.

A curative anti-anthrax serum has been prepared and recommended, but no time is to be lost in adopting the treatment already outlined.

PULMONARY TUBERCULOSIS AND THE DUTIES OF THE SANITARY AUTHORITY (FROM THE PUBLIC HEALTH POINT OF VIEW).

In recent years much attention has been devoted to the sanatorium treatment of Pulmonary Tuberculosis. In some districts compulsory, and in many others voluntary notification of this disease has been adopted by the Sanitary authorities, and on this basis prophylactic measures connected with the supervision and education of these patients, and with the periodical disinfection of their surroundings have been instituted. Some authorities have even proceeded further and, more especially with a view to isolation, have inaugurated a system of sanatorium treatment, utilising for this purpose buildings already at their disposal. It is possible that an experience of the great benefits derived from this action may largely increase the demand for such provision, so that it becomes necessary to obtain an idea of its principles and limitations.

The "cure" of a case of Pulmonary Tuberculosis is so uncertain and so prolonged, and the continued maintenance even of an arrested lesion so dependent on the private circumstances and environment of the patient, that it is not to be expected of a Sanitary Authority to take up this branch of the subject mainly with that object.

In order to obtain a reasonable percentage of "cures" the disease must be detected sufficiently

early, many months or even several years of treatment may be necessary, and the patient must consequently possess, or be afforded, the requisite means of support for himself or his family during his prolonged inactivity. Moreover, in order to permit of the "cure" or arrest being permanent, his occupation must be suitable, and provide adequate means of sustenance for himself and those dependent on him.

When one remembers the widespread nature of the ailment it becomes manifest that the Sanitary Authorities, though the guardians of the public health, and though Pulmonary Tuberculosis be regarded as essentially an infectious disease, could not in any way make themselves responsible for the encouragement of a proceeding, which would involve so radical a change in our social system.

On the other hand, a stay in a well-conducted sanatorium gives an education not only in treatment, but in preventive measures, which may be of the greatest assistance in enlightening the public on the necessary details, a work which may be considered as falling more particularly to the duty of the Sanitary Authority. For this purpose a stay of at least six to eight weeks is to be strongly recommended, the patients being chosen chiefly from the necessitous members of the community, and shewing clear evidence of their dangerousness in the presence of tubercle bacilli in their sputum, as well as in the existence of unusual opportunities for infecting others either in their domestic surroundings or their occupations. The most striking results of treatment are obtained in the earlier weeks, and whilst taking steps highly desirable from the

point of view of prophylaxis, the Sanitary Authority would at the same time be lengthening the life and increasing the capacity for work of many necessitous bread winners, or in other instances be temporarily relieving an almost unbearable load.

In some districts buildings erected as provision for the isolation of other infectious diseases and only occupied at intervals, *e.g.*, for Small-pox, may be utilised after thorough disinfection. In other districts large houses or residences, long untenanted from their situation or other cause, may, at small expense, be adapted for the purpose. The latter method has the advantage of demonstrating that the treatment, though most fittingly carried out in special institutions, can be beneficially undertaken even in the ordinary home.

Naturally the situation and aspect of the building demand some consideration. Investigation tends to shew that though the selection of a site at a considerable elevation may be of undoubted value, this does not in itself constitute an all important factor, and its advantages may readily be counteracted by excessive rainfall, as well as by an undesirable direction of force in the prevailing winds, which may prevent the patient from being sufficiently in the open air. In any case the results of experience shew that, in our own climate, by observance of the fundamental principles, the disease may be arrested in a not inconsiderable percentage of patients.

It is important that the building should be so situated as to be easy of access, that the atmosphere surrounding it should be as free as possible from dust or dirt, and that the main frontage

of the building containing the living rooms should not face due S.W. but preferably due S., in order to permit of the windows being kept widely open during the greater part of the year. By this means the maximum amount of light and sunshine will be obtained. With a S.W. aspect a covered verandah or protection against the wet weather is advisable. Further, there should be sufficient space round the building to permit the patients to be out on a couch when the weather is favourable.

Medical inspection and supervision is a necessity and should be constant. The medical officer should be within easy call in case of urgency, and should not only be interested in the method of treatment, but should have acquired an intimate practical acquaintance with the details of its performance.

The principles underlying sanatorium treatment may be considered under the following headings:—(1) fresh air, (2) good feeding, (3) rest, and (4) prevention of re-infection.

(1) The importance of fresh air, admitted freely and without fear, is so paramount that the method has been designated the "open air cure. The patient must be trained to appreciate the absolute necessity of making the atmosphere in which he lives approach as nearly as possible to that of the outside air, merely with the provision of a covering against bad weather, and a protection against too-violent winds. Fear of draughts must be dispelled, open fires save as a means of ventilation are better dispensed with, and even for this purpose the need for their use seldom arises, since the provision of fresh air is rather one of æration

than of ventilation. The patient recognising the tonic effect which proceeds from this method, often with the rapid arrest of attacks of perspiration, the production of sound sleep, and improvement in the appetite and general health, must be taught to keep himself warm by suitable clothing, coverings, and the use of hot-water bottles. In general the windows should only be permitted to be closed during the acts of dressing and undressing. In this there need be no feeling of hardship, the difficulty is to maintain the determination on rejoining the family. After a short time it is quite usual for a feeling of stuffiness and discomfort to be experienced by those who have thus accustomed themselves, when they again enter a warm room with no free currents of air passing through it.

When leaving the Sanatorium the patient should be told that it is of paramount importance for him to have a bedroom to himself and to sleep alone, as only under such conditions can he ensure a good night's rest, and be free to obtain the requisite amount of fresh air without considering the wishes of anyone else. He must retire early and eschew little social amenities and pleasures.

(2) The disease can only be vanquished by an improvement in the general health, which permits of a sufficient increase in the powers of reaction resident in the blood or phagocytic cells. Necessarily in this process feeding plays an all-important part.

Recognising the constant tendency to wasting so long as the disease is active, and the frequent association of increase in weight with improvement in the condition of the disease, it was for

some time thought the two were synonymous terms, and patients were therefore encouraged to undergo a system of forced feeding. Seeing that many phthisical patients are the victims of a capricious appetite, and that gastric catarrh, anorexia, or even vomiting are not infrequent complications, this method was to many particularly revolting. This constant overloading of the digestive system is now, however, recognised as unnecessary, and harmful rather than beneficial. On the other hand, abundant nutriment is a necessity, and the patient must be encouraged to eat as much as possible, the diet being varied and appetising, and containing a liberal supply of fat in a form suitable to the digestive capacity or inclination of the individual. In addition, the ordinary diet should be supplemented by the drinking of a quart of milk during the twenty-four hours, taken either with or between meals.*

As already stated a mixed ordinary diet is to be preferred, and in all cases a rest in the recumbent posture for an hour before a meal, and for one hour afterwards should always be insisted on. The patient should never eat, *i.e.*, begin a meal, when he is tired. Even when appetite and digestion are deficient, improvement and even recovery of normal digestive powers are practically always assured, either by a carefully planned dietary adapted to the condition of the patient, or by the assistance of drugs, *e.g.*, acid and bitter tonics, coupled with a continuance of the benefits arising from rest and fresh air.

* Good advice as to economic expenditure with limited means will be found in Bardswell and Chapman's recent book on "Diets in Tuberculosis."

(3) The value of fresh air and good feeding is readily comprehended, but the vital importance of rest is far from being so generally accepted or acted on. During the process of arrestation of the disease, confinement to bed must be considered of as fundamental importance as the two factors just mentioned. When the acute process has been arrested, as determined by the maintenance of a normal temperature throughout the day, the difficulty arises, whilst improving the strength of the patient, to determine the amount of exercise necessary for this purpose, which can be permitted. It is not uncommon for even educated persons, after being instructed against fatigue, to over-exert themselves possibly by walking too far, or at too rapid a pace, and thus to annul the results of months of constant and carefully thought out routine, and even to produce an acute exacerbation of the disease, which may turn the scale against recovery. There can be no doubt that great harm is not infrequently done by muscular exertion which is *for that individual* excessive. The patient cannot too early nor too firmly get fixed in his mind, that as far as he is concerned there must be no hurry, and no worry. When exercise is allowed a pace of two miles an hour must not be exceeded, hills must be totally avoided save under medical permission, walking against a strong head wind must be forbidden, and under no circumstances, *e.g.*, rain, being in time for meals, catching a train, etc., should the patient ever exert himself.

In all cases treatment is begun with complete rest in bed, which must be continued so long as the temperature of the body exceeds the normal, and all subsequent changes are to be

controlled by the use of the thermometer. Even in healthy individuals the taking of food or exercise is followed by a very temporary increase in the body temperature; in tubercular patients this increase is more marked, is of longer duration, and may readily become excessive. On this account the temperature is to be taken carefully and regularly, several times during the day. As regards the method to be adopted there is no doubt that rectal observations are the most reliable, and that great care is needed in oral records to avoid cooling of the mouth, whilst axillary records are always below the real body temperature. If there is a prospect of cure, the necessary muscular exertions required in returning to an ordinary mode of life must be done by the very smallest stages, the temperature being taken immediately after exercise and again after an hour's rest. Further rest must be insisted on should the normal not be attained after that interval. A continuance of rest in bed will readily determine in any case of doubt whether a temperature is the result of exercise, or of the active progress of the disease. In the former case it will be found to quickly subside and remain normal.

Another point that is often forgotten is that the best time for taking exercise is the early morning, because then the patient has had the benefit of a long night's rest, and the temperature is at its lowest. The "stiffest walks" are often given to patients at this time.

It is to be assumed, however, that under the conditions of admission previously specified, in the enormous majority of the patients there will be little prospect of a cure. Under these circumstances though the pyrexia will become lower,

it may fail to subside completely, and for such patients a preliminary rest for a month in bed, followed by a final two to four weeks in which they are allowed to get up and recline on a couch will be found to give the best results.

(4) It has been conclusively proved not only that the expectorated material in cases of pulmonary tuberculosis contains enormous numbers of living tubercle bacilli, and that these may be disseminated by allowing the sputum to dry and be blown about in the form of dust, but further that these bacilli are ejected in the form of a spray by coughing and even when speaking. The patient is therefore taught to use special receptacles for his sputum, and these are regularly disinfected, the danger of indiscriminate spitting being insisted on and absolutely interdicted, whilst he is further instructed on all occasions to cover the mouth and turn aside the head when coughing. Soft rags which can be destroyed each day are alone permissible in place of handkerchiefs, and when not in use they should be kept in a waterproof wallet, which is regularly washed with a disinfectant solution.

Finally the necessity for absolute cleanliness in every part of the room and its contents, as well as for the admission of as much daylight and sunlight into the remotest corner of the room as is possible; the manner in which dust is to be removed by damp cloths so as to prevent its dissemination; these and other rules of living, advisable not only for the patient's sake, but as prophylactic measures against the spread of the disease, are thoroughly impressed on the mind of each individual patient, both by precept and example.



Puerperal Septic Disease

BY

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PUERPERAL SEPTIC DISEASE.

“*Puerperal Fever is Wound Fever.*” The wound is either that which exists in the interior of the uterus after every labour, or it may be one resulting from laceration of the parts either naturally, by the passage of an abnormally large foetus, or by the application of instruments such as midwifery forceps. The infecting agent is a micro-organism.

This, however, need not necessarily be introduced from without, though in practice it usually is. Menge, Kronig, and others have found that the vagina normally contains, *inter alia*, streptococci during pregnancy and after parturition, but that the uterine cavity is invariably sterile. In the healthy (parturient) vagina, these organisms exist in an acid secretion, and are saprophytic only, there being no reaction between them and the tissues: their function is to help the vagina to rid itself of other organisms that may be introduced, and they are, therefore, beneficial. If, however, these streptococci are introduced into the uterus (where the secretion is neutral or alkaline) they may quickly become virulent, and pathogenic.

Anything therefore, that determines the introduction of the vaginal cocci into the uterus may produce an attack of puerperal fever. Repeated vaginal examinations with hands that are absolutely sterile may, for instance, be harmful. Menge also found that the vaginal streptococci became virulent in contact either with a fresh wound, or with necrotic tissue.

ETIOLOGY.

Taking all cases of puerperal infection, the commonest organism present is a streptococcus, which has been found in about eighty per cent of those examined. The bacillus coli communis is present in about thirty per cent, and other organisms such as pneumococci, gonococci, and diphtheroid bacilli, taken together, exist in another ten per cent: the infection is often, therefore, a mixed one.

The bacteriological findings appear to have some relation to the method of infection, though it is not possible to be dogmatic on this point. For instance, in cases which have been infected during delivery, the streptococcus is usually found, and that frequently in pure culture, while in cases which have been infected during the puerperium—it may be on the fifth, or later day—bacillus coli is more often present, and it may be found just before death in almost any type of case.

The foregoing remarks apply to cultures from the interior of the uterus, care being taken to avoid vaginal contamination. The only organism that is ever found in the blood is the streptococcus: it is not in any way possible to state in what clinical type of case this occurs, and the presence or absence of streptococci in blood cultures does not throw much light on the prognosis in any given case. Bacillus coli is never found in the blood except as a terminal invasion.

Infection of the patient may take place either during delivery (parturition infection) or subsequently (puerperal infection). In the former case, the causes of the disease are:—

(a) Laceration of the uterus, cervix, or vagina, either by the passage of an unduly large foetus, during precipitate labour, or, more usually from the use of forceps. A laceration of the cervix from natural causes is usually bilateral, that produced by forceps is diagonal, and not infrequently extends through the vaginal vault.

(b) The making of frequent vaginal examinations, even with sterile hands.

(c) The use of the vaginal douche during labour.

(d) The introduction of organisms from without, by unclean hands and instruments.

(e) The retention of placental tissue or membranes within the uterus.

The commonest causes of puerperal or post partum infection are:—

(a) The neglect to protect the genital canal from infection from without by contact with dirty clothes, or with faecal discharge from the patient's rectum.

(b) The use of the vaginal douche after delivery and during the puerperium, especially if a Higginson's syringe be used for the purpose.

(c) The transmission of organisms by the nurse from other septic cases.

PATHOLOGY.

The first step is the production of a local lesion in one of the aforesaid ways: this may be in itself extensive (as in the case of a deep laceration of the cervix) or so slight as to be with difficulty discoverable (as in the case of an intra-uterine infection), but its size and appearance are no criteria of the severity of the disease, which

depends on the extent of the absorption from that lesion.

This absorption may occur with great rapidity and severity, so that the patient may die of general septicæmia within twenty-four hours, or it may be so slight that the disease appears to be almost entirely localised. Either the organisms themselves—rarely—or their products—commonly—may be found in the circulating blood.

It is, in practice, impossible to draw a definite line between the stages of sapræmia, septicæmia, and pyæmia, as the difference is one of degree only and not of kind. In some cases, as for instance, when the uterus contains masses of putrefying placenta, the type is in the main sapræmic, products of the putrefactive organisms being absorbed into the circulation, and producing marked symptoms such as pyrexia, delirium, etc., which cease as soon as the source of the trouble is removed. In such a case, the patient makes a rapid and permanent recovery. But, if a case of this type is not treated effectively, it soon becomes one of septicæmia: cocci may be found in the blood, and, if death does not immediately result, the patient passes into a pyæmic condition, with the production of local abscesses in various parts. Other patients are apparently "septicæmic" from the onset, and do not live to become pyæmic.

The lesion may be multiple from the first, a laceration of the perineum, for instance, co-existing with some degree of endometritis.

In the cervix and vagina the lesions are easily seen, and consist of lacerations of more or less depth and extent. Their surfaces shew no sign

of healthy re-action, being as a rule pale, and covered with greyish sloughs, which frequently, especially on the vaginal aspect of the cervix, resemble diphtheritic membranes. The discharge is usually sanious rather than purulent, and has frequently an offensive odour. Sometimes very rapid destruction of tissue occurs, the soft parts appearing to melt away in a condition of moist gangrene. A small laceration of the cervix is of more consequence than a large tear in the vagina or perineum.

In the uterus, the lesions are not so obvious. There is always some degree of subinvolution, which may be extensive, the uterine cavity measuring even as much as eight and a half inches in length a week after delivery. Its interior feels soft and slimy, but as a rule there is no great amount of swelling of the endometrium: sometimes, however, this does occur, and fungous masses (which are subsequently found not to contain placental tissue) may be felt with the examining finger.

In slight cases, between the endometrium and the muscle there is a barrier of leucocytes, but in the more severe type this barrier does not exist, or is not effective in confining the bacteria and their products to the wall of the uterus.

In certain cases the uterine wall shews on section a number of small abscesses, which are generally most numerous immediately under the peritoneum. Occasionally, though rarely, these may be of the size of a walnut, and I have myself operated on two cases for peritonitis, resulting from the perforation of one of these abscesses into the general peritoneal cavity. In severe cases, the uterine wall shews, microscopically,

an infiltration with leucocytes and bacteria throughout all its thickness.

Whether the local lesion be uterine or vaginal in site, systemic infection may take place in one, or all of three ways:—

(a) The inflammation may spread along the cavity of the (vagina and) uterus, through the fallopian tubes into the general peritoneal cavity. A general peritonitis is thereby set up, and death may ensue from absorption of the products of this inflammation. This route is not common, inasmuch as before the products of the organisms can arrive at the peritoneal cavity, there has usually been closure of the abdominal ostia of the tubes by inflammatory adhesions. Peritoneal infection is most likely to occur in cases of retained placenta.

(b) There may be a rapid direct infection of the blood stream: these cases are almost invariably fatal within forty-eight hours.

(c) The infecting agents may travel by way of the lymphatics. This is the commonest route, and is seen typically in cases that originate in lacerations of the cervix. Here the systemic invasion is much slower, and abscesses may form in the cellular tissue round the uterus, but these are usually well shut off from the peritoneal cavity. Fixation of the uterus by adhesions is very apt to occur later on, and women who have suffered from this variety of puerperal infection, frequently become chronic pelvic invalids.

The changes in the blood in puerperal sepsis are very varied. The proportion of all cases in which streptococci are found in the circulating blood cannot be stated accurately, on account of the data being as yet insufficient. Amongst

those admitted to hospital (taking this as a criterion of severity) the proportion is about twenty per cent. It must be remembered, however, that the type of case in which they would most readily be found, namely, those dying of rapid generalised infection, either are not recognised as suffering from puerperal infection at all, or at any rate, are not admitted to hospital. Whether these are balanced statistically by the exclusion of the mild cases treated at home or not, is impossible to ascertain.

There is also a difficulty in describing the changes in the number and character of the white blood corpuscles. The blood count does not appear to bear any relation either to the type, or the severity of the disease. In the majority of cases of rapidly generalised infection, a leucopenia is perhaps more common, but I have seen an abnormally high count in patients of this class. Similarly, I have observed both persistently high, and persistently low counts in those who have done well, and in those who have gone steadily down hill. The presence or absence of local suppuration cannot be foreseen, or detected, merely by observations on the blood. Another difficulty arises from the fact that in any given case we seldom know what variations in the patient's normal leucocyte count have occurred in consequence of her pregnancy or parturition, apart altogether from the question of infection.

In a certain number of cases of blood infection, septic venous thrombosis occurs : cases have been described where thrombosed veins in the broad ligaments have been discovered and ligatured with a successful result, and obstruction of the

veins in the leg (usually the saphenous and femoral vessels) is not uncommon. In a small number of these, rapidly spreading thrombosis, with extension to the vena cava ensues.

Sometimes the blood itself is unduly fluid, and subcutaneous hæmorrhages, with bleeding from mucous surfaces, are seen. A petechial eruption on the trunk is not uncommon in this, as in other forms of septicæmia.

PREVALENCE.

Accurate statistics of the incidence of puerperal fever cannot be obtained, inasmuch as though it is a "dangerous infectious disease," and therefore compulsorily notifiable to the Sanitary authority under the Public Health Act, in practice all cases do not so come to the notice of the authorities. It is similarly impossible to find the exact death rate of the disease. In many parts of the country the number of deaths has habitually exceeded that of notified cases in the same area. Mild cases are often not notified at all, and in the severe forms of rapidly fatal septicæmia the difficulty of diagnosis may lead to a certificate of death from pneumonia, or other rapidly fatal illness. In Manchester in 1905 and 1906 the notified cases of puerperal fever numbered one half per cent of the total births. During the same period, the death rate of all cases, whether removed to hospital or treated at home was thirty per cent. There were in all 185 cases of puerperal fever in Manchester in the two years, and of these 73 were attended at the confinement by midwives alone, with a mortality of 17 (23 per cent) and 85 by doctors without midwives, with a mortality of 31 (36 per cent), while 27 were

attended both by doctor and midwife, with a mortality of 7 (41 per cent). It must be remembered, however, that in the "doctors'" cases there was probably a neighbour in attendance also, who may have had a share in the determination of the infection.

During the last twenty years forty per cent of the total childbed mortality in this country has been due to septic diseases, and in the year 1903, 1,686 women lost their lives through puerperal fever in England and Wales. It is probable, for reasons stated above, that these figures (obtained from the Registrar General's returns) do not include all cases of puerperal fever.

Puerperal Fever occurs exclusively amongst women confined in their own homes and is practically non-existent inside lying-in hospitals.

The difficulty of obtaining accurate statistics of the incidence of puerperal fever is partly due to the absence of a recognised definition of the disease. Probably the most satisfactory description is that formulated by a Committee of the N. W. branch of the Incorporated Society of Medical Officers of Health, which runs as follows:—

"The term 'Puerperal Fever' shall include all cases in which, within seven days after the birth of a child alive or still born, the mother shall have a rise of temperature exceeding $100\cdot4^{\circ}$ F. with quickening of the pulse, maintained for a period of 24 hours, or a rigor—each without obvious cause other than the puerperal state."

CLINICAL SIGNS AND COURSE.

The clinical signs of puerperal sepsis are of two kinds, those which are due to the lesion itself,

and those which are indicative of absorption from it. The former may be entirely absent, while the latter are invariably present, though they may differ in degree.

Of the purely local signs, it is not necessary to say very much. When the lesion is well marked, it can be seen or felt on examination, and its description may be found in works on gynæcology. Generally speaking, it is surprising to what little local discomfort these lesions give rise, there being but slight pain or tenderness, for instance, in the neighbourhood of a large pelvic abscess, or an extensive vaginal laceration.

The character of the vaginal discharge is sometimes important however; in cases of the sapræmic type, where there is retention and putrefaction of placenta, or where there is an extensive septic wound of the cervix or vagina, the discharge is foul, and may be diminished in quantity, or profuse and purulent, but in the worst cases of all where there is intense septicæmia, the lochia may be, and, in fact, usually are normal in character.

Perhaps the only local sign that is constant and occurs in all cases of puerperal infection is sub-involution of the uterus, and the degree to which this is present is often a useful index of the severity of the case. The height of the fundus varies very much but it is always higher than it should be after a normal labour, while the uterine wall feels flabby and toneless, and does not contract when the cavity is douched, swabbed or curetted.

It will now be necessary to consider in detail

the general signs and symptoms of puerperal infection. The onset of the illness is marked by a rise of temperature. This may be gradual but the pyrexia is more commonly accompanied by an initial rigor, during which the temperature may be 104°F. or even higher. The height of the pyrexia is, however, no criterion of the severity of the attack, in fact hyperpyrexia is more commonly met with in cases where there is retention of placenta, and which afterwards do well. The temperature, however, whatever its height, is usually remittent, or even intermittent. Marked and persistent intermission, with repeated rigors, while not pathognomonic of venous thrombosis, is very suggestive of this condition.

In some of the worst cases of rapidly fatal septicæmia, the temperature is but slightly raised and may even be subnormal towards the end. In all cases of puerperal infection the thermometer should be used frequently, as dangerous hyperpyrexia, which is not accompanied by any distress on the part of the patient, is liable to occur somewhat suddenly.

With the pyrexia there is quickening of the pulse rate, and this, unlike the character of the pyrexia, is a very valuable prognostic sign, and often affords almost the only indication of the progress of the patient. The rate of the pulse is usually raised out of proportion to the temperature, and often keeps up in cases which are not doing well, when the temperature is falling. The quickening of the heart may be extreme, so that the pulse cannot be counted at the wrist, and the tension is usually lowered.

With the pyrexia, and the quickening of the pulse, there are the usual signs of the onset of

acute disease, namely, shivering, nausea, headache, thirst, and often pains in the back and limbs, but the onset of puerperal fever is not, as a rule, characterised by marked discomfort. There is usually diarrhoea, but vomiting is uncommon. There may be some indefinite pain in the lower segment of the abdomen, but this is not as a rule acute unless the peritoneum is affected. The condition of the patient is from the first one of prostration. The skin is usually hot and dry, but profuse sweating is not uncommon, especially in cases where rigors occur frequently.

The mind is usually clear, and the patient conscious. Nocturnal delirium is often present, especially if the temperature is much above the normal; rarely there is a condition of maniacal fury, this being, in my experience, more likely to occur in cases where the infection is due to retention of placenta. In cases rapidly fatal from general septicæmia, the patient is drowsy from the first and soon becomes comatose. It is well to remember that true puerperal mania may commence very shortly after confinement, and the case be mistaken for one of puerperal sepsis, or that mania and sepsis may co-exist from the first, though this is uncommon, a more usual course being for the mania (or more commonly dementia) to supervene when the patient is convalescent from the septic symptoms. In these cases there is usually persistent refusal to take food, combined with delusions, and aversion to the husband or child.

The tongue is coated and moist at first, rapidly becoming dry, brown and cracked; the mouth is dry and full of foetid secretion, and the lips are covered with sores. These conditions

are most marked in patients who suffer from caries of the teeth.

There is at the onset loss of appetite, which, however, quickly returns and may become ravenous when the septic absorption ceases. There is usually diarrhœa at the onset, and often throughout the acute stage of the illness. More rarely there is obstinate constipation, though this is more usually seen when pelvic inflammation is present, and is then due to the local condition, and not to the general septicæmia.

There is almost always some paresis of the intestine so that the abdomen is distended; this is most marked in the lower segment, where there is frequently also some diminution of respiratory movement; there may be extreme meteorism. As a rule there is no rigidity of the abdominal wall unless peritonitis is present. In addition to the enlarged uterus, swellings in the broad ligaments, or localised collections of pus may be felt through the abdominal wall when these are present. The changes that occur in the abdominal signs when peritonitis supervenes will be considered later.

Apart from any gross lesion in the lungs, the respirations are quickened in the acute stage of puerperal fever, so that the rate may rise to thirty or forty per minute, or there may be a septic inflammation which usually takes the form of a low type of broncho-pneumonia, scattered throughout both lungs. In this type, localised empyemata are not uncommon sequelæ, or there may be a true lobar pneumonia, due either to a streptococcal, or pneumococcal, infection. Again, hypostatic congestion of the bases is almost always present in severe cases, and death may

result from pulmonary œdema. A certain degree of bronchitis is not uncommon in the acute stage of puerperal fever, and is not of serious import as a rule except in elderly women, or in those addicted to the abuse of alcohol.

The urine is usually scanty in amount, and of high specific gravity and loaded with urates in puerperal, as in other, fevers. Albuminuria is uncommon apart from previous kidney disease. Rarely the bladder may become infected from the vagina, and the resulting cystitis adds considerably to the gravity of the case: pyelitis or diffuse miliary abscess of the kidney may then supervene.

The skin may be hot and dry, but profuse and debilitating sweatings are not uncommon.

DIAGNOSIS.

Puerperal fever has to be distinguished from other febrile diseases whose onset has occurred shortly after, but independently of confinement: of these, the commonest, perhaps, are typhoid fever, pneumonia and scarlet fever. It may also be confused with inflammations of various abdominal organs, such as appendicitis and peritonitis. The point to be decided is simply whether the cause of the pyrexia is intra- or extra-genital. The latter may be eliminated by discovery of the characteristic signs of each disease, which need not here be enumerated. Positive evidence of a genital origin of the pyrexia may be obtained from the presence of sub-involution of the uterus accompanied by a discharge from its cavity which is found to contain micro-organisms, or the existence of a septic wound of the vagina or cervix, or of pelvic

inflammation—all bearing a definite relation in point of time to confinement or abortion.

PROGNOSIS.

This is often very difficult, and is frequently determined by changes in the aspect of the patient which cannot well be described. Perhaps the most important point is the state of the pulse, a persistently high rate being of unfavourable import.

Other signs of severity are rapidly increasing coma, low muttering delirium (maniacal fury being often a favourable sign), the absence of gross lesion to account for the height of the pulse and temperature, repeated rigors, meteorism, persistent diarrhœa, hiccough, cyanosis apart from gross pulmonary or cardiac lesion, a sweet odour of the breath, intense anæmia, the persistence of marked uterine sub-involution, and the onset of peritonitis or of venous thrombosis.

COMPLICATIONS.

The most important of these is general peritonitis, and it may be well to refer briefly to the signs of its onset. The first is abdominal pain associated with an increase in the rapidity of the pulse and a change in the aspect of the patient. The pain may be sudden, severe and accompanied by intense collapse, and in such a case there could be little doubt of the nature of the lesion, but it is important to note that this is not always, or, as I believe, usually the case. The pain may be slight, and thought to be simply due to colic; there may be little or no collapse, but if it is accompanied by vomiting the probability of peritonitis having occurred is great. The local signs are

also often indefinite. There may have been much abdominal distension previously, with resulting diminution of respiratory movement, but there is almost always some rigidity; later on there will be the signs of effusion of fluid, but a diagnosis which has been deferred to this stage is of no use whatever for the purpose of treatment; when effusion occurs the patient almost invariably feels better. Neither the character of the pyrexia, nor the state of the blood count are of any diagnostic value whatever, and have the disadvantage of leading towards fatal delay in the adoption of effective treatment. It is well to remember that the difficulty in the diagnosis of peritonitis is greatly increased if opium has previously been given.

Other complications are venous thrombosis, pulmonary embolism, pelvic cellulitis, pelvic peritonitis, pyosalpinx, tubo-ovarian abscess, and subsequently fixation of the uterus in faulty position from pelvic adhesions. Vesico-vaginal fistulæ may also follow sloughing of the vaginal walls; sterility is a frequent sequel of an attack of puerperal fever. These events, however, are described in the gynæcological text-books and need not be further referred to here.

TREATMENT.

Whatever be the line of treatment adopted in an attack of puerperal septic disease, its object should be firstly to cut off, if possible, the source of supply of the toxins or bacteria, and secondly, to neutralise the effects of those already absorbed. It is also important to sustain the patient's vital powers, and so to strengthen her powers of resistance to the bacterial invasion.

In practice there are two schools advocating methods of treatment which differ somewhat widely. Some authorities teach that anything in the nature of active interference with the puerperal uterus is to be deprecated, local cleanliness being all that is necessary or advisable. The attention of the surgeon should be devoted mainly to the sustaining of the patient's strength, and, in some cases, to the administration of bactericidal serum. The basis on which this teaching rests is the assumption that, in any given case, there exists between the visible lesion, whatever this may be, and the system, the barrier of leucocytes before mentioned, and that any active local treatment will destroy this layer, and so increase the extent to which systemic absorption can proceed.

Others, on the contrary, advocate an active line of treatment, including somewhat forcible disinfection of the local lesion, with the object of cutting off, as far as possible, the source from which the toxins are being ascribed. General measures are adopted by both schools.

My own view is that the assumption on which the treatment of the "expectant" school is based is inaccurate. In mild cases, there may be, in this, as in other, kinds of wound infection a protective layer of leucocytes, in fact, I have seen it myself in a section from the uterus of a woman who died of pneumonia, and in whom the septic signs were not pronounced. But in the severe cases, in which the necessity for effective treatment of some sort is most pronounced, this barrier is either non-existent, or is not effective. I have now had the opportunity of examining sections of many uteri from fatal cases of puerperal septicæmia, which had not received any

active local treatment, and I have only once seen this barrier at all. In all the other cases the leucocytic infiltration was homogeneous throughout the uterine wall. There is a further assumption that if the barrier exists, local treatment with the curette will remove it, which also does not appear to be in accordance with the facts of the case.

Furthermore, the expectation that active curetting of the uterus is dangerous to life is not borne out by statistics. The lowest mortalities exist where curetting is in vogue.

The details of the method I adopt are as follows—

The patient is examined in the lithotomy position in a good light, the vagina having been previously cleansed and disinfected as far as possible. For the operation that follows, a general anæsthetic is not as a rule necessary, and I have been in the habit of giving,* one hour previously, a draught of hot brandy and water, followed in a quarter of an hour by a hypodermic injection of morphia. For the average patient two ounces of brandy and a quarter of a grain of morphia are sufficient.

The cervix is exposed by a modification of Auvard's weighted speculum, and seized with two volsellæ. A sterilised swab is then passed (through a sterile glass tube if necessary) up to the fundus and gently rubbed against the uterine wall; from this swab, direct films, or cultures, are prepared, the length of the uterine cavity being ascertained at the same time. A digital examination is now made of the interior of the

* This suggestion I owe to Professor Sir William Sinclair.

uterus, and any loose masses removed with the finger. Inasmuch, however, as the uterine cavity may be as much as nine inches long, it is often impossible to examine, or treat the entire endometrium with the finger alone, as has been frequently advised.

A sharp curette of the largest size which can be passed through the cervix is now introduced. This instrument is shaped somewhat like a hoop, but is flattened, and broad at its extremity; it is passed at once up to the fundus, and broad strips of endometrium are then removed, right down to the muscle in a series of parallel cuts; no force whatever is required or should be employed. The raw surface thus produced is then rubbed with strips of gauze soaked in undiluted izal fluid, or in a 1 in 500 solution of perchloride of mercury with glycerine; this friction should be thoroughly and methodically performed. The uterine cavity is then packed with izal gauze, or with lint soaked in a weaker (1 in 1,000) solution of perchloride of mercury. A vaginal plug is also inserted and the patient then sent back to bed. At the same time the surface of any cervical or vaginal lacerations is scraped and disinfected with izal in the same way. The plugs are removed in 24 hours and usually do not require to be re-inserted. In cases where the uterus has contained a large quantity of foul material, it may be necessary to repeat the swabbing with izal. Intra-uterine and vaginal douches are not employed either at the time of the operation or subsequently.

In mild cases, where the patient's condition is good, and there is no great amount of subinvolution, the curetting may be omitted if the

endometrium feels smooth, and the uterine cavity swabbed with izal, or absolute alcohol only.

In favourable cases, the uterus should contract strongly both to the curetting and swabbing. Absence of this reaction is of bad prognostic import.

The next question is the utility or otherwise of antistreptococcic sera. All authorities are agreed that in this the element of time is of great importance, the action of the sera being more marked the earlier they are given. It is also agreed that harm does not result from their administration in a case that is not due to the streptococcus. It is, I think, essential that the serum shall be polyvalent, *i.e.*, prepared from streptococci obtained from more than one case. I am not, however, prepared to admit that it is an advantage to employ as many streptococci as possible. The dose should be larger than that usually employed, and I now give at least 100 cubic centimetres in one injection, which is not repeated.

As it does no harm, there is in theory, no reason why serum should be withheld in any given case, but where expense is a consideration, it may be reserved for those cases in which the septicæmia is profound, and the local lesion slight, and in these it is not advisable to await the result of the cultures, or to withhold it if streptococci cannot be seen in the direct film. In severe cases the serum may be added to three or more pints of normal solution, and the whole given gradually by subcutaneous infusion.

In cases where the bacillus coli is the infecting agent a serum prepared from one or more strains of this organism may be given either alone, or

in addition to the antistreptococcus serum. Like that preparation, it does no harm, and may do good.

In addition to these measures, it is generally advisable to give calomel by mouth, in doses of one grain per hour for five or six hours; a saline purge is sometimes necessary also. Stimulants are usually required in the acute stage, but the use of alcohol should be discontinued as soon as possible and it is not necessary when the patient is taking food well. Many of these patients can enjoy a fair quantity of prepared solid food even when pyrexia is present, and they do well on it. It is best in fact to give the patient as much food as she can enjoy and digest, irrespective of the state of the temperature chart. In the acute stage abundance of fluid is very essential, and the thirst from which the patient usually suffers, renders possible the administration of several pints of water during the twenty-four hours. When there is any difficulty in giving this by mouth, enemata of normal saline solution should be added.

While the value of hysterectomy in puerperal septic disease is still sub-judice, the balance of evidence so far is distinctly against its employment as a routine measure. If the uterus is removed before the patient is seriously ill, it is in any given case open to question whether the operation was necessary. In such cases local disinfection should be tried first.

As a last resource in severe cases, while the operation may be justifiable, yet it does not hold out any great prospect of success. The causes in which it is most likely to be of use are those

of abscess of the uterine wall, and it is not possible to diagnose this condition beforehand.

As regards the treatment of complications, there can be no doubt that the only possible method of dealing with general peritonitis is by abdominal section. In these cases the dictum of Murphy, "Get in quick and get out quicker," is sound advice.

In other words, a small incision should be made, and the condition of the uterus and tubes ascertained. If the peritoneum has become infected through the fallopian tubes, these should be rapidly ligatured but not removed unless a well marked pyosalpinx is present; a tubovarian abscess can be drained. If there is perforation of the uterine wall the hole should be closed by suturing with cat-gut unless the patient's condition is abnormally good, in which case supra-vaginal hysterectomy may be justifiable. In any case, an opening is made into the posterior vaginal fornix and a rubber or glass tube inserted and brought out through the vulva, a similar drainage tube is left in the abdominal incision. The general peritoneal cavity should not be either irrigated or mopped out, and the patient should be put back to bed as soon as possible and propped up in a sitting position; saline solution should then be run in under the breasts or the skin of the thighs through two needles; a dose of adrenalin not exceeding 15 minims of the 1 in 1,000 solution may be added to the saline solution.

Pelvic abscesses should be incised as soon as the existence of pus is suspected, if possible through the vagina, otherwise by abdominal section.

When venous thrombosis occurs, ligature of the affected vein may be possible and is then advisable. If possible, and there is evidence that the thrombosis is extending upwards, the vein should certainly be ligatured above the clotted area.

In all cases of puerperal sepsis great care should be exercised by the patient during convalescence, and she should abstain from any undue exertion. Many patients do well until they leave hospital and return to domestic work when pelvic pain and leucorrhœa supervene, and the patient becomes a chronic invalid.

A. KNYVETT GORDON.



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