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THE BRADSHAWE LECTURE

ON THE PATHOLOGICAL RELATIONS OF THE
ABSORBENT SYSTEM.

DELIVERED BEFORE THE ROYAL COLLEGE OF
PHYSICIANS OF LONDON, AUGUST 18TH, 1884,

BY

GEORGE HARE PHILIPSON,

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1884.

SIR WILLIAM LUTHER TOWN

OF BATH, N.B.

THOMAS TOWNSEND, 101, THE AVENUE, BATH, N.B.

WILLIAM TOWNSEND, 101, THE AVENUE, BATH, N.B.

THIS TOWN

RESIDES AT BATH

OF BATH

WILLIAM TOWNSEND

TO

SIR WILLIAM JENNER, BART., K.C.B.,

M.D., D.C.L., LL.D., F.R.S., ETC.,

PHYSICIAN IN ORDINARY TO H.M. THE QUEEN, PRESIDENT OF THE
ROYAL COLLEGE OF PHYSICIANS OF LONDON, ETC.,

THIS LECTURE,

DELIVERED BY HIS DESIRE,

IS DEDICATED,

WITH SINCERE RESPECT.

THE BRADSHAWE LECTURE, 1884.

MR. PRESIDENT, FELLOWS AND GENTLEMEN,

The occasion of the present assembly of this College is for the delivery of the fourth BRADSHAWE lecture. By the munificence of the widow of WILLIAM WOOD BRADSHAWE, of Andover and Reading, a Member of this College, a Master of Arts, and a Doctor of Civil Law of the University of Oxford, a sum of money was bequeathed, whereby a lecture might be delivered at this College, annually, with the object of perpetuating the memory of her husband, it being stipulated that the subject of the lecture should have a bearing upon some question of medicine, and that the lecture should be delivered upon the 18th day of August, the anniversary of his death. The munificence of the benefactress and generous founder is well deserving of an expression of respectful and appreciative commendation, in that, while endeavouring to preserve the name of a loving husband, she was actuated with the laudatory idea of associating such with a formal discourse for the advancement of the profession to which he was devoted and which he adorned. This home-loving, studious, and scholarly man, who diligently cultivated his mind in literature and science, may, therefore, be fittingly extolled as an example for others to follow. His name will be justly venerated and transmitted in good repute, as well as that of his generous and devoted widow.

In undertaking the important duty that has been entrusted to me, I feel the honour and estimate the responsibility of the position. It shall be my earnest endeavour to justify the choice of our revered President, to whom I beg to offer my grateful acknowledgements for this distinctive mark of his favour.

I have selected "The Pathological Relations of the Absorbent System" as the title of the lecture. The absorbent system occupies a prominent place in relation to several important pathological processes and conditions, and is at the present time receiving considerable attention from histologists and pathologists. As illustrations of these relationships, it may be mentioned that this system is

undoubtedly concerned in many septic conditions, and the late MESSENGER BRADLEY classified glanders, malignant pustule, snake-bite, dissection wounds, and erysipelas as forms of septic lymphangitis. Moreover, it is supposed to play an important part in relation to various zymotic diseases, such as plague, typhus and typhoid fevers, and diphtheria. The serous cavities are also now regarded as parts of the lymphatic system, and some cases of inflammation of serous membranes, for instance, of puerperal peritonitis are considered as being due to lymphangitis. Again, the absorbents are concerned in conveying to various parts of the body morbid products, such as those of cancer, syphilis and tubercle, and thus of disseminating these diseases through the system. Again, they are often involved in connection with diseases of internal organs. Some structures consist mainly of lymph follicles, and their chief diseases are associated with these follicles. Certain skin diseases, such as erythema, have been attributed to inflammation of lymph rootlets, and changes in the lymphatics seem to constitute an important element in the morbid anatomy of elephantiasis and several other affections. These illustrations will suffice to show the importance of the pathological relations of the absorbent system, and justify the selection of this subject for this commemorative lecture.

As an introduction to the consideration, it will be fitting that a short reference should be made to the anatomy and physiology of the absorbent system. For, without such a statement, the pathological changes, or the departures from the healthy state, to those of disease, could not be indicated with the same precision and comparative exactitude, as this method will ensure. Having in regard, also, that Physiology, in its true acceptation, is the science which treats of the conditions, phenomena, and laws of the life of the human body, in the state of health, while Pathology comprises the departures from such, manifested to the observer in disease. This process commends itself as the right and true way for this dissertation to be conducted.

The lymphatic and the lacteal systems together constitute the absorbent system. There is no essential difference between the two systems. The process of absorption has for one of its objects the introduction into the blood of fresh materials from the food and air, and of whatever comes into contact with the external or internal surfaces of the body, and, for another, the gradual taking away of parts of the

body itself, when they need to be renewed. In both these offices, absorption from without and absorption from within, the process manifests some variety, and a very wide range of action, and in both two sets of vessels are, or may be, concerned, namely, the blood-vessels and the absorbents. The lymphatic system may, therefore, be considered as an appendage of, or supplementary to, the blood vascular system. The materials which they take up being, in fact, merely the spare nutrient substances forced into the intertextural spaces, that is, the commencement of the lymphatics, by the continued exudation of fresh fluid from the capillaries. (a) The lymphatics never come quite close to the surface of the dermis, but the blood capillaries are superimposed upon them (TEICHMANN and BELAJEFF). The lymphatic system consists of vessels, both trunks and capillaries, and of collections of a peculiar kind of connective tissue, adenoid, the meshes of which are crowded with round colourless cells. When these are situated in the course of the lymphatic vessels, and are invested with a capsule, they are termed lymphatic glands, but if there is a mere reticulum enclosing the cells, and so forming a patch in the sub-mucous or sub-serous tissue, it is described as a lymph follicle. Around all such follicles there is a large plexus of lymph capillaries. (b) The principal vessels of the lymphatic system are, in structure and general appearance, like very small and thin walled veins, and like them, are provided with valves. By one extremity they commence by fine microscopic branches, the lymphatic capillaries or lymph capillaries, in the organs and tissues of nearly every part of the body, and by their other extremity they end directly or indirectly in two trunks which open into the large veins near the heart. Their contents pass only in one direction, from the finer branches to the trunk, and so to the large veins, on entering which they are mingled with the stream of blood, and form part of its constituents. The lymphatic capillaries commence most commonly either in closely-meshed networks, or in irregular lacunar spaces between the various structures of which the different organs are compounded. They are composed of a single layer of flattened cells, nearly equal in length and breadth with a marked sinuous outline. When passing into the large lymphatic vessels they present a varicose appearance, from an incomplete valvular apparatus in their

(a) BROADBENT. "HUMPHRY and TURNER's Journal of Anatomy and Physiology," vol. i., 1870, p. 14.

(b) CURNOW, *Lancet*, vol. i., 1879, p. 397.

interior. In the extremities, the lymphatic vessels are divided into superficial and deep. The superficial anastomose freely with one another, and so do the deep, but there is no communication between the two sets, except in the glands, which may be common to both. To this is due the remarkable circumstance that either set may be separately diseased, and that superficial and deep lymphangitis may be spoken of as distinct affections, although inflammation spreads from one to the other. The mode of anastomosis is peculiar. A lymphatic vessel will run for a certain distance parallel to two other vessels, and then divide, it may join both of them, or one of the branches will continue onwards and the other run into an adjacent vessel. In this manner a plexus with large meshes is formed. The rapidity with which inflammation spreads from vessel to vessel is thus easily explained.

In certain parts of the body openings exist by which lymphatic capillaries directly communicate with parts hitherto supposed to be closed cavities. These openings have a roundish outline, never exceed the size of an epithelial cell, and have been termed stomata. An absorption into the lymphatic system, also, takes place in membranes by epithelium or endothelium, through the interstitial or intercellular cement substance, and not through the cells themselves. This mode of absorption may be said to take place through pseudo-stomata. Stomata have been found in the pleura, and as they may be presumed to exist in other serous membranes it would seem as if the serous cavities hitherto supposed closed form part of a large lymph sinus, or widening out, so to speak, of the lymph capillary system, with which they directly communicate.

The current of lymph is much aided by the valvular mechanism. All occasional pressure on the exterior of the lymphatic and lacteal vessels propels the lymph towards the heart. Muscular and other external pressure accelerates the flow of the lymph, as it does that of the blood in the veins. The actions of the muscular fibres of the small intestine, and probably the layer of organic muscle present in each interstitial villus, seem to assist in propelling the chyle. For the general propulsion of the lymph and chyle it is probable that, together with the *vis a tergo* resulting from absorption and from external pressure, some of the force may be derived from the contractility of the vessels. The respiratory movements, also, favour the current of

lymph through the thoracic duct, as they do the current of blood in the thoracic veins. (a)

Blood and lymph are the essential juices of the body. They stand in the closest relation to the vital processes which go on in the tissues. By means of the blood the constituent elements of the body are supplied with the nutrient substances and the oxygen which they require. By the blood and the lymph are conveyed away the waste and surplus matters which have ceased to be useful to the tissues. The nutrient substances and the oxygen are derived from without. The former usually enter the body from the alimentary canal ; the latter usually through the lungs. But most parts of the body are, under certain conditions, capable of directly assimilating both nutriment and oxygen. The channels of entrance are in such cases the smaller blood-vessels and lymphatics. The matters which have to be removed from the tissues are partly surplus nutriment, partly the products of tissue waste and metabolism. These matters are carried off, either to be utilised elsewhere within the system, or to be ejected altogether. Under normal conditions, the incomings and outgoings balance each other in amount. The channels by which the normal constituents gain access to the blood and lymph may also serve to admit matters which are noxious or at least abnormal. These matters may be either wholly extraneous, or produced within the body itself, in virtue of some morbid or abnormal metabolism. The result of their admission is a more or less enduring pollution of the blood and lymph. In many cases the blood is able to eliminate them harmlessly, and speedily, chiefly by means of the kidneys and the liver, but in other cases the pollution is more permanent. The composition of the blood often suffers in consequence, and its renovation may not be effected until some of the tissues or organs have been more or less injured by malnutrition. (b) The lymph is merely the liquid transuded from the blood-vessels, together with certain products of tissue metabolism and certain matters taken up by the lacteals from the outside. To this the lymphatic glands contribute a number of lymphoid elements, in addition to the few cells derived from the blood. The sources of the lymph being thus somewhat various, it may be expected that morbid changes in the composition will not be uncommon. Changes

(a) KIRKE'S "Physiology." P. 362.

(b) Ziegler, MACALISTER'S Translation, Part II., p. 1.

in the blood and disorders of the tissues generally give rise to changes in the lymph, and the various impurities of the blood, are all of them apt to pass into the lymphatic system on leaving the blood-vessels. (*a*)

With this narration of the anatomy and physiology of the absorbent system we are in a position to enter upon the disquisition of its pathological relations. The anomalies in the distribution of the lymph will first receive attention. Every change in the circulation, which determines an increased transudation of liquid from the blood, leads by consequence to an increased saturation of the tissues. This increased saturation is generally balanced by an increased discharge through the lymph-channels. But this compensating action has its limits. If the transudation from the blood-vessels still increases, then at last comes a time when the saturation of the tissues with liquid can no longer be kept down, and so it rises above the normal degree. The condition in which fluid collects in the substance of the tissues is called *œdema*, when in the greater cavities of the body, *hydrops* or *dropsy*. The liquid transudation in *œdema* and *dropsy* has never the same composition as blood plasma, it is always markedly poorer in albumen. Three varieties of *œdema* may be distinguished, according to their mode of origin, these are the *œdema* of engorgement, inflammatory *œdema*, and *hydræmic œdema*.

The *œdema* of engorgement, as the name implies, depends upon a disturbance of the circulation. If from any cause the outflow of blood from the veins is hindered, the blood tends to accumulate in the capillaries and venules. If the degree of obstruction exceeds a certain limit, the plasma seeks a lateral exit and escapes from the vessels. The amount of liquid thus escaping is proportionate to the discrepancy existing between the inflow and the outflow. The escaped liquid is always poor in albumen, poorer even than the normal lymph. It contains, however, a certain proportion of red-blood cells, depending on the intensity of the engorgement. The immediate consequence of increased transudation is an increased flow through the lymphatics. Often enough, this may be quite sufficient to convey away all the liquid which escapes. If it is insufficient, the liquid collects in the tissues, and the result is *œdema*, or *dropsy*. Obstruction to the outflow through the lymphatics does not usually bring about *œdema*, direct experiments have demonstrated

(*a*) Ziegler, MACALISTER'S Translation, Part II., p. 33.

this. In the first place, the lymphatics of most parts of the body possess ample anastomoses, so that it is not easy for a stagnation of the lymph to occur. Even when the thoracic duct is occluded, collateral channels may be opened up and the circulation restored. Furthermore, when in a limb, for example, the whole of the lymphatic outlets have been closed, if no more than the normal amount of transudation from the blood-vessels goes on, no œdema is produced. The blood-vessels themselves have the power of taking up again the lymph they have produced. If the thoracic duct be completely occluded, and no collaterals are opened up, then œdema is the result—it takes the form of ascites. At the same time, the larger lymphatics become greatly distended with accumulated lymph. Though lymphatic engorgement alone is inadequate to produce œdema, it may possibly increase an œdema which has already been produced by increased transudation from the blood-vessels. The quantity and the nature of the liquid which escapes from the capillaries and veins depends not only on the intra-vascular pressure, and the resistance of the flow, but also to a great extent on the character and conditions of the vessel wall. Alterations in the amount of transudation may thus be referable, not to disturbance of the circulation, but to changes in the vessel wall, and especially in their endothelial lining. The vessel wall may, in fact, be made more permeable for the corpuscles as well as for the liquid constituents of the blood, by various causes. One of these is long-standing engorgement, involving incomplete renewal of the blood supply to the vessel. More serious causes of injury are persistent ischæmia, imperfect oxygenation, chemical changes in the blood, very high or very low temperatures, and traumatic lesions. What the exact injuries are which these bring about we are not as yet able to say, but it may fairly be imagined that they amount to a loosening of the connections between the endothelial cells of the intima. It is in virtue of such alterations in the vessels that inflammatory and hydræmic œdema are produced.

As regards inflammatory œdema, no doubt can exist that it originates in some vascular change. It occurs as an independent affection in the form of a more or less local and circumscribed swelling with dropsical effusion; but it may also, as a secondary phenomenon, accompany other processes, like severe inflammation. In the latter case, it is often characterised as collateral œdema. Inflammatory

œdema is distinguished from the œdema of engorgement by the fact that in the former the exudation is very much richer in albumen and white blood-cells. It is also common for coagulation to take place in the dropsical tissues.

Hydræmic or cachectic œdema is very near akin to inflammatory œdema. It was formally believed that hydræmia, in which the blood is impoverished of its solid constituents, and hydræmic plethora, or over-dilution of the blood with water, might directly give rise to increased transudation from the vessels. It was conceived that the vessel wall acted like other animal membranes, through which liquids, poor in albumen, filter more readily than liquids rich in albumen. This is incorrect. COHNHEIM has shown that the vessel wall is not to be regarded as a dead membrane, it is a living organ. When hydræmia is artificially produced it is not followed by œdema. Even hydræmic plethora produced by over filling of the vessels with diluted blood, though it does lead to increased transudation, does not do so till the dilution has been carried on to an extreme degree. Even then, the œdema does not make its appearance at the parts which are the usual seat of hydræmic œdema in man. We must, therefore, look for another explanation of the œdema of cachexia and of nephritis, in which disease the function of the kidneys is disturbed. According to COHNHEIM, they owe their origin to a change in the vessel wall. This change is due to the watery character of the blood, or to some deleterious substance circulating in it. Hydræmic œdema is near akin to inflammatory œdema, but it is not identical with it. This appears from the fact already alluded to, that the liquid effused in the former is much poorer in albumen than that in the latter, and that it contains considerably fewer of the corpuscular elements. (a)

As to the diffusion of disease by the lymphatics. The granulative formations are all distinguished by similar characters. Their development usually stops short at the fibroblast stage, and having reached it, or even before that, the constructive process gives place to retrogressive changes. Cicatricial development being arrested, the granulation tissue persists for a time unmodified, and often develops to a considerable amount. For this reason, VIRCHOW described the formations as granulative growths or granulomata. All of these growths have furthermore the clinical character of infectiveness. Hence they have been termed infective

(a) Zeigler, MACALISTER'S Translation. Part I., p. 48.

growths by KLEBS and COHNHEIM, and specific inflammations by RINDFLEISCH. Their infective character may be recognised by various signs. Thus they are all locally invasive, that is, the granulation tissue spreads centrifugally from a centre into the surrounding structures. At the same time the central or oldest part of the new formation usually dies and disintegrates. In many cases the lymphatic system becomes affected, so that secondary granulative foci are formed in it.

From the lymphatics, the process is at times transferred to the blood, or it may invade the blood-vessels directly. The final result is the spread of the disorder to various organs, or throughout the system.

In most of the granulomatous disorders, we may have not merely a diffusion of the disease throughout the individual organism, but also a transference of it from one individual to another, the affection is inoculable. If one person be inoculated with the inflammatory products derived from another, a disease is acquired whose course is exactly similar to that of the original one, and which yields identical inflammatory products. This latter character of infectiveness is that by which it is most readily recognised.

To this group of infective granulomata belong the neoplastic formations found in tuberculosis, syphilis, leprosy, lupus, glanders, and actinomycosis. All these affections are due to the invasion of the body by a virus or poison derived from the outer world, or from the body of another individual. This virus may probably be produced by vegetable parasites. In leprosy (HANSEN, NEISSER), tuberculosis (KOCH), and in syphilis (KLEBS) bacteria have been found, and in actinomycosis, a special fungus. These are declared to be the originating causes of the respective diseases. Our ideas as to the nature and character of these affections are as yet mainly based upon their clinical course, but we have also derived something from inoculation experiments. Tuberculosis and syphilis are thus known to be communicable from one person to another; tuberculosis is also communicable from man to the lower animals. (a)

Inoculation with sputa containing bacilli of tubercle gives rise to tuberculosis, which is developed more rapidly when the bacilli are abundant. The inoculated bacillus multiplies in the organism, and invades the lymphatic system, liver,

spleen, and serous membranes ; by its presence it sets up a chronic inflammatory process, with the formation of products which become caseified and subsequently soften, producing gradual destruction of the organs. The bacillus is found in the centre of the tubercles in their earliest stage of formation, and hence is the cause, and not the effect, of the morbid process. The lymphatic vessels, amoeboid cells, and the blood-current, are the means by which these micro-organisms are transported from one organ to another and diffused throughout the body. (a)

The lymphatic vessels are subject to two principal classes of tubal changes, namely, dilatation and hypertrophy, and obstruction. Dilatation may affect the capillary network of the lymphatics, more commonly the larger trunks ; or occasionally the thoracic duct or the receptaculum chyli. It presents various degrees, and assumes different forms. Thus there may be merely a localised reticular dilatation of the lymphatic capillaries, or more frequently varicose, saccular, tubular, fusiform or circoïd dilatation of the trunks ; or the enlarged vessels may form a distinct growth, named lymphangioma or lymphangiectodes, which has been divided by WAGNER into the three varieties, simple, cavernous, and cystoid, in which cysts are developed. Moreover, enlarged lymphatics constitute an important element in the structure of elephantiasis and other growths, especially elephantiasis lymphangiectodes. The thoracic duct and receptaculum chyli may be enormously dilated, the former, in extreme cases, reaching the size of the little finger, or else attaining larger dimensions than this. The deep lymphatics and the lacteals are liable to dilatation, as well as those on the surface. Lymphangiectasis is in many cases congenital, and it has been supposed that this may be due to the want of specialisation in the lymphatic system of certain parts. The condition is attributed to different causes. Thus it may follow lymphangitis, in consequence of which the larger tubes are blocked, and the afferent vessels become, therefore, dilated. In other cases it is not preceded by marked inflammation of the lymphatics, but there is considerable hypertrophy of the cellular tissue, and the vessels enlarge, forming a very free anastomosing network. Again, it is supposed that dilatation may arise from mere hypertrophy of lymphatic plexuses, or from paralysis of the coats of the vessels. Any obstruction from internal

(a) SORMANI, *London Medical Record*, 1884. P. 53.

plugging or external pressure may lead to enlargement of the vessels, the circulation through which is thus impeded ; and probably the obstruction may be occasionally seated in the glands. Lymphatic dilatation is most frequently met with in warm and moist climates. When lymphangiectasis occurs on the surface of the body, it can be recognised by objective examination. Dilatation of the superficial lymphatics is generally observed on the inner side of the thigh, the sides of the abdomen, the scrotum, and the penis. It is characterised by vesicles like grains of sago, grouped irregularly (CURNOW). Sometimes, only ampullæ are formed, which are generally soft and painless. The vessels may rupture subcutaneously, forming vesicles containing a clear or milky fluid. They are also liable to rupture externally, or into various internal parts when situated internally, and it is only thus that the latter can be at all recognised clinically, the escaped chyle or lymph appearing in the fæces or urine. Even superficial dilatation of the lymphatics has been not uncommonly mistaken for other conditions, such as herniæ, abscesses, and strumous enlargements. The discharge of lymph confirms the diagnosis. If inflammation attacks dilated lymphatics, it tends to spread rapidly, and may prove fatal.

Multiple lymphatic nævi of the skin, a newly observed disease of the lymphatics, has been recently described by HOGGAN. The condition is believed to be not uncommon, quite as frequent, perhaps, as venous nævi, which it often accompanies and complicates. It also forms the initial stage or predisposing pathological condition of other diseases, such as lymphatic varix of the larger vessels, and also of elephantiasis, in the production of which it may often be the most important factor. That this has not been observed before is probably due to the fact that no proper histological examination, as apart from microscopical, has been made of the tissues in the initial stages of the diseases. That the condition has not been recognised clinically, is probably due to the want of colour in such nævi, as compared with venous nævi. But there can be little doubt, from the frequency with which venous nævi have been observed in elephantiasis, that the two conditions of venous and lymphatic nævi are generally co-existent, and that conditions of hypertrophy, due really to the latter form, have, through being unrecognised, been erroneously ascribed to the former. On the other hand, when the

lymphatic nævi were small, and placed so superficially in the skin, that distension by lymph, produced at will, made them appear above the general surface, like vesicular papules; such a condition would almost certainly have been described as varicose lymphatics. (a)

The absorbent vessels may become obstructed. This condition may involve the lymphatic capillaries, their main trunks, or the thoracic duct itself. It may result from the blocking up of their channels by coagulated lymph, from inflammation of the walls of the vessels, or from external pressure. Thus, the thoracic duct may be more or less obstructed, or even completely obliterated, by the pressure of enlarged glands in the thorax, or of an aneurism. The lymphatic trunks in the limbs may also be compressed by glands, aneurisms, and other morbid conditions; and also the capillaries are subject to pressure in consequence of inflammation of the surrounding cellular tissue. Obstruction of the thoracic duct is said to arise from disease of its valves. It may be remarked, further, that a certain degree of obstruction to the flow of the lymph and chyle may arise from marked interference with the venous circulation, as the result of cardiac disease or direct obstruction of the principal veins. If the thoracic duct is obstructed, and if the chyle cannot reach the venous system by the establishment of a collateral circulation, grave general symptoms arise—viz., marked wasting and anæmia, tending towards a fatal issue. Various degrees of obstruction of this channel have, however, been found in several cases at post-mortem examination, in which no symptoms had been observed during life. The most obvious direct effects of obstruction in the absorbents are dilatation of the vessels behind the impediment, in the course of the circulation, and the development of lymphatic œdema. These conditions necessarily vary much in their extent and degree, according to the situation and character of the obstruction. The dilatation may ultimately lead to rupture of the vessels.

When lymph or chyle is discharged from the vessels or glands, either on the surface of the body or into some internal part, the amount varying much in different cases, the terms lymphorrhagia or lymphorrhœa are applied in signification of the condition. Lymphorrhagia has been observed as a consequence of a wound, but more commonly of

(a) HOGGAN, *Journal of Anatomy and Physiology*. April, 1884. P. 304

engorgement from closure of the lumen of the duct by inflammation or a tumour. In rare cases it may occur from slight wounds, especially in the neighbourhood of joints, which is probably due to a constitutional defect, a lymphorrhagic diathesis corresponding to the hæmorrhagic diathesis (BRADLEY). Usually traumatic lymphorrhagia results from wounds of the thoracic duct, of the larger lymphatic trunks, or of the glands. Idiopathic lymphorrhagia is generally due to previous dilatation of the vessels, which ultimately give way. A most interesting case has been reported by CAYLEY, in which the receptaculum chyli gave way spontaneously as the result of previous extreme dilatation, and fatal peritonitis ensued (*a*). Lymphorrhagia may be associated with chyluria, and is then believed to be due to the *filaria sanguinis hominis*. When lymphorrhagia occurs on the surface of the body, the discharge of the lymph is the clinical sign of the condition. The amount of fluid which escapes varies considerably—from one ounce to five or even ten pounds during the twenty-four hours. It also differs at different times, and the flow has been known to assume a periodic character, increasing during digestion. The fluid which escapes after injury may be clear and limpid lymph, or mixed with inflammatory products or blood. That which comes away in cases of rupture from dilatation of the vessels is more or less white and milky, like chyle, and it contains a variable quantity of fat. The quantity of fibrin present varies much, and therefore the power of spontaneous coagulation of the fluid. When lymphorrhagia takes place internally, it can only be recognised by the presence of the fluid in the urine or fæces respectively, in the former case giving rise to chyluria, in the latter to fatty stools. BRADLEY directed attention to the probable origin of certain cases of hydrocele, hydrocephalus, pleuritic effusion, and ascites from a lymphorrhagia into the respective serous cavities. As proved by CAYLEY's case, the escape of chyle into the peritoneum may set up fatal inflammation. The general condition is more or less affected in cases of lymphorrhagia in proportion to the amount of fluid lost. (*b*)

The consideration of inflammation of the lymphatic system would now appear to be appropriate. Acute inflammation presents three varieties, namely, when the vessels are alone affected, lymphangitis or angeioleucitis; when the

(*a*) "Pathological Transactions," vol. xvii., p. 163.

(*b*) ROBERT'S "Medicine," p. 765.

condition is limited to the glands, adenitis, or when both vessels and glands are involved. It will be convenient to consider these varieties together. As a rule the disease is localised, but under certain circumstances the absorbent system is more or less widely implicated, especially if the inflammation is of a septic character. It may be set up and extend with great rapidity.

This class of affections may be of traumatic origin, being due to various forms of injury, such as a wound, contusion or strain, or they result from various kinds of irritation, such as that induced by neighbouring inflammation, suppuration, ulceration, or diseases of joints or bones. The implication of the glands under the jaw, in cases of diphtheria and scarlatina, is a familiar illustration of irritation from within. External irritation, as, for instance, the strong heat of the sun, may induce superficial lymphangitis. Special forms of inflammation of the absorbent system are set up by specific kinds of irritation, such as that of the syphilitic virus, and septic forms of the disease are induced by various septic poisons. The lymphatics connected with the internal organs are often inflamed when these are the seat of any irritation. Pus has been found in the neighbouring lymphatics in cases of purulent pleurisy. Some forms of pelvic cellulitis have also been regarded as being due to lymphangitis. Inflammation may be immediately excited in the vessels and then travel along to the glands; or the irritation may be conveyed by the current of lymph to a more or less distant part, the intervening portion being unaffected, or the glands may be implicated by extension from the surrounding tissue. When a gland is involved, while the vessels between it and the source of the irritation are unaffected, the inflammation is said to be sympathetic. Inflammation is much more readily excited in the lymphatic structures in some persons than in others, and especially in those who are of a strumous habit. The glands are more liable to be affected in the early periods of life. A low state of the health may predispose to inflammation of these structures from slight causes.

Lymphangitis is distinguished as reticular or tubular, according as the fine capillary network or the trunks of the vessels are involved. In the former case the skin and its capillaries are usually implicated. In the latter variety the vessels become dilated, and their walls are thickened, the endothelium often disappears, and the internal coat becomes

opaque and uneven. The lymph coagulates in their interior, blocking up their channels, and the clot may become organised, obliterating the vessels permanently, or occasionally it softens and suppurates in the centre, and the pus may find its way into the circulation, leading to septicæmia or pyæmia. Exudation also takes place, while the surrounding cellular tissue undergoes hyperplasia and becomes thickened. Lymphangitis may lead to inflammation in joints, which may be of a purulent character. In adenitis the affected glands become congested and swollen, as well as the seat of exudation, while the passage of the lymph through them is impeded. Resolution may take place after a time, but not uncommonly the inflammation terminates in suppuration, this beginning in the centre, the cavities of the glands becoming filled with pus, and the surrounding cellular tissue being also involved. In other cases, the glands remain more or less indurated, and they may form adhesions to the surrounding structures, especially if the irritation is repeated several times. Glands which are chronically enlarged, as the result of inflammation are very liable to become the seat of acute inflammation from slight causes. They may subsequently suppurate, or undergo a caseous degenerative change, but often remain unaltered for a considerable time. This condition of the glands interferes with the passage of the lymph through them.

When the superficial lymphatic vessels or glands are inflamed, this condition is evinced by objective signs. Lymphangitis is indicated by wavy or straight lines, running towards the glands, or sometimes there are isolated red patches, the skin and the capillaries being involved along with the lymphatics. The large vessels may be felt as firm and knotted cords. If the glands are affected, these can be felt and seen to be more or less enlarged and swollen, at first feeling firm.

At the same time pain is experienced, often very acute, with sensations of heat, stiffness, and tenderness. When the affected structures are deeply situated there are no red lines, and redness is not always present. There is induration of the part, more like that of œdema than inflammation. The inflammation may, however, pass through the intervening tissues from the deep to the superficial lymphatics, and *vice versa*. Owing to the interference with the passage of the lymph, more or less swelling from lymphatic œdema is often present of a firm character, and a limb may be much

enlarged from this cause. If suppuration should take place in glands, this will be evidenced by the ordinary signs characteristic of an abscess. There is more or less pyrexia, in proportion to the extent and intensity of the inflammation. In septic forms of lymphangitis, signs of general septicæmia are likely to arise. (a)

Regarding the morbid conditions of the lymphatic glands, manifested by enlargement, if we have regard to the anatomical characters, there are at least three, which it is extremely difficult, and often impossible, to distinguish from one another. These are simple inflammatory hyperplasia, lymphoma—the so-called scrofulous form of enlargement—and that morbid condition now generally known as lymphadenoma.

Lymphoma is a comprehensive term, and includes formations which are not strictly tumours, but rather hyperplasias of the tissue proper to lymphatic glands, lymphadenoid, or briefly, adenoid, tissue, as it is called. Lymphoma, as a neoplasm, would imply the development and deposit of new adenoid tissue in the form of a tumour within a lymphatic gland, a follicle, or some other structure of the connective tissue group. In what is usually called lymphoma, this does not happen. What does happen is, that the tissue of the lymphatic gland, or follicle, increases in size because the lymphoid cells it contains are multiplied, while the reticular tissue undergoes hyperplasia. The process is often inflammatory in character, in other cases the lymphoid hyperplasia seems to begin idiopathically, that is, without any cause hitherto discovered. It may often be doubtful whether the increased growth of a lymphatic gland should be regarded as neoplastic or as hyperplastic. Many cases of lymphoma, especially the leukæmic kinds, seem referable to hyperplasia. The lymphatic glands, adenoid structures of the intestine, and lymphoid follicles of the spleen, all maintain their structure as they grow in size, or alter but slightly. Moreover, the functions of the glands seem to be more actively performed. This does not seem to indicate that they are invaded by anything of the nature of a neoplasm.

In addition to the hyperplastic lymphomata, there is a true or heteroplastic tumour, whose structure agrees with that of lymphadenoid tissue. As the term lymphoma has been perverted to describe the hyperplastic formations, we

(a) QUAIN'S "Dictionary of Medicine," vol. i., p. 907.

may do well to distinguish the genuine tumour as lymphadenoma or lymphosarcoma. It is a sarcoma whose structure somewhat resembles that of a lymphatic gland. It most commonly originates in lymphatic glands, and in the adenoid tissue of the mucous membranes. It may, however, arise elsewhere. When it attacks a lymphatic gland, it may be distinguished from mere hyperplastic lymphoma by its rapid growth, and by its tendency to overpass the limits of the gland, and to form metastases. (a)

The term scrofulous is commonly applied to the slow and painless enlargement of groups of lymphatic glands, which occurs for the most part in children, and almost invariably ends in the destruction of the glands, by an imperfect kind of suppuration. Scrofulous glands are generally met with, in either the neck, thorax, or abdomen, and are commonly limited to one of these regions. Indeed, in the neck, where their progress can best be followed, we often see that the enlargement commences in one gland only, that the glands in the vicinity are successively affected, and often at long intervals, and that, after a while, the morbid process ceases with the destruction of all the implicated glands, those on the opposite side of the neck possibly remaining all the time perfectly healthy. In the earlier stages of the affection the glands differ little, either to the naked eye or under the microscope, from such as are simply hyperplastic from inflammation, but they tend soon to become opaque, yellow and friable, to undergo caseous degeneration. This change commences in the central parts, and gradually involves the whole mass, which presently breaks down into a semi-fluid *detritus*. Occasionally, the caseous lump dries up, earthy salts are deposited in it, and it becomes an inert earthy concretion. There is a good deal of vagueness in the sense in which the term "scrofulous" is generally employed. It is taken for the most part to imply that the morbid process to which we attach it, is dependent upon some peculiar condition of the constitution, and further, that there is some close affinity, if not actual identity between it and tubercle. But the so-called "scrofulous glands" are certainly not tubercular; and, although their appearance is sometimes followed by that of tubercle, in a very large number of cases no such sequence is observed. And as regards cachexia, it is certain that "scrofulous glands" often develop in persons who appear in all other respects in the best of health; and

(a) Ziegler, MACALISTER'S Translation, vol. i., p. 216.

further, if we may judge by the limitation of the morbid process, that if we admit their dependence on a pre-existing state of cachexia, that cachexia must in many cases be limited to a definite part or district of the organism. It is well known, moreover, that when a single gland has undergone scrofulous proliferation, there is a remarkable tendency for the morbid process to spread thence to other glands in its immediate neighbourhood, and thence again to others; it seems in fact to spread from gland to gland, through the agency of some infective material which the diseased organs evolve. It is well known, also, that scrofulous enlargement of the glands of the neck not unfrequently follows upon certain diseases affecting the throat, such as parotitis, diphtheria, and scarlatina. Now, basing his arguments upon such facts as these, VIRCHOW maintains, and we think with reason, that scrofulous proliferation of the lymphatic glands, like ordinary inflammatory hyperplasia of the same organs, is always secondary to the same peculiar process, going on at the mucous surface or other part, which is in direct relation with them by means of the lymphatic vessels; that scrofulous disease of the glands of the neck is traceable to some inflammatory condition of the throat, fauces, or contiguous parts; of the bronchial and mediastinal glands to pulmonary or bronchial inflammations, and of the mesenteric and retro-peritoneal glands, to similar conditions of the alimentary canal. He considers that there may be some specific quality or element in the primary inflammation, and a tendency in its products to undergo rapid decay similar to that which characterises the morbid products of the diseased lymphatic glands, but that generally they are not recognisable, from the fact, that in this case the cells are mostly developed at a free mucous surface, and are speedily shed from it. But he considers, further, that there may be some special aptitude or weakness, congenital or acquired, in the lymphatic glands of certain persons, or of certain parts of them, which makes their inflammations, induced by indifferent causes, assume the scrofulous character. (a)

In contradistinction to the scrofulous enlargement, tuberculous lymphadenitis may be mentioned. It attacks certain parts of the lymphatic system rather than others, especially those through which the lymph is, as it were, filtered, namely, the lymphatic glands. It is in the glands

(a) BRISTOWE'S "Medicine," p. 62.

that the tuberculous eruption is most intense. Generally, the process makes a kind of halt at these gland stations, but it sooner or later finds opportunity to spread onwards, and at length reaches the main trunks and the thoracic duct itself. Wherever the tuberculous process has become established, it is distinguished by the development of tubercles, and this in the lymphatic vessels as well as the glands. A more or less intense inflammation of the surrounding tissue is always associated with the tubercular eruption, it is manifested by hyperæmia with infiltration and swelling. If the process lasts for a certain time it not unfrequently happens that young connective tissue is developed at the seat of the eruption. The usual fate of the tuberculous growth is caseous necrosis and disintegration. It rarely issues in the formation of fibrous tissue, and still more rarely in complete resorption of the tubercle. The virus which engenders tubercle may be carried out of the lymphatic system into the blood, either from a tuberculous focus in a gland, or a tuberculous ulcer in the thoracic duct. It may thus be conveyed to distant organs.

In the morbid condition, known as lymphadenoma, the enlargement of the lymphatic glands consists, at first of mere hyperplasia, and subsequently of fibroid induration. It varies much in its extent. A few glands only may suffer, or every gland in the body may be enlarged. The former cases have the character of a local growth, the latter is distinctly a general disease, for which the term lymphadenosis seems the most exact. The glands vary in consistence; when soft, there may be a considerable excess of leucocytes in the blood, when hard, there may be simple anæmia. Microscopic examination reveals that the enlargement is due to hypertrophy of the glandular tissue, the whole structure being converted gradually into lymph cells, with a fine network of cellular tissue. In addition to the hypertrophy of the glands, other organs, in course of time, present growths of a similar nature, especially the spleen, and, less commonly, the liver, lungs, kidneys, and alimentary canal. Even the canals of the bones may be filled with lymphoid cells. Very little is positively known as to the ætiology and pathology of the condition, but it is assumed that it is a primary affection of the lymphatic system, depending upon some special constitutional condition or diathesis, named lymphadenosis. By some pathologists it is regarded as malignant, and is placed by WILKS between

cancer and tubercle. In many cases, the disease seems to begin without any obvious cause, but in others it evidently starts from some local irritation, and such irritation has probably been present in other instances where it has been too slight to attract attention. As regards predisposing causes, the disease is most common in early and late adult life; in males; and amongst the poor, its development being aided by bad food, insufficient clothing, cold and damp, and unfavourable hygienic conditions. When the affected glands are superficial, their enlargement is evident on objective examination, and their extension and growth can be observed. In the large majority of cases, there is neither pain nor tenderness, but if the enlargement is very acute and rapid, sharp shooting pains may be complained of. When situated in internal cavities, the existence of lymphadenomatous growths can generally be made out by physical examination. Some of the most important symptoms result from pressure and irritation by the enlarged glands, these necessarily varying according to their position and their relation to adjoining structures. Obstructive dyspnœa is often a marked symptom when the growth is situated within the chest. Along with the local signs of the disease, the constitution is obviously affected, as a rule. This may occur before any local symptoms appear, but usually the general symptoms are gradually developed as the glands progressively enlarge, including emaciation, anæmia and its attendant phenomena, often combined with an appearance of serious illness, marked muscular weakness, the patient often tottering and trembling, and feeble circulation. More or less pyrexia is present in most cases, especially in young patients. Free perspirations are common, and the skin is pale and usually moist. Œdema of the legs is a frequent symptom. The blood does not present any excess of white corpuscles, but is often very watery and wanting in its normal colour, the red corpuscles being markedly deficient. The patient is much depressed and low spirited, and attacks of syncope are not uncommon. Bronzing of the skin arises from enlarged retro-peritoneal glands surrounding and compressing the solar plexus. Unless death should occur from the local effects of the enlarged glands, the course of the disease is generally chronic and progressive. In most cases, death occurs within two years, either from gradual asthenia and exhaustion, from the effects of pressure, rarely from hæmorrhage, owing to perforation of a blood-vessel, or from

some intercurrent complication, such as pneumonia, pleurisy, erysipelas, or kidney degeneration.

Hard lymphadenoma or lymphosarcoma occurs as a primary growth most frequently in the superficial lymphatic glands. Other groups may be attacked in the further course of the affection. For example, if the affection starts in some of the cervical glands, the rest of the cervical glands and the thoracic and abdominal glands lying near the large vessels are attacked in succession. The glands are transformed into firm, tough, elastic, or hardened knots, forming dense clusters in combination. Simple glands may reach the size of a walnut. On microscopic examination the lymphadenoid structure is seen to be preserved, while the cells are increased in number, and the reticulum is thickened. Fatty degeneration, calcification, or softening rarely supervene. In later stages the follicles of the spleen may be affected, and be changed like the glands into hard nodules. The spleen is never primarily affected in this form of lymphadenoma.

Sarcoma of the lymphatic glands is a somewhat uncommon affection. It occurs in single glands, or several of the same group are simultaneously affected, and cohere into a nodular tumour. It often overpasses the limits of the gland, and invades the adjoining tissues. Secondary growths are usually developed. Small round-celled sarcoma, spindle-celled sarcoma, fibro-sarcoma, and alveolar sarcoma or alveolar angiosarcoma are all forms which occur.

All the forms of tumour which give rise to metastases may affect the lymphatic glands. Cancers especially are apt to do so, and the glands become enlarged and altered as the disease advances. Sarcomatous metastases, like the carcinomatous, may originate in sarcoma cells which have entered the glands through the lymphatic vessels.

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