Essays on the treatment of deformities of the body / by Frederic R. Fisher.

ESSAYS

ON THE

TREATMENT OF DEFORMITIES OF THE BODY

BY

FREDERIC R. FISHER, F.R.C.S.

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ETC. ETC.

No. I

THE TREATMENT OF POTT'S DISEASE, OR ANGULAR DEFORMITY OF THE SPINE

LONDON
J. & A. CHURCHILL, NEW BURLINGTON STREET
1879

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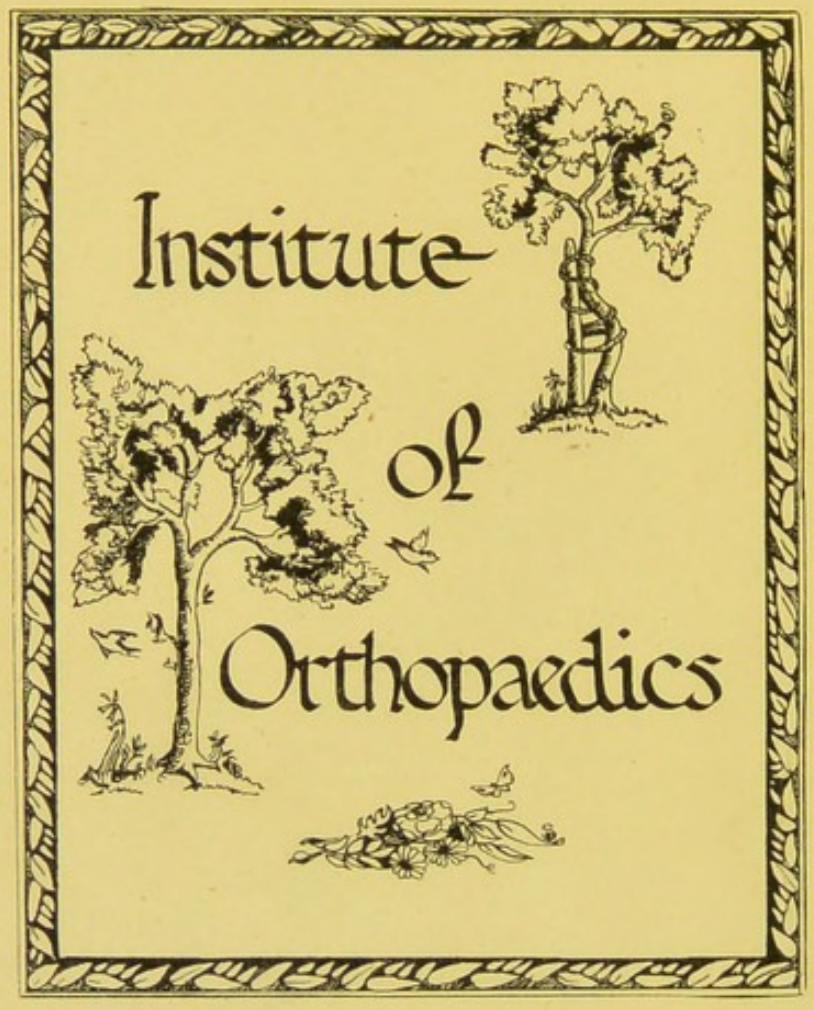

See p. 35.

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In these essays on the Treatment of Deformities of the Body I propose to discuss the practical value of methods of treatment which have recently been introduced. This, the first of the series, is especially devoted to the Treatment of Pott's Disease or Angular Deformity of the Spine by means of "the Jacket;" the subject of Lateral Curvature of the Spine will be considered in the second essay; in the third will be taken the Treatment of Club-Foot, and in the fourth Rachitic and other Deformities of the Limbs.

FREDERIC R. FISHER.

Grosvenor Street;
April, 1879.

POTT'S DISEASE

OR

ANGULAR CURVATURE OF THE SPINE.

ANGULAR CURVATURE of the spine results from destruction by disease of the bodies of the vertebræ; it is the treatment of this morbid process which claims chiefly the attention of the surgeon, and not merely, as in the case of simple mechanical deformity, the restoring misplaced structures to their normal anatomical position. The term angular curvature now commonly applied to this affection by English surgeons, is a by no means appropriate title; it points only to the existence of deformity, and is, moreover, at the best but a ridiculous expression, since to speak of an *angular curve* is a manifest absurdity. The old name Pott's disease of the spine, still retained on the continent, is far better; it clearly indicates the existence of a morbid lesion, and worthily records the name of the distinguished surgeon who first accurately described the nature of this complaint.

The pathology, causes, and symptoms of this affection I propose to consider only so far as is

necessary for the introduction of the special subject of treatment, and thus briefly to notice only the main points of interest in reference to these questions.

Pott's disease of the spine commences in the large majority of cases by inflammation of the cancellous bone tissue of the vertebral bodies, ostitis interna. As a result of this morbid action the cancellous tissue becomes softened and disintegrated; the outer shell of compact tissue is next involved, and the destructive process extends to the adjoining intervertebral discs and neighbouring vertebræ. Such is the most common course of this disease, the bone being the original seat of mischief; in some instances, however, the periosteum, intervertebral discs, or ligaments are first affected, the bone becoming secondarily implicated. In all cases it is the anterior portion of the spinal column that is destroyed, the posterior segments of the vertebræ formed by the laminæ, pedicles, and different processes escaping unaffected. Hence arises the deformity. The anterior portion of the column, the function of which is to bear the weight of the body, being undermined, the column above the seat of disease sinks down upon the vertebræ below, pushes back the arches of the partially destroyed bones, and gives rise to the deformity known as angular curvature. The shape which the distorted spine assumes will be found to vary; when disease is limited to one or two vertebræ only, and the bodies of these are completely, or almost completely, destroyed, the projection will form a sharp angle; but

when several bones are implicated and none of these to any great extent, the projection will be rounded in outline, forming a curve corresponding in length to the number of vertebræ diseased.

As a result of the inflammatory process affecting the bodies of the vertebræ, further mischief may arise beyond destruction of a portion of the column and distortion of the spine. Spastic contraction, and paralysis with complete loss of function of the muscles of the lower extremities not unfrequently occur; the former condition depends either upon inflammation of the theca vertebralis, or of the large motor nerve trunks; the latter arises from the spinal cord being pressed upon by inflammatory deposit, or possibly, by the displaced vertebræ. This implication of the nervous structures gives rise, first to involuntary jactitation of the limbs, which is followed by a condition of constant muscular spasm, and eventually by paralysis with complete loss of function; sensation is very rarely affected.

Another serious complication and one which often proves fatal, is the formation of abscess in connection with the diseased bone; the accumulating pus most frequently comes to the surface either in the lumbar region, lumbar abscess, or in the groin, psoas abscess; but it may pass through the sciatic notch and appear in the buttock, or running between the muscles of the thigh may present in the popliteal space, or even as low down as the heel.

These complications, nerve-lesion and suppuration, I shall dismiss with this brief notice of their occurrence:—The existence of nerve-lesion is best

treated by the methods employed for the relief of the original cause of mischief, the disease of the vertebræ; the treatment of abscess in connection with Pott's disease differs in no way from the course to be pursued in the case of any other chronic and large accumulation of pus; the advocates of early or of late operative interference, of antisepticism, or the use of simple dressings, will follow that plan of treatment which is, in his experience, the most advisable.

The etiology of Pott's disease of the spine is a subject of some obscurity, for the reason that an opportunity for post-mortem investigation of the affected structures in the early stage is seldom afforded us. The disease may occur at any period of life, but is rarely met with in the adult; it is especially an affection of childhood, and it is the children of the poor of large cities who are more particularly subject to the complaint. The affection was formerly described as one essentially of a strumous nature, but as chronic inflammatory enlargement of the lymphatic glands and other symptoms characteristic of scrofula rarely coexist with vertebral disease, this theory is now generally discarded. Nor does the origin of mischief depend upon tuberculosis; the earlier observers described the *débris* left at the seat of disease as tubercle, but the microscope has demonstrated this to consist of nothing more than the usual products of inflammation in bone tissue, and to possess no specific character; to be sure, in a few cases miliary tubercle has been found in the affected bones, but this is of very exceptional occur-

rence. Rejecting, then, these theories based upon the existence of specific influence, the question arises as to whether the disease results from injury to the bones. This opinion is held by many authorities in the present day, notably by Dr Sayre, who says * that injury is "always or almost always" the origin of mischief, and that the disease is "essentially of traumatic origin." As a proof of this traumatic theory Dr Sayre advances the following argument:—"The very fact that hundreds of people are walking about distorted, in many cases to a great degree, and yet remain in this condition and enjoy an average degree of health, until they have reached a good old age, is evidence that the disease is not tubercular in character." This, no doubt, is very true so far as it goes, but other causes of disease exist beyond tuberculosis and injury; the non-productiveness of the former is no proof of the fruitfulness of the latter.

That injury is frequently the *exciting* cause of Pott's disease is undoubtedly true, but in a large number of cases no history of an accident of sufficient severity to have of itself originated the disease can be obtained. Of course, the determined inquirer can extract from a parent a reminiscence of some slight shock that a child may have received in the course of play; but what child does not over and over again give its spine the chance of developing this disease, and yet how seldom, comparatively speaking, do the vertebræ avail themselves of the presented opportunity? Dr Sayre himself says †

* 'Spinal Disease and Spinal Curvature,' p. 2.

† Loc. cit., p. 3.

that in many cases the "injury has been unrecognised by either the parents or friends, and has been revealed only after the most careful questioning."

The fact that the victims of this complaint are almost invariably weakly, ill-nourished children, suffering either from constitutional defect or from want of good food and pure air, points clearly to the influence of defective nutrition in the production of the disease. Healthy children are seldom the subject of vertebral disease, and when so afflicted the original cause is, I admit, always traceable to injury received—injury, however, not of a trifling character, such as every child receives in the course of play, but of a distinct and appreciable nature, clearly to be discovered without severe cross-examination of the parents.

In support of the traumatic theory of causation it is said that the spine is especially liable to injury in its state of development during childhood, and a supposed prevalence of this affection amongst boys is declared to be dependent upon their rougher habits of play, by which they more recklessly expose their spines to injury than do girls. Now, the portion of the spinal column affected by Pott's disease, the bodies of the vertebræ, is the best protected against direct injury, being so situated anatomically as to be absolutely safe except from accidents of the gravest kind, whilst the extreme flexibility of the spine in children is a safeguard against indirect injury, such as concussion, &c. The statement that boys are especially liable to Pott's disease is not confirmed by my own experience, nor have I ever seen it proved by statistics.

On referring to the register of the National Orthopædic Hospital I find that of 500 consecutive cases 261 were females and 239 males. We are also told that the affection being more frequently met with amongst the poorer classes is evidence of the influence of traumatism as a producing cause, because poor children are more exposed to the rough experiences of life than their more fortunate brethren; but I take it that the youthful son of Dives has as little regard for the safety of his spine as has the poorest street arab, and that the prevalence of the disease amongst the lower classes is, as before stated, conclusive proof that defective nutrition is the main cause of Pott's disease. The occurrence of low inflammatory action arising idiopathically in the half-starved tissues of ill-nourished weakly children is sufficiently familiar to all who have experience of hospital practice in large cities; the exact method in which such inflammatory action commences it is impossible to define, because, as already noticed, of the absence of opportunity for examining the bones in the first stage of disease.

In the early stage of Pott's disease the local symptoms are not well defined; the most constant is a state of impaired mobility at the seat of disease. This restricted movement of one portion of the column is readily detected by laying the hand along the spinous processes whilst the patient flexes and again extends the spine; if vertebral disease is present the segments of the spine at the affected spot will be found to move in a mass, and not with that equal bending of one upon another that is

characteristic of the normal movement of the column. This rigidity is probably due to contraction of the intervertebral muscles from reflex stimulation of the motor nerves; it is especially well marked in children, and if present may be taken as a certain indication of the existence of vertebral disease, and as such is a valuable guide in the diagnosis of doubtful cases.

Pain is rarely complained of, at the seat of disease, in the early stage, except in cases resulting directly from injury; indeed, the absence of pain throughout the whole course of this affection is by no means uncommon. It is a symptom that cannot be relied upon as evidence of Pott's disease; in fact, local pain in the back is much more frequently met with when no disease of the spine exists than when the vertebræ are affected. In many writings on this subject will be found recommended the making a patient jump from a stool to the ground, or the forcing down the shoulders or head and thus pressing together the affected vertebræ, so as to excite pain at the seat of disease; such proceedings are unscientific, and are to be avoided, as they may cause mischief by harm done to the diseased structures.

When deformity has occurred we are presented with an unmistakable symptom of Pott's disease; the projection caused by the falling in of the bodies of the vertebræ and the pushing backwards of their posterior segments cannot, with the most ordinary care in examination, be mistaken for any other form of deformity of the spine. The difference in shape which the distorted spine assumes has already been

commented upon; but one fact must be borne in mind in the treatment of this affection, that the amount of deformity is no positive indication of the extent of disease; of course, where deformity is great destruction is also great, but considerable disease of bone may exist without the formation of any curvature. There is in the Museum of the Royal College of Surgeons a preparation (988[a]) showing complete destruction of the body of the last dorsal vertebra without distortion of the column.

Pott's disease of the spine is accompanied by certain peculiarities in the movements of the patient. When walking the spine is kept rigid by voluntary contraction of the muscles of the trunk; the subject thus walks with his legs only, the swaying of the body, which, together with movement of the limbs, normally constitutes the act of walking, is absent, and the gait is consequently stiff and ungraceful. This rigidity of the spine is assumed in other movements; for instance, if told to pick up anything from the floor the patient reaches the object by bending the lower extremities, and not by the natural act of stooping. As disease advances this withdrawal of the spine from work is increased; thus, when lying down, the sitting posture will be gained by pushing the trunk up with the arms, the muscles especially adapted for this purpose not being used, or only so far brought into action as to render the column rigid. When standing up the body will be thrown backwards as much as possible, so as to relieve the bodies of the vertebræ, and if these are laterally affected by the disease the subject

leans to the unaffected side and supports himself chiefly on the corresponding leg; by such means an endeavour is made to convey the weight of the body to the sound portion of the column.* Again, the patient still further attempts to relieve his spine of the burden it has to bear by transferring this to some other part of the body. In cases of cervical disease the head is supported by placing the hand under the chin. Where the upper dorsal vertebræ are affected the weight of the shoulders will be sustained by placing the hands on the hips. When the lower dorsal or lumbar vertebræ are the seat of mischief the hands will be placed on the thighs. In the earlier stages of disease these attempts to take off pressure from the affected bones will be made only when the patient is fatigued, but in the advanced state of the affection he never moves without giving supplementary aid to his weakened spine.

This disease of the spine varies greatly in the course which it runs in different subjects. Usually it is slow in its progress, and is justly classed as a chronic affection; not unfrequently, however, it advances with great rapidity—four, five, or more vertebræ being quickly involved. A short time since a young gentleman consulted me on account of a swelling which had appeared in the right lumbar region, this proved to be an abscess connected with disease of the dorsal vertebræ, and although projection of the arches of the affected bones had existed, and been noticed for more than two years, yet this gentleman had pursued the ordinary athletic amuse-

* See Fig. 3, p. 40.

ments of young men without any inconvenience. In contrast to this case, I had at the same time under my care a little child in whom in four months at least five vertebræ, judging from the severe deformity present, had been almost completely destroyed. Midway between such extremes of acute and chronic condition is the course followed by this affection in the majority of cases, the activity of the disease being directly dependent upon the constitutional condition of the subject. The most chronic form is the rarest, and is generally of traumatic origin, arising in children free from any marked constitutional defect; the acute is met with amongst those whose ill-nourished tissues are excellent soil for the development of inflammatory action.

In the case above quoted the acute condition of disease was assumed from the commencement of the attack, but more frequently this active character is developed at a later period, the destructive action progressing slowly for some weeks and then suddenly advancing with great rapidity, smouldering, as it were, for a time, and then bursting forth with consuming vigour. I have seen many instances of this amongst my hospital patients. On seeking the history of such a case one is at first told that the child has been ill for a short time only, further inquiry reveals the fact that deformity has existed for a considerable period, but from the child appearing in perfect health the parents have disregarded this until all the symptoms of severe disease have arisen. This change from slow to active destruction, although rapid,

is gradual and clearly owing to exacerbation of disease. It must not be confounded with another condition which is occasionally, though rarely, met with, in which the column having been slowly undermined suddenly gives way; the progressive destruction of the one, and the sudden occurrence of the other, enables the surgeon to distinguish between the two conditions.

Method of Repair.—The process of repair in Pott's disease of the spine is by bony ankylosis; the lost structures are not replaced, but the vertebræ remaining at the seat of disease are soldered together by deposit of new bone, which in the most favorable condition of recovery firmly unites the under surface of the vertebra situated above the destroyed portion of the column to the upper surface of the vertebra below; connecting bands of bone are also deposited upon the superficial surfaces of their bodies. Recovery is thus an imperfect process, as the spine is never restored to its normal condition, but loses its property of flexibility at the affected portion of the column; this, when disease has been very extensive, interferes greatly with the movements of the subject, but where destruction has been more limited very little inconvenience ensues.

Indication for Local Treatment.—To place the diseased vertebræ in a state favorable for repair the first requisite conditions are those universally demanded for all diseased structures, viz. rest and relief from all sources of irritation. It is at once

evident that these are by no means easy conditions to fulfil in the case of a diseased segment of such a structure as the spinal column; the mobility of the spine, the important office it performs as a supporting column, the impossibility of applying directly to it any restraining mechanical contrivance, are all serious obstacles to the attainment of the above conditions. Nature appears to make an effort to obtain a state of rest for the diseased vertebræ by the muscular contraction and consequent decrease of mobility of the spine at the seat of mischief, which has been commented upon in considering the symptoms of this affection; but this muscular contraction is also a cause of evil, as the diseased structures are thereby drawn together, and being thus kept in close apposition become sources of mutual irritation.

Changes in the normal condition of the unaffected portion of the spine will result from the position which the patient assumes in order to relieve the diseased portion of the column of the weight of the trunk; thus, if the subject throws the upper part of the body backwards, or leans to one side, these habits, if long continued, will give rise to confirmed deformity in the healthy portion of the column apart from that which may exist at the seat of disease; treatment must be directed therefore to the prevention of this compensating distortion. To attempt to relieve deformity at the seat of disease is of course useless, since, as we have seen, deformity here results from destruction of structures which are never replaced.

The indications for local treatment may be briefly

stated to be, first, the obtaining a condition of immobility for the diseased bones; secondly, the relieving them from the pressure caused by the weight of the body above; thirdly, the relaxation of local muscular contraction; and, lastly, the restoring the spine, as far as possible, to its normal condition.

Methods of Treatment.—The measures adopted for obtaining the conditions above enumerated may be considered under two heads:—First, the recumbent plan of treatment, that is, enforcing complete rest of the whole body and consequent rest of the spine; secondly, the employment of mechanical supports, which, applied to the body, prevent movement of the spine, thus avoiding the restraint imposed by the first method. The recumbent plan of treatment, until recently almost universally adopted in this country, is now becoming superseded by the use of mechanical supports, great improvement having been made in the latter by the plan of treatment introduced by Dr Sayre and by some modifications thereof. The recumbent treatment is, nevertheless, still of great value in some conditions of Pott's disease; to be effectual, however, it must be so conducted as to obtain perfect rest and immobility of the spine. Now there is some difficulty in keeping a child constantly recumbent; no matter how docile and obedient the little patient may be, he is naturally incapable of remaining quiet for a few hours, much less for a period of some weeks. Unfortunately, too, these children are usually fretful and irritable from the effects of their malady;

for, as I shall afterwards explain, it is in the worst conditions of the disease that this treatment is called for. To insure complete rest and immobility of the spine I adopt the following plan:—The patient is ordered to lie upon a mattress of moderate hardness, the head, trunk, and extremities being upon the same plane. To prevent the patient from raising himself in bed, or moving from side to side, I use a *bed-frame*, such as I employ in the application of weight-extension to the lower extremities.* This contrivance consists of two flat iron bars, each having attached to it a crutch and strap for receiving the shoulders, connected together by a third transverse bar, which is fixed to the head of the bed; a bandage is passed over the lower ends of the crutch-bars and tied to each side of the bed. The shoulders being strapped to this frame all movement of the trunk is rendered impossible, whilst the restraint imposed is by no means irksome to the patient. If the subject under treatment is a very restless child weights may be attached to the lower extremities of sufficient power to act as a check upon movement of the limbs. A child thus placed is not so tightly bound as to cause discomfort, but is sufficiently restrained to insure a perfect condition of rest.

Treatment by Mechanical Supports.—Mechanical supports used in Pott's disease are of two kinds—those made of steel, spinal supports, and those made of some material that can be moulded to the trunk by the surgeon, and which completely surround the

* See 'The Lancet,' Feb. 23rd, 1878.

body in a rigid casing, so-called "jackets." The "jacket" treatment is that originated by Dr Sayre, but his treatment consists of something more than the mere encasing the trunk in a retentive appliance; he endeavours, by first extending the spine, to place the diseased bones in a condition favorable for repair, and then, by applying plaster-of-Paris bandages to the body, to permanently maintain the spine in a state of extension by the jacket thus formed.

Dr Sayre's method of applying the plaster-of-Paris jacket is as follows, the description being abridged from his recent work on 'Spinal Disease and Spinal Curvature.' The bandages used consist of some loosely-woven material, the meshes being filled by drawing the bandage through freshly ground and very fine plaster of Paris which is also rubbed into the material. The bandages, lightly rolled, are, when required, set on end in a basin containing sufficient depth of water to cover them entirely; a free escape of bubbles of gas will be observed through the water for a short time, when this has ceased the bandages are ready for use. A closely fitting shirt, or vest, without armlets, and composed of some soft material, having been put on the patient he is then suspended. The suspension apparatus consists of a curved iron crossbeam, to which is attached an adjustable head-and-chin collar, and straps fitted to axillary bands. To a hook in the centre of the crossbeam is fixed a compound pulley, the other end of which is secured either to a hook in the ceiling or to the top of an iron tripod about ten feet in height. The head-and-chin collar

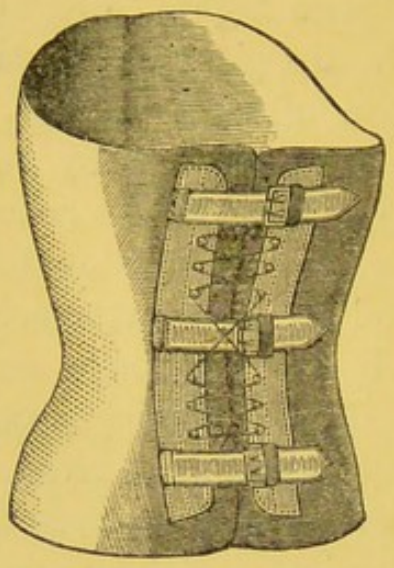
and the axillary bands having been carefully adjusted the patient is gradually drawn up until he feels perfectly comfortable, and never beyond that point; while he is retained in this position the bandage is applied, being smoothly rolled round the trunk and not drawn tight. Previous to applying the bandage pads are placed beneath the vest, one over the abdomen of wedge shape, with the thin end upwards, others over, or by the side of, any spots that it may be necessary to relieve of pressure; the abdominal pad is used to allow for the difference between a full and an empty stomach. The vest is tightly stretched over the pads and fastened by means of tapes. The bandaging process being completed the patient is removed from the suspending apparatus and laid upon a mattress until the plaster has set, the abdominal pad being removed just previously, and the plaster gently pressed in with the hand in front of each iliac process for the purpose of widening the case over the bony projections. Such briefly described is Sayre's method of applying the plaster jacket, for further details and for many valuable hints his work* should be consulted.

Some modifications of Sayre's plan have been introduced; of these the only one of practical importance is the employment of the poroplastic felt as a material for making the jacket in lieu of the plaster of Paris. This particular description of felt is that invented by Mr Cocking; it possesses the quality of being readily softened by heat, and of cooling and again becoming rigid in a few minutes. Jackets are

* 'Spinal Disease and Spinal Curvature.' By Lewis A. Sayre. Smith, Elder, and Co.

made of this material in the shape of the trunk; they are open in front like a corset, and are supplied with three straps and buckles, together with hooks for lacing (Fig. 1); they are accurately moulded to the

Fig. 1.



patient in the following manner: A soft vest is put on as in Sayre's method, but no pads are used, the patient is then suspended and wrapped around with cotton wool or wet cloths to protect him from the heated material; in the meantime the jacket is softened by placing it in a chamber of air heated to a temperature of 180° Fahr., or if the necessary apparatus for this process is not available, immersing the jacket in boiling water answers all practical purposes. In from two to three minutes it is rendered perfectly soft and pliant, and is at once wrapped round the patient's body, moulded with the hand where necessary, and fixed by a bandage rolled round it from below upwards; this part of the process must be done as quickly as possible as the felt becomes rigid in about the same time that it

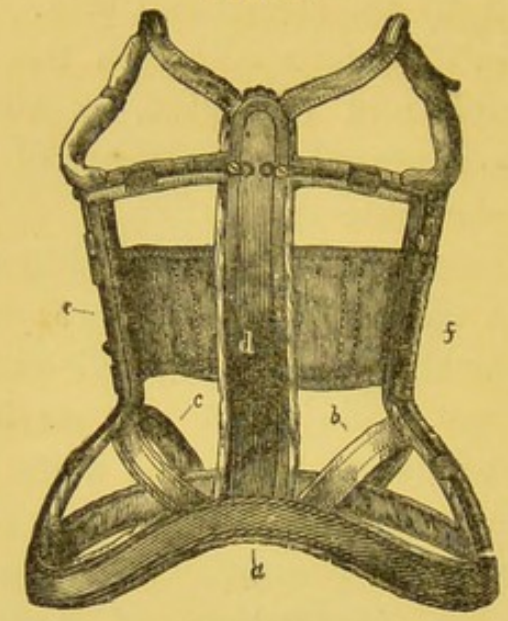
takes to soften. So soon as the jacket has become quite firm the patient is released from suspension, the bandage is then gradually removed, and the jacket fastened by the straps and lace. Should any failure occur in the first application the jacket may be again heated and reapplied, as the softening process can be repeated any number of times without injury to the material.

The steel instrument is now seldom used, the jacket being a more efficient support; as, however, this instrument has done good service in its time, it would be an act of injustice to pass it by with a bare mention of its existence, the more so that the use of the steel support has been very roughly condemned by surgeons who are evidently unacquainted with the proper construction of, and method of using, this instrument. Many of the spinal instruments constructed for the treatment of Pott's disease are quite useless, these possess one common characteristic, viz. that they are devised for the purpose of exerting pressure on the curved spine by means of a lever with cog-wheel movement. This attempt to force the spine into position by mechanical pressure has, of course, met with failure, and the instruments used with this intent owe their origin no doubt to an attempt to treat Pott's disease of the spine on the same principle as the purely mechanical forms of curvature, such as scoliosis, are treated, an evident impossibility.

The instrument which I have been in the habit of using is illustrated by Fig. 2. It consists of a pelvic band (*a*), and hip-pieces (*b* and *c*), which form the basis of support, from the pelvic band rise

sliding crutches (*e* and *f*), which take the weight of the shoulders, a divided back lever (*d*) is fitted

Fig. 2.



closely on either side of the spine, thus giving the required support without undue pressure on the prominent vertebræ. The back lever and crutches gain additional firmness by being connected together by horizontal cross-bars at the top. This spinal instrument is constructed by Ernst, and is very light and comfortable to wear; it is designed to form a support to the weakened spine, and, as such, is as perfect as this description of appliance possibly can be.

Owing to the different anatomical conditions of the spine in the upper and lower portions of the column it is necessary to divide the subject of treatment, and consider, first, the measures to be adopted when disease is situated below the third dorsal vertebra, and, secondly, when arising above that point.

Treatment of Disease of the Spine situated below the third Dorsal Vertebra.—It is in this region of the spine that disease most frequently occurs, and fortunately so, for it is less dangerous and more amenable to treatment than when situated higher in the column. First, with regard to the stage of progressive destruction. As before stated, Pott's disease runs a much more rapid course in some cases than in others; in the treatment of this acute condition, which it is needless to say is the most serious, it is absolutely necessary to fulfil the indications previously pointed out, especially the obtaining rest and relief from all sources of irritation for the diseased bone. This can be done only by strict observance of the recumbent treatment; excellent retentive splint as the jacket, poroplastic or plaster of Paris, is, it cannot be trusted to produce, so long as movement of the body is permitted, that complete immobility of the spine which is imperatively demanded in this severe phase of the disease.

I have frequently heard the objection made that the recumbent treatment is useless, because it is practically impossible to carry it out; by following the method already described a perfect condition of recumbency is obtained, but unless some such measures are adopted the treatment is certainly of no avail. To merely order a child to be kept constantly lying down conveys to a parent but an imperfect idea of what is really required. The object of recumbency and the method of conducting the treatment must be clearly explained to the person in charge of the patient, otherwise the child will be allowed to sit up in bed for his meals, or to

play with his toys, the nurse being ignorant of the fact that a few minutes in the sitting position will counteract the good effects of some hours' rest. At first the child will probably rebel against the enforced restraint, but he soon becomes not only resigned to, but contented with his lot; he appreciates the fact that from the treatment he is undergoing his condition is greatly improved, and the relief obtained compensates him for all inconvenience. No ill results from the long-continued lying down need be feared. I have, when formerly using this treatment for much longer periods than I now do, kept children recumbent for many months without any complication, such as bed-sores, &c., arising therefrom. As to how long the treatment by complete rest of the body should be continued in these cases of an acute character it is impossible to lay down any definite rule; much depends upon the nature of the case and on the reparative powers possessed by the subject. In some instances a few weeks are sufficient to produce great improvement, in others a prolonged period of perfect rest is necessary. The main indications that should guide the surgeon are improvement in the general health, especially gain in flesh, the absence of any complication, such as abscess or nerve lesion, or an improvement of these if already existing. Much information may also be gained from examination of the seat of disease; when destruction is actively progressing, pressure on the affected vertebra causes the spine to yield readily, there is the feeling that the back might with a little exertion be broken; when a better local

condition is obtained there is greater firmness and resistance to the pressure of the hand.

In the less severe forms of Pott's disease of the spine the recumbent treatment is not perhaps absolutely essential during the early stage of disease; but it is, in my opinion, better to commence treatment with a few weeks of perfect rest. Dr Sayre considers that the plaster-of-Paris jacket affords sufficient protection to the spine, even in the early stages of the affection, but he gives the history of no such cases; although the plaster jacket is an excellent retentive splint, it is practically impossible to apply it so as to render the spine perfectly immovable. Great stress is laid on the fact that, when properly fitted with a jacket, the patient is able to take exercise and obtain the advantage given by fresh air. This is no doubt a strong point in favour of the appliance, but still out-of-door exercise is of secondary importance to perfect rest; the commencing treatment, with a week or so of recumbency, has yielded such excellent results that I confidently advise its adoption in all cases.

Having now by the observance of complete rest reduced the activity of the destructive process, a less rigorous course of treatment may be entered upon; it must be remembered, however, that the greatest care is still necessary, and that any irritation of the diseased structures will again excite increased activity of the morbid condition. On relaxing the constraint of enforced recumbency, and permitting the patient to move, it is necessary to give support to the diseased and weakened spine by means of some mechanical appliance, and this is

most efficiently done by the use of a jacket. The method of applying this form of spinal support has already been described, one part of the process, however, requires further consideration, since some doubt has been expressed as to the advisability of suspending the patient, it having been declared that this proceeding is not only useless but, in some instances, has been attended by dangerous symtoms. The object of suspension is to extend the spine and thus draw apart the surfaces of the affected vertebræ, to relax muscular contraction, and to restore the column, as far as possible, to its normal condition. To ascertain what was the effect produced upon the spine by suspension, I recently experimented on the dead subject, a child who had died from Pott's disease of the spine affecting the lower dorsal and upper lumbar vertebræ, complicated by a large abscess and amyloid degeneration of the liver and kidneys. The autopsy was conducted eight hours post mortem; there was no rigor mortis. Examination of the spine revealed an abscess sac surrounding the column from the twelfth dorsal to the third lumbar vertebra; the body of the first lumbar vertebra and the adjoining intervertebral discs were completely destroyed; the under surface of the body of the twelfth dorsal and upper surface and left side of the body of the second lumbar vertebræ were eroded; the anterior common ligament was also destroyed. When first exposed by dissection the surfaces of the twelfth dorsal and second lumbar vertebræ were in close apposition, the slightest movement of the legs making them rub one against the other; there was

a small deposit of lymph of cartilaginous consistence on the anterior surface of the second lumbar vertebra. Raising the body and suspending it by the head caused the surfaces of the diseased bones to separate by about a quarter of an inch, more forcible extension was made by dragging down the pelvis, but the greatest traction that could be exerted by this means produced no further effect than had resulted from suspension alone.

This experiment does not give any great amount of information as to the effects of suspension, since the case was an unfavorable one by which to test the process, much more could be learnt in a subject with less advanced condition of disease; yet this much is proved that great force may be applied without doing any damage to the spine at the diseased spot, no fracture or other mishap resulted from the violent measures adopted. It also shows that the diseased surfaces of the vertebræ are drawn apart by suspension as conducted in Sayre's method of treatment. No structures were dissected away in the examination which could during life have held together the bodies of the affected bones, all these tissues being much softened and disintegrated.

The extent to which the diseased bones were separated, a quarter of an inch, was certainly more than would be desirable in practice, since perfect repair can be obtained only by bony union of the affected vertebræ—to leave a considerable gap between them would retard or perhaps prevent recovery. It must be distinctly understood that suspension is not made with the intent of reducing

deformity at the seat of disease, but only for the purpose before enmuerated. Dr Sayre lays rather too much stress on the fact that patients are increased in height after suspension and application of a plaster jacket, but the same result is obtained by the same means in subjects with healthy spines; by thus treating a boy, aged eight years, I made him nearly three quarters of an inch taller, so that we may conclude that the gain in height is due to decrease of the compensating curves and to stretching of the intervertebral discs throughout the column, and not to any reduction of the deformity at the seat of disease. It being, then, quite possible to extend the spine more than is desirable, it is necessary that suspension should be used carefully and conducted on some rule of practice, so that we may obtain from its employment the greatest amount of good without running the risk of doing harm.

Since suspension of the body causes extension of the spine by throwing upon it the weight of the body below, it is evident that, directly the feet are drawn off the floor, the greatest effect is produced; the patient may be dragged up to the ceiling, but no more extension of the spine will be obtained than if he is just kept clear of the ground. Again, the higher in the column disease is situated, the greater will be the force brought to bear upon the affected portion of the spine; thus, greater power is exerted when disease is situated at the fifth dorsal than when at the third lumbar vertebra, and the difference will be just so many pounds more as is the weight of that portion of the body between the two vertebræ. The power will also vary according to the age of

the patient, for the reason that the younger the child the less are the lower extremities developed in proportion to the rest of the body. A child of nine years of age with disease of the tenth dorsal vertebra will be proportionately heavier below that point than a child three years old. These facts may guide us in determining the extent to which suspension should be carried, and in using this process some definite line of action is very desirable; this is wanting in Dr Sayre's direction, to "suspend until the patient says he is comfortable," since, to take the feelings of the patient as a guide, is not always practicable, for the reason that children are frequently frightened, and their alarm is too great to allow them calmly to review their condition, and inform the surgeon whether or not they derive benefit from the treatment to which they are being subjected. It is difficult to lay down definite rules with regard to the use of suspension, but the following are, with as much exactness as I can give them, those which I take as a guide; they must, of course, be received only as general instructions, because practical experience alone can teach the surgeon the precise amount of extension desirable for every particular case. Using suspension with a full, a medium, and a moderate exercise of force, I would direct.

1st.—In no case draw the patient clear of the floor; by allowing the toes to touch the patient gains confidence, an important point in children, and he is able to steady himself, thus rendering the application of his jacket more easy than when swinging about. This, the extreme degree of

extension ever required, should be used for patients under twelve years of age, when destruction is quite limited, and in younger children, under five years of age, in whom disease is more extensive.

2nd.—A more moderate degree of suspension, leaving the fore-pads of the feet on the floor with the heels raised about two inches, to be used in cases of more advanced disease occurring in children under twelve years of age, and in severe cases under five years of age.

3rd.—Suspension until the heels are just on the point of being lifted, to be used in adults and all over twelve years of age, and in children with severe disease between the ages of twelve and five years.

The patient must be raised slowly and, so that traction may be made directly through the spinal column, by the head alone, except in the case of adults, or of children with extensive disease in the upper region of the spine, when the axillary bands must also be used, care being taken that the straps are so adjusted as to equally distribute the weight amongst them. The apparatus used should be as simple a piece of mechanism as possible, that originally devised by Dr Sayre answers the purpose very efficiently; many different arrangements of the straps and bands have been suggested, but none of these are of much practical value, with the exception of one very useful addition, introduced by Professor Gamgee; this is an automatic catch on the traction cord of the pulley, by which the patient is maintained in position at any degree of suspension that may be desired.

Conducted carefully, and with observance of the

precautions I have detailed, suspension is unattended with the slightest danger; on one or two occasions it has happened that during the application of a plaster-of-Paris jacket the subject has fainted and exhibited unpleasant symptoms of suspended animation, but these were most probably due to the jacket having been applied too tightly and having thus seriously impeded respiration. So far as my own experience goes, I can speak confidently of the safety of this proceeding, having suspended patients of all ages and with all conditions of disease without the least sign of a mishap; I do not doubt that mischief may be done by this as by any other process; perhaps, if one ran up one's patients in a seamanlike manner it would be to their discomfort, but used with surgical intelligence it seems to me to be a very safe operation.

The mere fact of a process being incapable of doing harm is not sufficient to recommend its employment; it must also be proved to be a valuable aid to successful treatment. On this point the following experiences are instructive:

A child, æt. 5, suffering from extensive disease of the upper dorsal vertebræ, with great deformity and complete paralysis of the lower extremities, was admitted to the National Orthopædic Hospital in November, 1878. At the time she was in a state of extreme exhaustion and so wasted by disease that it seemed impossible for her to live more than a few days. I applied a plaster-of-Paris jacket and jury-mast, but from the inconvenience it caused was obliged to remove the appliance and adopt different measures. The child during the

day was propped up in bed in the sitting position, and the spine kept slightly extended by means of the suspension apparatus. At night she was allowed to lie down. Immediate improvement followed, the general health was soon perfectly restored, and in a few weeks muscular power had returned so far as to enable the child to move the legs with considerable freedom.

To a child suffering from disease in the mid-dorsal region with spastic contraction and loss of all power over the muscles of the legs I applied a plaster-of-Paris jacket during suspension, but had to remove the jacket a few hours afterwards from the plaster being of bad quality and not setting. On my next visit to this patient, after the lapse of three days, I was surprised to hear from the mother that the child had gained considerable power over the legs, and found on examination that the muscles were much less rigidly contracted.

A third case almost exactly corresponding to this last I met with at the hospital.

The immediate improvement which followed suspension in these cases proves most conclusively that extension of the spine is very beneficial in the treatment of Pott's disease; no other treatment was adopted, so that to suspension only can the remarkable results be attributed. During the time that the first case alluded to was under treatment I received from Dr Lee, of Philadelphia, a copy of a paper read by him before the American Medical Association, advocating the employment of suspension in the treatment of Pott's disease. It would appear that Dr Lee has used this method with great success since the year

1866, and that upon his treatment was founded Sayre's plan, Dr Lee having first introduced suspension, and Dr Sayre advanced a step further by applying the jacket.

The benefit obtained from the treatment applied to the child whose case is the first of the three above quoted impressed me so favorably that Mr Ernst has, at my request, contrived a bed capable of being raised or lowered, so that the patient may be placed in the sitting or recumbent position as required, and with a suspending apparatus attached to the head; with such a couch extension of the spine can very conveniently be combined with recumbency. I have not yet had sufficient opportunity of thoroughly testing this plan of treatment, but I expect to find it of much use in severe cases, such as I have hitherto treated by recumbency alone.

The plaster-of-Paris jacket is an excellent retentive splint; the materials for its construction are readily obtainable and at the command of every surgeon, but it possesses some disadvantages which lessen its value in practice, these being certain difficulties attendant upon its application, and some inconveniences connected with its after-use.

With regard to its application the plaster, besides being a dirty material to deal with, takes some little time to put on and still longer to set, the patient has therefore to be removed from the suspension apparatus and kept lying down until the casing has become rigid; this shifting of the patient has to be performed whilst the bandages are soft and liable to displacement, so that, unless very carefully con-

ducted, there is great danger of spoiling the jacket, a very likely occurrence if the subject is heavy and not easily moved. Even if this difficulty is successfully overcome there is the risk of the patient becoming restless and damaging the jacket during the process of setting, to prevent which a child has to be kept constantly under observation. Again, it is not always easy to obtain a well-fitting appliance; in cases of great deformity it is almost impossible to roll the bandages smoothly round the trunk, much turning and crossing is required which results in the jacket being of unequal thickness and not of uniform strength throughout. Moreover, if the child cries under the operation, the heaving of the thorax and abdomen is a great trial to the patience of the bandager, who finds his artistic efforts to surround this moving object with an evenly moulded casing are of no avail. But a still greater inconvenience is that, having got through the difficulties of application, the plaster bandages may be defective and not set, then all the trouble has to be gone through again; it is by no means easy to prevent plaster of Paris from absorbing moisture, this coarse and common stuff requires for its preservation almost as much care as any delicate and volatile essence.

In the after-use of the plaster jacket I have found it to be an inconvenient appliance for several reasons. The plaster is very liable to rub out of the bandages after being worn for a short time, the jacket then cracks and loses its efficiency as a retentive splint; also if it is desired to examine the spine the jacket has to be removed and a fresh one applied, for when

divided it becomes quite useless as a support, the material not being sufficiently rigid when the continuity of the jacket is destroyed. This is a great inconvenience. To be sure Dr Sayre says that these jackets may be worn for months, now (putting aside such a trivial objection as the interference with cleanliness which this must entail, because frequent washing may be regarded by some as a luxury and therefore not indispensable) I hold that it is contrary to surgical rule to thus cover up and withdraw the seat of disease from observation for a lengthened period. It is true that in these days the surgeon, by his own act, often conceals the lesion he is treating, but when surrounding with antiseptic dressings a compound fracture or the stump of an amputated thigh, he knows that the development of any local disturbance will be signalled by general symptoms, of which he will obtain immediate information; not so with Pott's disease of the spine, which creeps furtively along and gives but scanty warning of any mischief that may be brewing. The following case illustrates one difficulty that may arise from over-confidence in the plaster jacket.

E. C—, suffering from disease of the lower dorsal vertebræ, after a short period of recumbency was fitted with a plaster jacket; this after it had been worn for about two months was removed for the purpose of examining the spine; no change was found and another jacket was applied. For reasons unconnected with the state of disease, or the condition of the appliance, the second jacket was taken off, and there was discovered in the lumbar region

a large abscess, of which no evidence of formation had been given, so that until obtaining ocular demonstration I was ignorant of its existence. Had this abscess been allowed to pursue an unchecked course, the skin and superficial tissues, pressed against the unyielding surface of the jacket by the force of the accumulating pus, would have sloughed, and a stream of matter would have appeared from beneath the concealing structure I had raised. The frequency with which Pott's disease is complicated by the formation of abscess is sufficient to render it very desirable to keep the surface of the body under observation, for it is only by examining the surface of the body that the presence of an abscess can be detected, these chronic collections of pus giving no other evidence of their development.

A further objection to the plaster jacket is that for adults and adolescents, in order to obtain a casing of sufficient strength, the plaster has to be laid on with a liberal hand, thus rendering the jacket very heavy. The steel instrument has been abused by the advocates of the plaster jacket because of its weight, but although it has been my lot to see many cumbersome and ill-contrived steel supports, these have been surpassed in weight by some plaster jackets, which have turned the scale at fifteen pounds.

A practical experience in the treatment of Pott's disease by Sayre's jacket led me to experiment with different substances in the hope of finding a material which, while forming an equally efficient retentive appliance, would be more convenient for use than the plaster of Paris. Amongst other failures in

these attempts was one of making a jacket from the poroplastic felt, all endeavours to shape a jacket out of the sheets of this material, as supplied for making arm, leg, and other splints, being unsuccessful, from the impossibility of moulding a circular casing out of the flat sheet. This difficulty has been overcome by manufacturing the jacket on a block in the shape of the body, so that having the appliance in the circular form all the surgeon has to do is to soften it and apply it directly to the patient in the manner already described. At the request of Mr Ernst, the well-known surgical mechanician, I tried one of these jackets on a patient of mine in the National Orthopædic Hospital, this being the first experiment with the appliance. The trial was most successful, and I cannot give a better illustration of the efficiency of the jacket as a support than is that afforded by this case—a child suffering from extensive disease of the lower dorsal vertebræ. The accompanying woodcuts are from photographs taken at the time. Fig. 3 shows the girl standing unsupported. It will be seen that she leans backwards, and throws the weight of the body entirely on the left leg. This position is not at all exaggerated in the photograph, but is that which she always assumed. In Fig. 4 is displayed the position she readily stood in when supported with the jacket, and which she declared she could maintain with comfort, although quite unable to do so without the support. This efficiency of the poroplastic jacket may be ~~readily~~ demonstrated in such cases by making the patient stand up with the jacket on and then removing it. Directly the

jacket is off the patient assumes that attitude which best relieves the weakened spine, and if a chair or other means of support is near he will stretch out his hand for assistance.

Fig. 3.

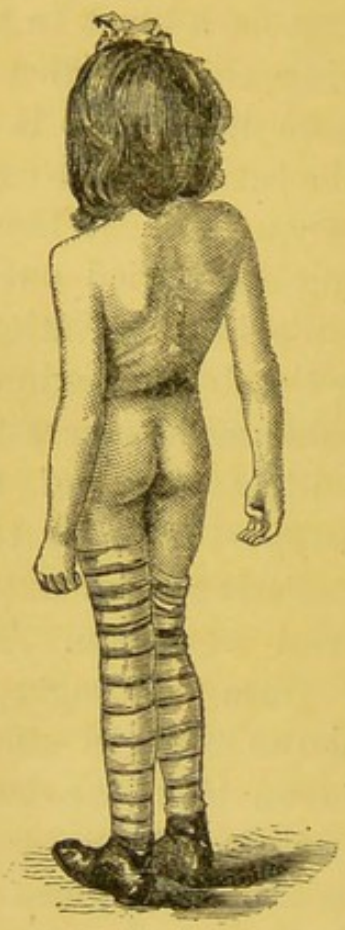


Fig. 4.

The material of which the jacket is composed is so rigid that it makes even a better retentive splint than the plaster of Paris. Many patients who had previously worn a plaster jacket have expressed to me a strong preference for the poroplastic, not only patients whom I had myself fitted with the plaster casing, but several who had been treated by other surgeons. It is owing to the firm and stiff proper-

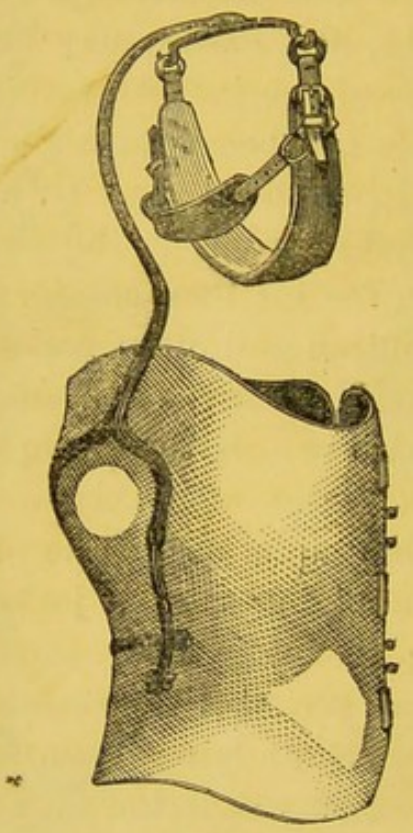
ties of this felt that a jacket made from it is capable of being removable, and yet is a sufficiently strong support; the plaster of Paris, as already noticed, is deficient in this respect, for if divided down the front and fastened with a lace, as is the felt jacket, its qualities as a retentive appliance are lost. It has been objected that the patient may remove the poroplastic jacket, and thus interfere with the treatment; but this difficulty, if it exists, may be overcome by making the edges of the jacket overlap in front, and fixing them above and below with a couple of rivets. I have never experienced any trouble from this cause, as the relief afforded by the jacket is so great that the patient, for his own comfort, will never be without it. Children will often resist and cry most wofully when the support is taken off by others.

The facility with which the poroplastic jacket is applied contrasts most favorably with the trouble and mess attendant upon use of the plaster of Paris. The process of applying the felt jacket is completed in two minutes; the patient is subjected to suspension for this short period of time only, and is relieved from the discomfort of lying down for half an hour or more in order that the jacket may set; all risk of spoiling the jacket before it has become rigid is also avoided, nor is there any fear of the material failing; moreover, an accurate fit is obtained in cases of severe deformity, the jacket being of uniform strength, and very light and comfortable to wear.

When disease is situated high up in the dorsal region of the spine it is necessary, as the jacket cannot be carried up high enough to give support at the affected spot, to use, in addition, Sayre's *jury-*

mast apparatus, or, as it may be more correctly called, a head-piece. This consists of a steel rod bent to the shape of the deformed spine, carried up over the back of the head, and having attached to its upper end a head-sling, similar to that used in the suspension apparatus, the sling being adjustable

Fig. 5.



by means of straps, so that any amount of extension desirable may be obtained. This apparatus is fastened to the plaster jacket by layers of plaster bandage, the rod being fitted below with strips of tin, which are bent round the trunk, and over which the bandages are rolled; to attach it firmly in this way is rather difficult, there is also the inconvenience that it cannot be removed and is liable to

displacement when the patient lies down; to the poroplastic jacket it is attached firmly by rivets (Fig. 5), and is so contrived that it can be slipped off at night, or at any other time, if necessary.

To summarise the advantages possessed by the poroplastic jacket over the plaster of Paris, these are—greater facility of application, greater strength and durability, lightness, no risk of failure of the material, capability of removal to examine seat of disease, and more convenient arrangement of head-piece.

An extensive experience of the use of the felt jacket, gained from the treatment of the number of patients who have presented themselves at the National Orthopædic Hospital, at the Victoria Hospital for Children, and before the Surgical Aid Society, has satisfied me that it is by far the most efficient and convenient appliance at present at the disposal of the surgeon for the purpose under consideration. I first drew the attention of the profession to this form of jacket by a letter published in 'The Lancet,' July 13th, 1878, having then used it in about a dozen cases of Pott's disease; the rage for the plaster-of-Paris jacket which then existed, and had been raised by the demonstrations recently given by Dr Sayre in this country, caused the new contrivance to be received somewhat coldly; indeed, one surgeon, in his enthusiastic admiration of the plaster jacket, went so far as to warn the profession against the use of any other form of splint, especially alluding to the felt jacket, of the use of which he had at the time, to my certain knowledge, had no practical experience whatever. A more extended trial of the

plaster of Paris has, however, brought to light several disadvantages attending its use; Dr Sayre in using the plaster employed the best substance then at his disposal, and by its means was able to introduce a method of treating Pott's disease of the spine which is of the very highest value. The substituting a different material for moulding the jacket cannot in the least detract from the great merit of Dr Sayre's plan as originally brought forward by him, for, although jackets may have been used before, and extension had been previously employed, to Dr Sayre are we indebted for the method which places the diseased spine in the most favorable condition for its recovery, and retains it in this state by means of a rigid casing then applied to the body.

From the time of the first trial of the poroplastic jacket I have most thoroughly investigated its capabilities, using it in the treatment of patients suffering from all the varying conditions of Pott's disease affecting the spine below the third dorsal vertebra, including the different complications of abscess, spastic contraction of muscles, and paralysis; this severe testing the appliance has borne most satisfactorily. Many difficulties arose during the experimental testing conducted at the National Orthopædic Hospital. In overcoming these Mr Ernst has exercised an amount of ingenuity and perseverance which alone could have obtained the success that has been achieved.

On commencing with the use of the jacket and relaxing the restraint of recumbency, the greatest care and watchfulness on the part of the surgeon is necessary. Having carefully applied the jacket and

seen that it fits accurately, the patient should be ordered to take half-an-hour's exercise, out of doors when possible, every morning, which if all goes well may be increased to a second half hour in the afternoon. Then the subject may be allowed to sit up for his meals, and the periods of recumbency be gradually shortened and greater freedom be cautiously permitted; all violent movements must be strictly forbidden. As the slow process of repair advances treatment has no longer to be directed to the obtaining a condition of rest and immobility of the affected bones, as these are cemented together by new material, so that all that is required is to give support to the still weakened column and relieve it of the weight of the body. An outline of the spine should be taken by means of a strip of lead, and a record kept; then if any increase of deformity occurs it can be at once detected. The general health must also be carefully watched, and if evidence of renewed activity of disease is present recumbency should be resumed. Should the jacket require readjusting as the case proceeds towards recovery, it is advisable to suspend the patient to a degree only just sufficient to raise him to his full height, and thus not to bring the power of extension to bear on the affected portion of the spine. After firm consolidation has been obtained the jacket should not be hastily discarded, but should, to avoid all risk, be worn for a further period of two years.

Treatment of Pott's Disease of the Spine arising above the Third Dorsal Vertebra.—Disease of the

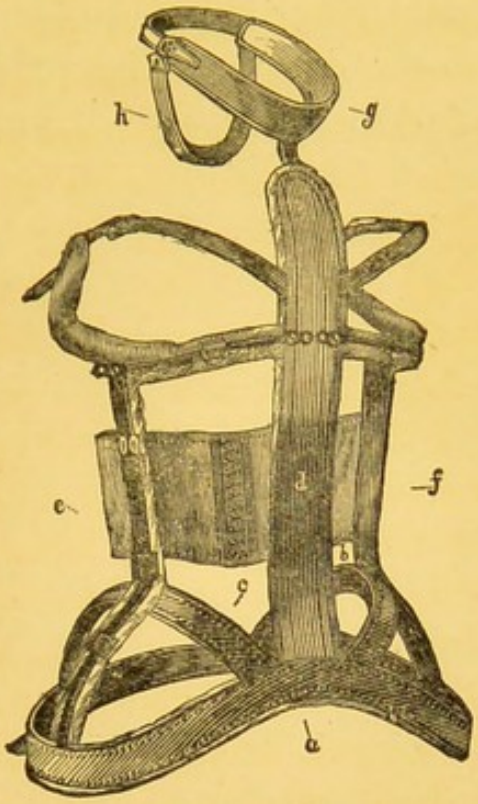
spine in this situation is accompanied with great danger to the patient; the occurrence of nerve lesion is a most serious matter, and the formation of abscess amongst the important structures in this region of the body a very grave complication. The difficulties of treatment are also increased, as the cervical portion of the spine is the most movable part of the column, and is less amenable to restraint by the employment of mechanical appliances; for obvious reasons the neck cannot be encased in a rigid support, as the body is surrounded with a jacket.

In the treatment of these cases we have to trust entirely to recumbency, and this must be so conducted as to obtain a condition of absolute immobility for the diseased vertebræ. The patient must lie upon a firm mattress without a pillow, and movement of the body be prevented by fixing the shoulders with a bed-frame; the neck and head must be surrounded with and imbedded in sand bags. This is a more convenient arrangement than is that of placing the patient in a padded couch moulded to the shape of the body, as the restraining appliances are more readily removed if occasion for shifting the patient should arise. The mattress can be laid upon a movable frame, so that the patient can be carried from one room to another or be taken out of doors; for, as this recumbent treatment has to be endured for a long period, the irksomeness of the enforced restraint is greatly lessened by such changes.

When disease has been arrested, and the reparative process is well advanced, the recumbent treatment may be relaxed, and the patient having been

provided with a mechanical support may commence to take a little exercise. The most efficient instrument to use in the case of disease of the cervical vertebræ is one of the pattern here figured. It

Fig. 6.



consists of a pelvic band (*a*), hip-pieces (*b* and *c*), and crutches (*e* and *f*), as does the instrument for disease in the dorsal or lumbar region already described. The back lever (*d*) is carried to the occiput, and provided with a chin and forehead strap, as shown at *g* and *h*, this lever being made to elongate so as to regulate the amount of extension required. With this instrument (Ernst's pattern) the vertebræ are kept steady, and are relieved of the weight of the head much more effectually than

by the use of Sayre's jury-mast apparatus, which only gives extension and does not limit movement.

A careful watch must be kept when the recumbent treatment is withdrawn for the occurrence of any symptoms indicating relapse. The necessity for close observation of the patient, as before pointed out when considering the treatment of disease affecting the lower region of the spinal column, is even more urgent in these cases of cervical disease.

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