Pott's Disease of the Spine and its Treatment.

By Francis R. Russell M.B.

Since the commencement of the present century, when M. Percival Pott first pointed out the possibility of cure in certain cases of spinal curvature, no disease has been subjected to a greater variety of treatment, or has been treated with more unsatisfactory results.

It is only within the last few years that there seemed to be any hope of removing this class of cases from the group which still form the reproach of Medical Science.

Before proceeding to the consideration of the morbid condition, let us consider shortly the anatomy of the spinal column in a state of health. It is unnecessary to enter into a detailed anatomical description, but a few points of importance in relation to the subject may with advantage be brought under notice.

The vertebrae are directly connected only by their oblique articular processes, situated posterior to the spinal canal, the weight of the head, and chest being entirely supported by the bodies of the vertebrae connected together by means
of the intervertebral discs.
The soft intervertebral discs give to the spine its great elasticity, and according to Prof. Darwin and Sharpey, they occupy about one quarter of the whole column, excluding the atlas and sacrum; that is, from four to five inches.
The compressibility of these cartilages is so great that as Mr. Bishop states there is a difference of one inch between the erect and recumbent postures.
He writes as follows, "When the trunk has been kept in the erect position during the day, an adult man of middle stature loses one inch in height, which he does not regain until after having remained some hours in the recumbent posture." Dr. J. Bishop on the "Pathology and Treatment of Deformities," page 37.
In twenty-four cases on which I experimented, taking as my points of measurement the 7th cervical vertebral prominence, and the top of the sacrum, and marking those points before any measurements were made, I obtained the following results.
I average difference between the erect posture at night and the recumbent posture in the
morning 3/4 of an inch. Average difference between the persons suspended in the morning and the same persons in the erect posture at night also 3/4 of an inch. No difference therefore could be detected between the recumbent position in the morning, and suspension when tried on a healthy subject. The bodies of the vertebrae increase in size from above downwards, a form which mechanically provides the greatest stability.

Mr. Bishop observes, page 36, "The areas of the articulating surfaces of the bodies, increase from the second cervical to the last lumbar vertebra, so that the surfaces of the bones increase as the weight they have to sustain augments."

There are four normal curves in the antero-posterior plane; in the neck and loins the convexity is forwards, in the back and pelvis it is in the opposite direction. The lumbar convexity is greater than the cervical, and the sacral convexity greater than the thoracic. These curves are necessary to bring the weight of the head and thorax more directly over the base of support that in the lumbar region being partly caused, by the obliquity of the pelvis, the position of which
brings the base of the spinal column perpendicular to the heads of the thigh bones, as pointed out by Mr. Weber "Mechanik der menschlichen Gelenkgegen.
If we are to take as the criterion of the strength of the spine, the weight which a person can bear on his head and shoulders, it is evident that these curves are a source of weakness, and that the loss of strength will increase in direct ratio to the degree of curvature.
On the other hand the double curve will act as a spring, and assist in protecting the head from concussion, as well as add to its elasticity as a whole; and doubtless this flexibility is of greater importance than mere strength.
Whether a slight degree of lateral curvature is, or is not, the normal condition, seems to be still a matter of controversy, but into this it is unnecessary for the present purpose to enter.
The pathology and etiology of Pott's disease are still somewhat in dispute.
The affection is usually described as one of sequestrulous origin; as we read in Prof. Spencer's Surgery, page 259,
"Caries of the bodies of the vertebrae, like most manifestations of scrofula, is a disease of early life." Also Mr. Broadhurst in his work on Orthopedic Surgery 250, says, "Disease of the spine is essentially of a scrofulous nature." Dr. Avery, if it is true, is of opinion that in every case the origin is hematemic. He says, page 2, "I reject altogether the view that Pott's disease is above all others one of essentially stormous origin." "It frequently occurs in subjects, but even in those traumatism is a necessary condition for its development." This is certainly exaggerated, for he admits that in some of his cases no cause could be assigned; and in others "only after most careful questioning" some fall is remembered by the relatives to have occurred many months before. How few parents would be unable to recollect some slight fall or shock received by any one of their children at play! Evidence of injury which can only be obtained after careful inquiry is of little practical value. Undoubtedly cases of Pott's disease even in healthy children do arise from injuries, but such will require no questioning to bring them to light; and the evidence of disease
will follow rapidly after the injury.

Injuries must also frequently be an exciting cause in those who are already predisposed to the disease; and a great aggravation in those cases where it is in its incipient stage; in the latter cases a very slight shock would of course produce marked effects, and might frequently draw attention to the disease, formerly over-looked.

Some writers reject the prevalence of periculosa because chronic enlargement of the glands, and other manifestations, do not frequently coexist with vertebral disease. But might not inflammatory action in the bodies of the vertebrae take the place of, and prevent the inflammatory enlargement of the glands, and thus account for their frequent absence?

Certain it is that the children of the poor in large cities are most subject to the complaint; the class in which periculosa is also most common.

All are at least agreed that the disease is of inflammatory nature, and the most common point of origin is stated by Mr. Payne to be, "where the inter-
vertebral cartilage is connected with the bone, and in the intervertebral cartilage itself. "In other cases the vertebrae retain their natural texture and hardness, and the first indication of the disease is ulceration of one or more of the intervertebral cartilages, and of the surface of bone with which they are connected."

(Jones and Sieveking: Pathological Anatomy page 820)

The posterior segments of the vertebrae formed by the laminae, pedicles, and different processes usually remain uninjured.

As a result of the inflammation, the intervertebral discs and the bodies of the vertebrae become softened, and in consequence of the pressure above, the disease bones become attenuated at their softest anterior portion; and as it were a wedge-shaped piece, thick in front and tapering behind, is removed from the column. The anterior portion of the spine being thus undermined, while the posterior part remains sound, the weight of the body must of necessity cause the upper part to fall forwards, and, pushing back the arches of the partially destroyed vertebrae, an angular prominence is found at the seat of disease. This prominence being greatest when
it occurs in the upper part of the dorsal region (this point being furthest removed from the vertebral axis) and least in the lumbar region, where the large surfaces of the bodies of the vertebrae, and the anterior convexity of the curve often suffice to prevent any displacement.

Now, being a jointed column in its whole extent, the upper portion not only leans forward, as a rigid column would, but, the relations of the vertebrae to each other being altered, and the inter-vertebral discs allowing considerable movement at each joint, no sooner as the vertebrae do not rest firmly on each other, the whole of the spine above the disease is curved forwards, thus adding to the pressure at the point of disease.

In the endeavour to overcome this curve, and to restore the balance of the body, as well as from the desire to remove pressure from the inflamed bones, the spinal muscles are kept strongly contracted and thus cause the formation of two compensatory curves, one below, and the other above, the angular prominence.
The deformity now consists not
only of the sharp angle, due to the loss of substance in the diseased vertebra, but in a far greater degree to those compensatory curves.

Now, as soon as this deformity commences, the diseased bone are not only subjected to the weight of the portion above, but are squeezed in the angle of the curved spine, (as is a finger when caught in the hinge of a door) by the weight of the body above, which, acting through the long arm of the lever formed by the upper part of the spine, acquires the power of a lever of the second order, the articular processes of the diseased bone acting as the fulcrum.

To this pressure is due the rapid development of acute curvature occasionally seen in cases where the inflammation has continued for some time, without the wasting of the anterior part of bodies of the vertebra, which is necessary to convert the downward pressure into the leverage described.

This distortion may produce a variety of symptoms by pressure on the spinal cord, or its branches, varying according to the position, and degree of pressure, nor are the many varieties to be wondered at, when we consider the important function of the spinal cord, and the immense...
number of branches from it. The formation of abscesses is of course a natural result, of the various destruction of the vertebrae, and one is more surprised at their frequent absence in severe cases, than at their frequent appearance. The pus usually finds its way to the surface by following the course of the poons, iliac or lumbar muscles; or in rare cases may burst internally.

In the early stage of Pott's disease, the local symptoms are not well defined; the most constant symptom is, perhaps, a rigidity of the vertebrae and muscles at the seat of disease, due to a voluntary, as well as reflex, contraction of the intervertebral and spinal muscles.

Unless resulting from direct injury, local pain is rarely complained of in the early stage, except in those cases where the disease has originated in the ligaments, when every movement will cause sharp pain. From the spinal nerves becoming involved at their point of exit, various pains and uneasy sensations are developed, and manifested at their peripheral extremities.

If the cervical vertebrae are affected, dysphagia and a feeling of constriction round the neck is complained of, often accompanied by
a troublesome cough from laryngeal irritation, and pain in the upper part of the thorax, while the lungs and larynx are themselves free from disease. In the dorsal region the feeling of constriction is round the trunk, with ill defined pains within the thorax and more or less flatulence, and other symptoms of indigestion. If the lower portion of the lumbar region is affected, the chief and earliest complaint is that of a frequent desire to relieve the bladder. See D. Sayre: 'Spinal Disease and Spinal curvature.' Page 4.

The most marked symptoms are the motions of the patients; the careful carriage, to avoid all unnecessary movement of the vertebrae; the head and shoulders being well thrown back, and the spine kept rigid by the constant contraction of the muscles of the trunk; while use is made of all possible external supports, to assist in relieving pressure from the diseased vertebrae.

The subject thus walks with the legs only, and the swaying of the body, which, along with the movement of the limbs, normally constitutes the act of walking, is absent; causing the gait to be stiff, and ungraceful. If told to pick up anything from the floor, the patient reaches
it by bending the lower extremities, and "squatting" down to the object, not by the natural method of bending the back.

In advanced cases where the disease is situated in the cervical region, the head is commonly supported by the hands, or if in the dorsal or lumbar regions, the hands may be placed on the thighs to remove the weight as much as possible from the diseased parts.

Where the disease has advanced rapidly, especially if several vertebrae are involved, and the patient has continued without proper treatment, a partial or total loss of the power of using the lower limbs is likely to occur.

When this is the case the motive power is first lost, for the obvious reason that the anterior columns of the cord are first exposed to pressure, and irritation of the diseased bones.

Paralysis may be caused either by effusion round the cord, or by pressure of displaced vertebrae; in the latter case the hope of recovery is very unfavourable.

Although Mr. Pitt names his writings on the subject "On the Palys of the Lower Limbs," he distinctly states that he did not regard the cases
as true paralysis; nor does he mention a single case of true paralysis as having come under his observation, although such cases do rarely occur among the severest forms of the disease.

In his first publication on the subject (Poth's Works, Vol. III. page 238) he says, "I have in compliance with custom called the disease a palsy, but it should be observed, that notwithstanding the lower limbs be rendered almost or totally useless, yet there are some essential circumstances, in which this affection differs from a common nervous palsy, the legs and thighs do not lose much of their natural sensibility." And three years later, in his farther writings on the same subject (Vol. III. page 263) he remarks, "In the present case the muscles are indeed attenuated, and shrunken in size, but they are rigid, and always at least in a tonic state, by which the knees and ankles acquire a stiffness not easy to overcome. By means of this stiffness, mixed with a kind of spasm, the legs of the patient are either constantly kept stretched out straight, in which case considerable force is required to bend the knees, or they are by the action of the stronger muscles, drawn across each other, in such a manner as to require as much
to separate them; when the leg is in a straight position, the extensor muscles act so powerfully as to require a considerable degree of force to bend the joints of the knee, and when they are bent, the legs are immediately and strongly drawn up, with the heels towards the buttocks; by the rigidity of the ankle joint, joined to the spasmotic action of the gastrocnemius muscles, the patient's toes are pointed downwards in such a manner as to render it impossible for him to put his foot flat to the ground; which makes one of decisive characteristics of the disorder.

This is a very lucid description of the spasmotic condition of muscles, in a case of pressure on, or irritation of, the spinal cord, which has not gone the length of paralysis; and this condition, in a greater or less degree, is often seen in severe cases of Pott's disease. Many writers of the present day still speak of such cases as paraplegic; but a distinction ought to be made between the two classes of cases, for where true paralysis exists as the result of caries of the vertebrae, and the lower limbs have become placid and unresisting, we cannot hope to restore their use to the patient.

From the nature of the disease it is evident that the only hope of
cure is by ankylosis of the diseased bones, and if taken in time, this result can in almost every case be brought about before the disease has caused any great deformity, new bone being thrown out round the affected vertebrae, firmly cementing them together.

The requisite conditions for successful treatment, are those universally demanded for all diseased joints, namely, complete rest and the removal of all causes of irritation. It should be distinctly borne in mind that any attempts to reduce the prominence caused by the loss of substance of the diseased bones, must be attended with great danger, and retard if not prevent the cure, for all such could only result in separating the diseased bones from each other, and the risk of increasing the inflammation.

Our objects in treatment ought to be to reduce all compensatory curves, to remove the weight of the upper portion of the spine from the affected vertebrae, and so to fix the spinal column that the diseased bones may remain in a state of perfect quiescence, such as we would desire in a case of a fractured limb.

This last condition is especially difficult to carry out in the case of a structure of the nature of the spinal column. Its mobility, its important functions as a support, and the impossibility of
applying any direct restraining mechanical contrivance, are all serious objections. Nature appears to make an effort to obtain a state of rest by muscular contraction, and consequent decrease of mobility at the seat of disease, but this state of tension must also be attended with danger, as it will draw the diseased structures closer together, and thus keep up irritation at their points of contact.

The variety of methods and instruments which have been employed at various times in the treatment of these cases would furnish a most interesting and instructive volume; only a few can be here mentioned.

The treatment employed by Mr. Bichat on the test is still sometimes used with benefit in suitable cases. He had remarked that sometimes the formation of an abscess resulted in the recovery of the patient, and believing this to be the only mode of cure he endeavoured to imitate nature by establishing a profuse discharge near the seat of disease.

His method of procedure was the application of caustic on each side of the protruding portion of the spine, and when the testes had separated, a long continued drain was kept up, by means of fine earthenware powder, or otherwise, until the restoration of health had been attained.
In severe and acute cases, especially when there is any puffiness near the affected vertebrae, the application of caustic or the cautery is often of marked benefit; such cases however are not of frequent occurrence.

Dr. Edward Harrison of Edinburgh, under the impression that the disease was essentially in the ligaments, and that the projecting vertebrae were dislocated, endeavoured to replace them, and to remove the deformity by direct pressure.

Another plan, which for long found great favour on the continent, was to keep the spine constantly stretched. Various complicated beds and chairs with steel collars were used for this purpose; and the results in most cases appear to have been highly deleterious.

Moderate extension is still employed with good effect, in suitable cases of lateral curvature.

The treatment by recumbent posture, apparently first advocated by Mr. Barynton, in the Edinburgh Medical and Surgical Journal, (Vol. VIII. No. 4) has been more fully tried and with greater success than any other method in this country; but the difficulty of enforcing this position, unless in the most serious cases, or during the acute or early stage is very great; and
in order that it may be properly carried out the patient requires constant supervision. For these reasons this form of treatment is almost inapplicable among the poor except in the acute stage, for few hospitals care to admit into their wards cases requiring such a long process for their cure.

The recumbent treatment is in some cases of great value; to be effectual, however, it must be so conducted that perfect rest and immobility of the spine may be obtained. To ensure this in children, it is necessary that the shoulders be by some method fixed to the bed, and it may even be desirable to attach light weights to the feet.

The recumbent method is now becoming gradually superseded by the use of mechanical supports; great improvement having been made in the latter since the mode of treatment introduced by D. Sayre, or some modification of it, has been generally adopted. Although artificial supports of various kinds had long been in use, they were in general found to be unsatisfactory, either from their weight, or costliness, or from the difficulty of getting them properly fitted.

For the last thirteen years it had been the custom at the Peterborough
Infirmary to use jackets made of thick sheet gutta-percha, applied, while warm, to the patient in the recumbent posture by the pressure of a many-tailed bandage. Although inferior to those of plaster of Paris, these jackets were found to answer well in most cases, and when laced up the front gave efficient support to the spine; they had the disadvantage, however, of being made of a material requiring great care in its manipulation, as well as somewhat expensive.

Dr. Sayre's method of applying his plaster jackets is now well known; it will not be out of place, however, to mention shortly his mode of procedure, as described in his recent work "On Spinal Disease and Curvature," pp. 14 to 22.

Bandages of crinoline or some loosely woven material, 2 1/2 or 3 inches in breadth and 3 yards in length, are charged with freshly ground plaster of Paris by its being well rubbed into the material, and these may be preserved in an air-tight vessel. When required for use they are set on end in a basin of water of just sufficient depth to cover them, and on the bubbles ceasing to rise the bandages are ready for application. The skin is protected by a tight elastic vest of soft texture, kept stretched by
means of shoulder straps and tapes

tied beneath the perineum. Before
the bandages are applied a wedge
shaped pad of cotton wool is placed
between the shirt and skin over the
abdomen with the thin edge downwards,
to be withdrawn as the plaster sets.

Any very prominent or inflamed
spongy processes may be protected by
small pastes; and two or three thickness
of folded cloth placed over the crest
of the ilium, and removed as the plaster
sets will prevent pressure on these
prominences. (In sore) The breasts also of
developing females may require to be
similarly protected. To raise the weight
of the body from the ground, the
following apparatus is used. (etc)
depthly padded axillary straps, and
a leather collar for the support of
the head, are attached to a small
metal crossbeam. This is elevated
by means of two pulleys, one attached
to the apex of a tripod or some
other fixed point above, and the
other to the crossbeam. The chin collar
and axillary supports having been
carefully adjusted, the patient is
slowly drawn up until the heels
swing just clear of the floor. A patine
rolled gently squeegeed is now applied
spirally round the trunk, commencing
at the smallest part, and carried down
slightly below the crest of the ilium.
and upwards as far as the axilla. The bandage should be simply unrolled with one hand and smoothed down with the other, and must not be drawn tight. After one or two thicknesses of bandage, narrow strips of tin roughened by punctured holes may be placed round the body, in sufficient numbers to strengthen the jacket, and fresh layers of bandages applied over them. In a short time the bandages are sufficiently dry to allow the patient to be laid on a mattress until the plaster is thoroughly set.

If any abscesses are present they should be opened before the jacket is applied, and a fenestrum cut in the latter to admit of their proper treatment.

In cases of cervical cancer, Dr. Sayre uses what he calls his "jury mast" apparatus. This consists of an iron rod carried in a curve over the top of the head, and capable of being elongated at will. This rod is fixed to the jacket between the layers of the bandages, by strips of tin rivetted to it, passing round the body. A small crossbeam is attached by a swivel to the top of the mast, and the head is supported by a padded leather collar suspended from the crossbeam.
Mr Fisher, of the National Orthopaedic Hospital, strongly recommends proplastic jackets moulded to the patient while suspended.

During the last two years Dr T. F. W. Wilks of Peterborough has adopted a different method for the application of the plaster jacket, namely, by means of a many-tailed bandage applied to the patient when in the recumbent posture, and in all the cases where it has yet been tried, the results have been highly satisfactory.

To carry out this plan of treatment no apparatus is necessary, except those of which the jacket is composed, but some simple machine, for charging the bandages with the mixed plaster facilitates the application.

I am fully convinced that the frequent failures of which one hears in the application of bayer's jackets, and which are all set down to bad plaster, are really due to the method of placing the bandages charged with plaster in a vessel of water. The plaster is so apt under such circumstances to take up an undue proportion of water, that, as long as this method is pursued, failures will be sure to occur, and such are always most annoying both to the patient and surgeon. The best plaster of Paris will not set if mixed with too much water, but if
the plaster and water be first mixed in their proper proportions, and the bandages then charged; the only failure possible is that the plaster may set too soon.

I am in the habit of keeping the plaster in months stored in paper bags, in a room without a fire, and, after applying over fifty jackets, I have never known a case in which the plaster did not satisfactorily set.

For a full sized jacket we use five pounds of plaster, forty five ounces of water, and from five to six ounces of mucilage, to keep the plaster from setting too soon. The mucilage must be prepared according to the Pharmacopoeia B.P. strength; otherwise a larger proportion will be required. The following is our method of procedure. A table or firm mattress is covered with a blanket and newspaper, on which the jacket is to be laid out, in the form of a many-tailed bandage. Two measurements are now taken, one of the girth of the patient's chest, to which four inches is added to permit the ends to overlap properly when the jacket is applied; this measurement gives the required length of the bandages to be laid out, and two marks may be made across the newspaper to indicate their extremities; the second measurement is from the apex of the axilla to a point two
inches below the crest of the ileum; this gives the length of the required jacket, and two marks may be made on the newspaper, at right angles to the former ones, to indicate the breadth of the many-tailed bandage required.

Bandages of crinoline, or Victoria lawn, nine yards in length, and from two to three inches in breadth, are now charged with liquid plaster and gum, mixed in the proportions already mentioned. The most efficient, cleanest, and quickest method of saturating the bandages with plaster is to use the simple machine here depicted. (a) represents the dry bandage, the end of which, passing under the fan roller (c), is rolled on the spindle (b) by turning the handle (f). The passage of the bandage causes the fan roller to revolve, and splash the plaster effectually over the bandage; the box is wide enough to charge three bandages at once. The bandage should be lightly rolled, otherwise too much of the plaster is squeezed out.

The bandage, having been thus charged with wet plaster, the end is taken by an assistant, and the surgeon rapidly unrolls it across the table, and divides it with scissors at the appropriate
length; according to the first measurement marked on newspaper, and leaves it lying across the table at the point marked for the upper edge of the jacket. A second strip is similarly laid down so as to cover two thirds of the first, and this is continued, each bandage covering two thirds of the one preceding it, until a many-tailed bandage of sufficient breadth has been laid down to reach the line marked for its lower edge, according to the second measurement. This would only provide a jacket equal to three layers of muslin, which would not be sufficient, and a second layer of bandages is therefore placed in a similar manner over the first, two strips of brown paper, one on each side, being placed between them, to prevent the ends becoming confused during the second stage of the application. A third layer even may be added if a strong jacket is required; and a few extra strips may be laid at the top and bottom where the thickness is less. The jacket may be strengthened still far further by extra strips on each side of the spine, but this is not generally required.

The patient, clothed in a closely fitting vest, is now laid on the bandages, care being taken that he is laid perfectly straight and that the upper
edge of the jacket comes well up to the fold of the axilla, and the lower edge below the crest of the ilium. The arms are now raised and the hands placed under the head, the elbows being in such a position as to clear the top of the manytail.

One end of the strip last laid down is now taken by the surgeon, and the other by the assistant, and the two are brought smoothly round the trunk and firmly crossed. This process proceeding is repeated until the whole of the layer last laid down has been so applied. The strips of paper separating the two layers are next removed and the process is repeated with the second set of bandages, and with the third (if there be a third); and the whole is smoothed over with the wet plaster which remains.

Layers "inner part" has not been found necessary, nor have I ever seen any discomfort caused by its absence; nor have strips of tin ever been found requisite.

Before the plaster hardens, the edge of the jacket should be nicked and folded down opposite the axilla, to permit the arm to be brought comfortably to the side; the lower edge may be similarly treated if it at all interferes with
the flexion of the thigh.
In a quarter of an hour the plaster will be firmly set, and the patient may be allowed to rise. It must be remembered that the various steps of the operation require to be gone through with a certain amount of rapidity, otherwise the plaster will set before the jacket is completed, but if everything is prepared before the plaster is mixed, and no time wasted during the application, there is no danger of this occurring.

When no machine for saturating the bandages can be procured, these, charged with dry plaster, may be dipped in a solution of consisting of one part of mucilage to eight of water and thoroughly squeezed. In this case it is best to pour some liquid plaster mixed with gum on to the first layer, and spread it well over, before laying down the second. This ensures a sufficient supply of plaster, and lessens the risk of it not setting from having absorbed too much water.

Or, strips of bandage, previously cut of the proper length, may be soaked in the liquid plaster, and spread out and laid in position.

When the disease is situated above the third dorsal vertebra, Dr. Walker uses the following apparatus to support the head. A piece of iron (a) has
fixed in it two pins, one threaded (c) and the other plane (d). Two pieces of perforated zinc (e, e) brand out from the under surface to which they are rivetted. This instrument is fixed over the sternum between the layers of the many-tailed bandage during the application of the jacket; and great care should be taken that it be set perfectly straight. When the jacket is hard, a second piece of iron, shaped like a pitchfork with a short flat handle (a), containing a long slit (e, e) in it, is attached to the first by means of a screw (b); and the two pins (d, d), sliding in the slit, allow it to be raised to the required height. The head is supported by a chin strap (d), and a band (c) passing under the occiput. This is found to give a perfect support to the head, and has the advantage of permitting the patient to wear an ordinary hat, which is impossible with Dr. Sayre's "jury mast."

The accompanying photograph shows the apparatus when in position.
In the more acute cases it is generally necessary to keep the patient for some weeks or even months strictly in the recumbent position, before he is in a fit state to bear the jacket; for excellent retentive splint as the plaster jacket is, it cannot be trusted to produce perfect immobility, so long as the patient walks about. The question how long this treatment is to be continued before a jacket can be applied, must be decided in every case according to the symptoms, no definite rule can be laid down; in some cases a week or two will suffice, others will require months. In less acute cases the jacket may be applied at once.

The great success which attends the treatment of caries of the spine, by fixing the trunk in a proper position in a casing of plaster of Paris, has been now fully recognised by the profession.

Some surgeons, it is true, object to plaster jackets on the ground of cleanliness, and others consider that it is contrary to all surgical rules to cover up, and withdraw the seat of disease from observation for a lengthened period. Any complications that might arise, however, would usually indicate their presence in some way to the patient. A lumbar
abscess for example, coming to the surface, would cause pain by pressure against the jacket, and in any case where pain is felt the jacket should be at once removed.

When the jacket is made of some material that can be removed by the patient, it is apt to be taken off too often, and thus retard the recovery.

In order that a jacket may be effectual it is a sine qua non that it shall be applied when the spine is in such a position, that the diseased vertebrae are free from all pressure, and the deformity, if any exists, is reduced to a minimum.

This condition is found, it is true, when the patient is suspended as recommended by Dr. Sayre, but it equally obtains when the patient lies flat on his back. The same increase in height, diminution of deformity, relaxation of muscular tension, and relief from pain and functional disturbance, follow the application of the jacket when the patient is in the recumbent posture, as when he is suspended. This statement may surprise those who regard suspension as an essential part of the treatment, instead
of (as I consider it) a hazardous comp-
lication.

When a patient with acute curvature
is laid flat on his back, he is
immediately relieved from pain and
distress, the compensating curves are
straightened out, the deformity,
except what is due to the loss of
substance in the vertebrae, is re-
moved, the patient’s height is in-
creased, and all muscular action
is at rest. The curvaceous bones are
not only relieved from the weight
of the upper part, but also from
the leverage action of the curved
spine formerly alluded to.

This is the condition of matters most
favourable for the application
of a jacket, for it must be dis-
tinguishedly remembered that the
compensatory curves are all one
can hope to relieve, and when
they are fully relieved it is wonder-
ful how little deformity remains.

By the recumbent posture these
favourable conditions are obtained
without risk of injury, without terror,
distress, danger of syncope, or any
inconvenience to the patient, and
with much greater ease and convenience
to the surgeon, who can apply the
jacket in his own consulting room, or in
the smallest cottage, without the
help of skilled assistance, or a
splash of plaster.
The same straightening of the spine, and relaxation of spinal muscles, can be obtained, it is true, by suspension, but independently of other inconveniences and dangers, the above mentioned favourable conditions cannot be obtained, even in an imperfect degree by suspension, without the risk of separating the diseased bones.
The following experiment carried out by Dr. J. Fisher, of the National Orthopaedic Hospital, in the case of a child who had died from Pott's disease, complicated by a large abscess, and amyloid degeneration of the liver and kidneys, shows how easily the diseased bones can be separated from one another. 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 disks were completely destroyed; the under surface of the body of the twelfth dorsal, and the upper surface of the body of the second lumbar vertebra were eroded; the anterior common ligament was also destroyed.
When first exposed, by dissection, the surfaces of the twelfth dorsal, and second lumbar vertebrae, were in close opposition, the slightest movement of the legs making them rub one against the other. "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 drawing, 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 also shows that the diseased surfaces of the vertebrae are drawn apart by suspension. No structures were dissected away in the examination, which could during life have held together the bodies of the affected bones." (Treatment of Pott Disease by T. Fisher F.R.C.S. pp. 28 & 29.)

This was of course an advanced case, and therefore not so good a test as one in which the disease was only commencing, but it shows that the bones may be separated, which would be most undesirable, as any separation, however slight, would retard, if not prevent, the recovery of the patient; for, as
before stated, perfect recovery can only be obtained by long union.
And yet this separation is what one would expect to occur, because when a person is suspended the spine alone supports the weight of the body, and, unless the ligaments have remained sound (which is very improbable) there is nothing to keep the diseased bones from falling apart, as the muscles will naturally be in a state of rest.

To obtain the full benefit of the recumbent posture, the patient should be kept in bed until the jacket is going to be applied, so as to allow the intervertebral discs to be fully expanded at the time of application. Dr. Sayre lays great stress on the increase in height, but any increase, beyond what could be obtained in the recumbent posture, must be due to disturbance of the diseased bones, for I have already shown, that in the healthy spine, as between the two positions, no difference in height can be detected. (see ante page 3).
If carefully carried out suspension does not apparently cause any injury, but it is difficult to know when to cease raising the patient, for it is evident that as soon as the patient's feet have been
lifted from the floor the full extension possible has been obtained, and that the higher the seat of disease, or the heavier the patient, the greater will be the strain on the diseased portion; and therefore the force to be exerted should vary in each case; less extension being required in a case where the sixth dorsal, than in one where the third lumbar, vertebra, is involved.

Dr. Sayre himself says that extension must be used with great care and never to the degree of causing pain. His rule is to extend "until the patient expresses himself comfortable," but with young children this injunction is almost useless, as they are generally much too frightened to notice anything. Occasionally also patients have fainted when suspended; fortunately this is of very rare occurrence, as it is a most serious complication.

Another serious objection to Dr. Sayre's method is, that the patient has to be moved from the suspending apparatus and laid on a bed before the jacket is perfectly dry, and great risk is thus incurred of injuring the jacket, any movement before it is quite set being apt to crack the plaster. Also it is not always easy to obtain a well
fitted appliance by rolling the bandage round the body, and in cases of much deformity it is almost impossible. The jacket is consequently of uneven thickness, and therefore not of uniform strength, and often requires patching afterwards.

The recumbent method on the other hand possesses many advantages. The addition of the gum renders the jacket stronger, and more durable; the plaster being much less liable to rub off. The application by the many-tail makes it easy to avoid undue pressure on any part, and renders the use of the "diviner-past" unnecessary; at the same time one is able to lay on the strips perfectly evenly, the result being, a smoother and neater jacket; one has also the satisfaction of knowing that the jacket is of equal thickness throughout, and there is therefore no unecessary weight; while the need of strips of zinc is done away with.

The double thickness in front due to the overlapping of the bandages, forms an excellent anterior splint, and acts like a prop in front of a falling house, and in cases where desirable, this
A split may be extended to the top of the sternum, which is of great advantage when the disease is situated about the fourth or fifth dorsal vertebra. During the application the patient lies perfectly at ease, and does not require to be moved until the plaster is perfectly hard.

As I know of no advantages possessed by suspension to counterbalance those of the recumbent method mentioned above, I cannot but think that the latter is by far the simpler and better method, and I will now give the results of a few cases, in which it has been tried, to shew that it is equally effective as a means of cure.

It is almost needless to say that only a certain class of cases are suitable for treatment by plaster jackets; one can hope to affect no improvement in those cases where the spine has already become fixed in a distorted position.
Case I. Sarah Ward, aged 21, residing at Whittlesea, first noticed a prominence in her back, about the end of July 1878, and for three months previously had felt pain at that point. As a child, she had been delicate, and suffered from enlarged cervical glands, but latterly had been much stronger, and able to take long walks. She could now only walk short distances, and suffered constantly from pain except when lying down.

On examination, on the 3rd of August, a sharp prominence of the 6th and 7th dorsal vertebrae was found, with considerable tenderness on pressure. A plaster jacket was applied in the recumbent posture, and a few days after the patient very foolishly took a walk of four miles, without experiencing any return of the pain but was much fatigued.

She attended again in January, and I wanted to remove the jacket to examine the state of the spine, but she so strongly objected to having it removed that it was allowed to remain on.

On the 11th of March of the same year, the jacket was taken off, and the prominence was found to be considerably diminished, but there was still a little tenderness on pressure, and a
new one was consequently applied.

The accompanying photograph was taken just before the removal of the first jacket. The second jacket was removed on the 17th of May, when the spine was found to be quite sound.

She again attended at the hospital last Autumn, at which time she still continued perfectly well.

This case shows how long a jacket can be worn with comfort by a patient and it will be seen from the photograph how little the jacket has suffered from its length of service. The efficiency of the jacket as a support was well tested during the long walk taken by the patient soon after its application.

Case II. Robert Spencer, aged 12, residing at Franes Deeping, was admitted into the Infirmary on the 24th of August 1879. At that time he was unable to walk or even to stand upright without holding on to some support; if he moved in bed, he usually had a spasm of the muscles of the lower limbs, lasting however only a few minutes. This symptom has lasted six weeks.

The first lumbar vertebra was very
prominent, and there was great tenderness on pressure being made on the twelfth dorsal, and second lumbar vertebrae. A pous abscess of considerable size was pointing in the left groin.
On the 29th August a trochar and cannula were used to evacuate the contents of the abscess, and a drainage tube inserted its end dipping into a basin of Carbolic Acid Lotion, while at its exit from the wound it was surrounded by lint kept wet with the same lotion.
On the 2nd of September the skin round the tube was slightly inflamed, but the temperature remained normal. The abscess still discharged freely through the tube. On the 7th the tube was removed and two days later a plaster jacket was applied.
The following day, the patient was able to walk about a little, and on the 15th was allowed to return home as the discharge from the abscess had almost ceased.
He attended again on the 28th September, when the sinus was found to have quite healed and he felt comfortable and free from pain ever since the jacket was applied.
On the 23rd October a new jacket was put on; at that time there was still considerable tenderness round the twelfth bone, but the boy was able
to stand without assistance.

This jacket was worn five months, by which time he had quite outgrown it; as there was no tenderness round the diseased bones, he was allowed to try a fortnight without any support.

On attending April 10th, 1879, he stated that he still felt some uneasiness when walking, and a new jacket was therefore applied.

On the 26th of June this was removed, and he has since continued perfectly well.

I have examined the boy again this year, the spine is now perfectly sound. Considerable prominence of the first lumbar vertebra still remains.

The rapid cure of the psoas abscess in this case was remarkable, also the immediate relief given when the jacket was first applied.

Case III. Mrs. Richards, aged 26, was first treated for the disease in 1877. She had suffered from tuberculous glands of the neck some years previously, and had not enjoyed good health since childhood.

The fifth, sixth and seventh cervical vertebrae were sharply prominent, and gave her constant uneasiness. The recumbent posture was tried for six months at her own home, but...
I believe, the treatment was not thoroughly carried out.

Early in 1878 a gutta-percha jacket was put on, and the patient allowed to walk about; she felt very comfortable while she continued to wear it; but after (after), a year's trial, it was found that the condition of the spine had not greatly improved. A deep iliac abscess could now be detected on the left side, but, as it occasioned no pain or uneasiness, it was not interfered with.

In February 79. a plaster jacket was substituted for that of gutta-percha, and was worn until the 12th of May. At that time the vertebra appeared rather firmer, and the abscess had not increased in size.

A third jacket was applied during September, at which time there was a decided improvement in the state of the spine; and when this was removed last February, it was found that no further support was required. The abscess is still of the same size as formerly.

In this case, the gutta-percha splint appears to have been strong enough only to check the further advance of the disease.

Case IV. Julia Ellen Johnston, aged 21, residing at Thorney, was admitted...
into the Infirmary on the 13th of December 1879. She was a weakly strumous child, and had never been well from her birth. The ninth, tenth, and eleventh dorsal vertebrae were very prominent, and there was a large porous abscess of the left groin. The prominence was noticed only three weeks before she was admitted, and seems to have come very rapidly. The child was unable to stand when brought to the Infirmary and cried whenever she was moved. The abscess was opened with a trochar and curetse on the following day, and a tube retained in the sinus until the 20th, when it was removed, and a jacket applied. By the 8th of January the child was able to walk about alone, and the discharge from the abscess had almost ceased. On the 16th the jacket had to be removed on account of pressure on the prominent vertebrae, and a new one was applied with a fenestrum over the ulcerated spot. On the 3rd of March the ulcer was almost healed, and the child appeared to be doing so well, that she was allowed to return home. The jacket was removed by the parents about six weeks after this, as they thought it was hurting her, and she rapidly became worse. Abscess
broke out in various parts of the body, and she has since then been too ill to be brought to the Infirmary. Lately her mother states that she has been growing a little stronger.

This is an instructive case, as showing the risk of undue pressure on the prominent vertebrae. It is of course impossible to say whether the jacket, or the want of it, was the cause of the child's growing worse, most likely neither had much to do with it. In this case, I believe it would have been better to have persevered for four or six weeks with the recumbent posture, before applying the jacket.

Case V. Tommy Wright, aged four, residing at Wittlesea, a pale weakly child, had been ailing for more than six months, and for the last two months had always cried when moved. When he wished to pick up anything from the floor, he squatted down to it, keeping his back rigid.

A very slight prominence was found of the first lumbar vertebra and the boy called out when this point was touched.

A jacket was applied on the 12th of January 1879, and by the 15th the child began to play about. He was permitted to go home on the 17th, and when brought again on
the 9th of February, already looked stronger and healthier.
As the jacket had slightly excoriated the skin over the crest of the ilium it was removed, and a new one applied well padded at that point.
This was worn till the seventh of June, when it had to be again changed, to allow for the child's growth; and when it was again taken off on the 23rd of August, the cure was found to be complete.

The rapid improvement which took place in the general health of the child, may have been due in a great extent to the Cod Liver Oil, which we always prescribe in such cases.

Case VI. Bailey George Beach, aged ten, residing in Boroughbury, a delicate boy with numerous scars from cutaneous abscesses of the neck, fell down stairs during the spring of 1879, but felt no bad effects from the fall at the time. During September, of the same year, he first noticed pain and stiffness in his neck, increased on jumping.

The recumbent posture was tried for four months, during which his general health rather improved.
The fourth, and fifth cervical vertebrae were prominent, and very painful on pressure. He was unable to hold up
his head for any length of time, without supporting it on his hands.
In February, 1879, a plaster jacket was applied with the pitchfork support for the head, attached in front; and when his head was fixed to it, the boy expressed himself very comfortable.
About the 10th of May, the jacket was changed, as the edge had become soft and crumbling.
Near the end of August, a third jacket was put on; and he was finally discharged cured, during February of the present year.
The accompanying photograph was taken after the cure was completed.
In this case the fall had probably nothing to do with the disease. It is the only case in which we have had an opportunity of trying this substitute for Dr. Sayre's jury mast, and it seemed to answer perfectly.

Case VII. James P. Adcock, aged 11, residing in Gladstone street, came under treatment in November 1878. He had formerly suffered from strumous disease of the ankle, from which he had quite recovered, several months before.
When examined on the 10th November, some prominence of the third, and fourth lumbar vertebrea was found; the recumbent position was maintained steadily for three months with very slight improvement; at the end of that time he was unable to stand comfortably without support for more than a few minutes.

A plaster jacket was applied on the 8th of February 1879, and within a week he was able to walk about the room comfortably. This jacket was worn till the end of November, when a second was put on.

The support was discontinued on the 1st of April, and the boy now appears perfectly well.

In this case the jacket was worn continuously for nine months, without in any way losing its efficiency as a splint. The improvement after the application was most marked.

Case VII. John Crowson, aged nine, residing in Chapel St., was admitted on the 5th of March 1879.

He had enjoyed perfect health till the autumn before, when he had a very severe attack of Typhoid fever, which confined him to bed for three months. He first noticed pain in his back about a month after his recovery, and examination revealed a considerable prominence of the fifth and sixth dorsal vertebrae.
very tender on pressure. He was able to walk about and had attended school within five days of his admission. A jacket was applied, and he continued to wear it until the 13th of June, when it had become rather tight for him, and a new one had to be put on. A third jacket was required during January as he still felt uneasy when he stooped, without support, and on the 31st March he was finally discharged cured. He had felt no pain since the jacket was first applied, and the prominence had diminished considerably. This case was very interesting in its advance, and considering the amount of prominence, I was surprised that the symptoms were not more severe.

Case IX Fred Toole, aged 10, residing at 69, was first admitted on the 15th of March 1879. Two years before, he had suffered from a lumbar abscess, which was now quite healed, but no prominence of the vertebrae was noticed until about two months before his admission. There was prominence of the ninth and tenth dorsal vertebrae, and pain was caused at that point when the patient allowed himself to come down on his heels, or received any jolt to the spine. Otherwise no pain was felt
and there was hardly any functional disturbance. The projection was said to have lately increased in size.

A jacket was applied in the usual method, the patient becoming 3t of an inch taller after the application. A second was applied during the second week of August, at which time the prominence had decidedly diminished in size, and he only gained a ¼ of an inch by the application. On the 12th December the support was finally discontinued.

It is curious in this case that the prominence should have been so long in appearing. One is almost inclined to believe that the abscess had no connection with diseased bone.

Case X. Fanny Patt, aged 7, residing at Crowland, was admitted on the 27th of March 1879. About six weeks before she had fallen from the top of a paling, and ever since had complained of pain in her back and body, but was able to walk about. Her brother was a patient some months previously with strumous cervical glands. There was considerable tenderness on pressure over the transverse processes of the sixth and seventh dorsal vertebrae; and at no other point in the spine.

She had the stiff gait and careful carriage peculiar to disease of the spine.
but no prominence had yet made its appearance.
She had been ailing ever since the fall, and could not be induced to play about as formerly. A jacket was applied, and in less than a week the child was playing about as if nothing was the matter.

On the 26th of July the jacket was changed, as it was too small for the growth of the child; and I have since heard that this was removed by the father three months later, and that the child has been perfectly well ever since.

In this case the fall was probably the exciting cause of the disease in a child of strumous taint.

Case XI Sarah Morton, aged ten, residing at Millfield, first attended on August 5th 1879. She was a very delicate child, with specific teeth, and valvular disease of the heart, having a loud systolic mitral murmur. She was said to have been healthy until a year ago, when she had a severe attack of typhoid fever. She is now very thin and has slight lateral curvature, with distinct prominence of the seventh dorsal vertebra, tender to the touch. She was unable to sit or walk for a quarter of an hour without
pain, and had constant derangement of the stomach and bowels. A jacket was applied and the pain entirely left the back, and she forthwith walked home a distance of a mile and a half. Her appetite also greatly improved, and she lost most of her abdominal symptoms. A new jacket was applied on the 2nd December, at which time great improvement had taken place, and when this was removed on the 25th of March, no further treatment of the spine was considered necessary. The chief interest in this case is the complication of heart disease; although the child suffered constantly from dyspnoea, the jacket seemed to cause no impediment to the respiration. When I applied the jacket I was quite prepared to have to remove it at once, and was equally surprised and pleased at the result.

Case XII. Robert Richards, aged 18, residing at March, working as a stone mason's apprentice, first attended on the 23rd November 1879.
A year before he had met with a fall of 25 feet, after which he was confined to his bed for some months with severe pain in the back. There was some prominence of the eighth dorsal vertebra, with slight tenderness
when the jacket was applied on the 24th. He had felt his back weak and uncomfortable ever since the accident, and was unable to follow his occupation.

He attended again on January 8th, when he stated that he had felt no pain or discomfort since he began to wear the support. Contrary to advice he returned to work during February. When the jacket was removed on the 21st March it was found that it did not require to be reapplied. This case certainly was the result of injury, and the rapidity of the cure was remarkable.

He became considerably stouter after his return to work, and the jacket was uncomfortably tight before its removal.

Case XIII Emma Knighton, aged 14, residing in Bedford Street, first attended on the 9th December 1879. She had previously suffered from strumous disease of the knee joint. The eleventh and twelfth dorsal vertebrae were found to be sharply prominent, and tender. She stated that she "never felt comfortable except when lying down".

A jacket was applied on the 9th December, her height being increased 3/4 of an inch by the application. She was able to walk about comfortably, and had no return of pain.
after the jacket was applied.
A new jacket was put on last week; she was then much improved, but there was still some tenderness on pressure. The accompanying photograph of the new jacket was taken before she left the hospital.

I will now give a case of lateral curvature to show the increase of height which can take place after the application of a jacket in this position.

Ellen Wilson, aged 13; residing at March; attended at the Infirmary on the 9th December 1879. It will be seen from the photograph that the lateral curve was considerable.

Her height, without any support was 4 ft. 9 1/2 inches.
The first jacket was applied according to Dr. Sagar's method, and her height after the application was 4 ft. 9 inches, a gain of 1 1/2 inches.
Three days after a second jacket was applied in the recumbent posture after which her height was 4 ft. 9 3/4 inches, a gain of 2 1/2 inches, and 3 1/4 of an inch in excess over the former jacket.

It is evident that this further increase could not be due to the greater length of the spine in the recumbent posture, but because a better jacket had been applied full advantage having been taken of all the irregularities of the body and a better support thus given to the whole.

In the case of the first jacket, a sinking down of the body probably took place when the patient was being moved from the suspending apparatus to the couch, before the plaster was perfectly hard.

From these cases it will be seen that as far as my own experience goes the disease is decidedly of serpulous origin, and that they are seldom the result of casualties. The are the only cases of Pott's Disease of the Spine in which I have as yet had an opportunity of trying the plaster jacket applied in the recumbent posture;
and, with the exception of one case, the results have been highly satisfactory, and in several almost brilliant.

I consider the treatment is to be preferred for the following reasons.

I. That the recumbent posture best fulfils the object of treatment, namely, the maintenance of the affected bones and joints in a position state of perfect quiescence, and in the position most favourable to cure, with as little deformity as possible.

II. That this is the only method by which a plaster jacket could be applied to fix the bones in that position.

III. That a much better jacket can be obtained, and with greater convenience, to the surgeon, and patient.

IV. That all the advantages of Dr. Jayre's method are secured to the patient, without the risks or inconvenience of suspension.