BACKACHE

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This paper is concerned with what may be called the orthopaedic or intrinsic causes of backache, that is, with those abnormalities of the muscles, bones and joints of the spine which may cause pain in the back.

It will be convenient to discuss the long list of diseases concerned under three heads; (1) Backache in children. (2) Backache in adults. (3) Backache in old age.

BACKACHE IN CHILDREN

Where children are concerned, backache is a symptom which must be taken seriously, since it frequently indicates bony disease in the spinal column, likely to cause permanent deformity and disability. In adults, backache is generally less significant.

The three principal causes of backache in childhood are (a) *Spinal caries*, (b) *Adolescent kyphosis*, (c) *Postural deficiency*, leading to abnormal antero-posterior curvatures, or to lateral curvatures of the spine; these deformities are nearly always painless, but may be associated with a little discomfort. They are included here principally because it is important that the abnormal antero-posterior curvatures of the spine, produced by postural deficiency, should be clearly distinguished from adolescent kyphosis.

Spinal caries.

It is unnecessary to say very much in this paper about spinal caries. The classical pentad of signs and symptoms is well known—pain, rigidity, deformity, abscess formation, and paraplegia. All five are not present in every case. The deformity in an early case is angular, and localised. It is like a knuckle under the skin, usually at the dorsilumbar junction. (Fig. 1.)

On X-ray examination, a very important point in the differential diagnosis from adolescent kyphosis is that the intervertebral discs between the affected vertebrae disappear at an early stage, whereas in adolescent kyphosis the discs are not narrowed. (Fig. 2.)

Adolescent Kyphosis. (Scheuermann's disease.)

Spinal caries may present itself at any age, but adolescent kyphosis as the name implies occurs at about fifteen years. It produces an aching back, with a *stiff, rounded* kyphosis extending over the lower dorsal region, quite different from the localised sharp kyphus of early spinal caries, and also quite different from the *mobile* rounded kyphosis, shortly to be described, resulting from postural deficiency. The adolescent kyphosis is very stiff indeed. It cannot be obliterated, or even modified easily, by pressure. (Fig. 3.) To understand the pathology of adolescent kyphosis it is necessary to be familiar with the normal development of a vertebra. (Fig. 4.)

About the age of puberty secondary centres appear. Amongst these are the epiphyseal rings, which form at the upper and lower borders of each vertebral body, like the rims of a drum. The space inside the ring is filled at each end of the vertebra by a plate of cartilage which comes up flush with the edge of the bony epiphyseal ring. (Fig. 5.)

On X-ray photographs of growing spines the epiphyseal rings appear as linear shadows at the upper and lower borders of the vertebrae. (Fig. 7.) These shadows are usually better defined at their anterior and posterior ends than in the centre.

The pathological basis of adolescent kyphosis is an osteochondritis affecting these vertebral epiphyses (the epiphyseal rings). The osteochondritis is comparable with that which affects the capital epiphyses of the femur in Perthe's disease. In Perthe's disease the epiphysis is flattened, fragmented and sclerosed; and there is also an irregular erosion of the metaphysis. (Fig. 8.) In adolescent kyphosis, the epiphyses are fragmented and sclerosed (they are already flattened in their normal state). The metaphyses are eroded, especially anteriorly, and the result is that the affected vertebrae become wedge-shaped. In many cases, cup-shaped hollows in the vertebral bodies are seen on X-ray examination. This appearance is produced by prolapse of a nucleus pulposus through the cartilage plate into an adjacent vertebral body. (Fig. 9.)

These changes occur in the lower dorsal region of the spine. The osteochondritis subsides in the course of a year or two and the epiphyses unite with the vertebral bodies, but the wedge-shaped deformity remains, and produces the fixed, rounded kyphosis which is the principal

clinical feature of the disease. It should be noticed that the intervertebral discs are not narrowed—an important point in the differential diagnosis from spinal caries.

There is a rare variety of osteochondritis affecting the primary centre of a vertebral body. (Fig. 10.) This disease was described by Calvé. It occurs in early childhood, and produces a deformed and painful spine. On X-ray examination the affected vertebral body is seen to be flattened and sclerosed, but the adjacent intervertebral discs are intact.

Postural Deficiency.

Postural deficiency may cause abnormal kyphosis or lordosis, but unlike the curvature of adolescent kyphosis these deformities are always quite mobile and easily corrected by traction or pressure. It has already been said that in children postural deformities are usually painless. In adults, however, they are often associated with aching pain.

The shape of the normal erect spine is determined and maintained by the involuntary postural activity of the individual's musculature. Abnormalities of this postural activity may take the form of underaction or overaction by certain groups of muscles, with the result that the shape of the spine is altered. The cause of postural deficiencies is usually obscure, although sometimes there is an obvious reason; for instance, when the posture is temporarily deranged during the period of debility after an illness.

The role of the gluteal muscles in postural deformities is an important one, and is the key to successful treatment. The mechanism may be explained in the following way. The position of the pelvis clearly exerts a great influence on the shape of the spine, since if the pelvis is tilted forwards the lumbar lordosis will be increased, whilst if the pelvis is tilted backwards the lumbar spine will be flattened. The pelvis is balanced on the hip joints, with a natural tendency to tilt forwards under the influence of gravity. This tendency is controlled by the postural activity of the gluteal muscles, which in an average individual maintain the pelvis at the "normal" inclination. If, as the result of an abnormality in their postural activity the gluteal muscles tilt the pelvis too far backwards a flat back will result, the lumbar lordosis being wholly or partly obliterated. On the other hand, if the gluteal muscles allow the pelvis to tilt forwards, a hollow back will be produced, the lumbar lordosis being exaggerated. (Fig. 11.)

It will be clear from the very brief clinical descriptions given above that the differential diagnosis between the principal causes of backache in children is not difficult.

Treatment

The treatment of spinal caries should be carried out in a sanatorium, where suitable general treatment can be organised. The technical details involved in the treatment of the spinal disease itself are beyond the scope of this paper.

In cases of adolescent kyphosis, the spine must be put at rest, and weight-bearing avoided whilst the spine is painful. This will prevent further deformity of the affected bones, and will promote the earliest possible subsidence of the disease. It is worth while to keep the child in bed for 6, 9, or 12 months until the disease becomes quiescent, as shown by the disappearance of pain, and the return of normal texture in the X-ray. During the period of recumbency the child lies in a plaster bed, and daily attempts are made to reduce the deformity by increasing periods of suspension in a Fisher frame, and by properly supervised stretching exercises in the gymnasium. The Fisher frame is an apparatus which employs gravity as a stretching force. It consists of an inclined plane, carrying a jury mast, from which a Glisson sling depends and is fastened round the patient's neck. By racking up the jury mast until the child's buttocks are clear of the bed a great stretching force, which at first can be tolerated for only a few minutes, is applied to the spine. The apparatus is fixed to the head of the bed. (Fig. 12.)

When the child is allowed up, if much deformity remains, it is well that a spinal support should be worn for one or two years to prevent a gradual increase of the curvature and to avoid recurrence of the pain. Some degree of residual deformity is the rule.

The basis of the treatment of abnormal antero-posterior curves, caused by postural deficiency, must obviously be a re-education of the gluteal muscles, to enable them to control the tilt of the pelvis. It should be clearly understood that the object of treatment is not to make the patient more muscular, but to convert the muscle fibres which she already possesses to a proper activity. The muscles are trained, by systematic exercises repeated over and over again, to posture at the desirable length. Habit is second nature, and in time the new activity becomes involuntary.

BACKACHE IN ADULTS

The numerous causes of backache in adults may be classified into two groups:—

(1) *A group in which there is no disease or displacement of the spinal skeleton.* This group includes: (a) Backstrain, (b) Postural defects, (c) Functional conditions.

(2) A large group of cases in which *disease or displacement of the spinal skeleton* is responsible for the backache.

Any case may be assigned to the appropriate group on radiological evidence, since in Group I X-ray examination will reveal no bony abnormality, whereas in Group II the lesion will usually be visible.

The large majority of cases falls into the first group, and the commonest individual cause of backache is backstrain.

GROUP I.

Backstrain

The term backstrain means a painful condition of the back produced by injury of a spinal joint or muscle. Three principal types are recognised, namely: 1. *Sacroiliac strain*: 2. *Lumbar backstrain*: 3. *Lumbo-sacral strain*. For each of these there is a characteristic distribution of pain and tenderness by which they are distinguished clinically.

1. In **sacroiliac strain** the *pain* is felt over the affected joint, and may radiate down the back of the corresponding thigh to the calf, and there is localised tenderness on pressure over the joint.

2. In **lumbar backstrain** the *pain* is felt over the erector spinal muscle on one or both sides in the lumbar region, and there is a corresponding point or area of tenderness.

3. In **lumbo-sacral strain**, which is comparatively rare, the *pain* and tenderness are localised over the fifth lumbar spine, or just lateral to it.

In all three varieties X-ray examination is negative. An X-ray should always be taken as a precaution against confusion with other causes of backache. It is a necessary safeguard. For instance, radiological evidence may be the sole, and will nearly always be the only certain, method of distinguishing sacroiliac strain from the early stages of tuberculous arthritis of the sacroiliac joint.

The diagnosis of backstrain is not difficult. It is based on three points—*localised pain*, *localised tenderness*, and the *absence of radiological abnormalities*. There is sometimes a history of injury. In the discussion which follows concerning the various types of backstrain the pathological basis of each will be described so far as it is known.

Sacroiliac Strain

The term sacroiliac strain covers a number of different conditions. (Fig. 13.)

Acute Sacroiliac Strain is usually produced by a sudden twist of the back, which is followed by severe pain over the affected joint. The patient often feels that something is out of place in the back. He cannot stand upright, but leans towards the affected side, and finds that any attempt to straighten up exacerbates the pain in his back. If asked to indicate the site of the pain he places his finger over the dimple which marks the posterior aspect of the sacroiliac joint, and this spot is tender on pressure.

Rotatory movements of the affected joint are painful. This test is made with the patient lying on a table, facing the examiner, with the affected side uppermost. The upper leg hangs over the side of the bed, and the uppermost arm is placed behind the patient's back. The surgeon leans with one forearm on the uppermost iliac crest, whilst with his other hand he grasps the corresponding shoulder. By pulling the iliac crest forwards, and pushing the shoulder backwards, a rotatory movement of the sacroiliac joint is induced, and in cases of sacroiliac strain this movement is painful. In acute cases it is agonising.

This manipulation, sharply and vigorously performed, is the cure for acute sacroiliac strain. If the patient is able to relax, and to allow the manipulation to proceed without resistance, it may be performed without anaesthesia. But in many cases an anaesthetic is necessary and pentothal is the most convenient. The conscious patient actually feels something "go back into place," and can always tell at once whether or not the manipulation has been successful. It therefore seems probable that acute sacroiliac strain is really a subluxation of the joint,

but even the best stereoscopic X-rays fail to reveal any displacement of the articular surfaces in these cases. It is possible that the displacement is a rotation of small degree, which would be difficult to display radiographically in a joint whose opposing surfaces have such complex and irregular contours.

Acute sacroiliac strain is liable to recur, and with progressively more trivial provocation. A type of recurrent subluxation, produced in and out of season by commonplace and unavoidable activities is frequently encountered in orthopaedic practice. A doctor of my acquaintance has a sacroiliac joint so unstable that it "goes out" repeatedly, sometimes several times during a week, and usually when he is sliding into the driving seat of his car. On these occasions he feels an aching pain over the affected joint, and the pain persists until the joint is put back by manipulation. He is, fortunately, able to relax completely, so that anaesthesia is unnecessary; and he has solved the obvious difficulty of obtaining professional assistance as frequently as it would be necessary by teaching the village carpenter, who lives nearby, to perform the manipulation. This case is typical so far as the ease with which the subluxation is provoked and reduced is concerned, but fortunately the recurrences are not as a rule so frequent.

Another type of sacroiliac strain is encountered in women after pregnancy. All the pelvic ligaments are softened during pregnancy by the hormone relaxin. In some cases the ligaments do not readily resume their normal length and consistency after the child has been born, and in these patients one or both sacroiliac joints may be the site of chronic pain. In these cases, X-ray examination may show widening of the joint space, and a slight displacement of the ilium in relation to the sacrum. Treatment for these cases should be at first conservative, consisting of radiant heat to relieve the pain and remedial exercises to restore muscle tone. A binder or corset should be worn. If the pain persists, manipulation is performed, but not until several months after the birth of the child. Manipulation does not always cure this type of sacroiliac strain. If it fails a supporting corset should be tried. This support may also be used for cases of recurrent sacroiliac subluxation to increase the stability of the joint.

There is still another sacroiliac syndrome, of which the features are chronic pain and tenderness over the sacroiliac joint, constantly present to some degree, made worse by work or exercise and usually of insidious onset. This condition may also be a sequelum of acute sacroiliac strain. When the onset has been gradual, and not associated in the patient's mind with any remembered injury, it is nevertheless probably a traumatic lesion. We all know from experience how easy it is to overlook an injury received at a moment when the mind is concentrated and engrossed, for instance in moments of danger, or in games. Realisation of the injury may, under these circumstances, be delayed for hours. Many cases of chronic sacroiliac strain may without absurdity be supposed to originate in injuries of this kind. This type of sacroiliac strain can usually be cured by manipulation. It is obvious that in this variety of sacroiliac lesion, with its apparently gradual onset, and chronic course, there are possibilities of confusion in diagnosis with tuberculous arthritis of the joint, and X-ray examination is therefore of great importance, and must always be made before manipulation is performed. Manipulation of a tuberculosis sacroiliac joint would, of course, be harmful.

To sum up, there are several varieties of sacroiliac strain:—

- (1) Acute sacroiliac strain. This may recur in an acute form, or may pass into the condition of chronic sacroiliac strain.
- (2) Recurrent subluxation of the sacroiliac joint.
- (3) Puerperal sacroiliac strain.
- (4) Chronic sacroiliac strain.

All these types have the following clinical features in common.

- (1) Pain over the affected sacroiliac joint, sometimes radiating down the course of the corresponding sciatic nerve.
- (2) The pain is produced or made worse by rotation of the sacroiliac joint.
- (3) There is tenderness on deep pressure over the sacroiliac joint.

Any of the four types may be bilateral.

The operation of arthrodesis of the sacroiliac joint should be mentioned here. It is employed at times for cases where the pain continues in spite of repeated manipulations, and is not relieved by the use of a supporting corset. The arthrodesis may be performed by the extra articular method of Verrall, who lays a bone graft across the back of the sacrum from one

sacroiliac joint to another; or by the intra-articular method of Smith Petersen, who exposes the joint cavity by cutting a window in the posterior part of the ilium, and then removes the articular cartilage which is thus exposed, on both sides of the joint. Some failures will certainly be encountered by those who practise these operations. They will be fewer if cases are carefully selected, rejecting all those in whom there is a functional element. There is a psychological component superimposed, in many cases of longstanding backache, on the original organic basis of the complaint. In these individuals the backache is likely to persist in spite of a technically successful arthrodesis.

Lumbar Backstrain

This is a type of backache caused by an injury which tears some fibres of the muscles of the back as they arise, in the lumbar region, from the vertebral column. The onset is usually acute, the immediate sequel of a definite injury, often sustained in industry, and particularly in lifting heavy weights. In some cases the origin appears to be insidious, because the original injury was unnoticed at the time of its occurrence (compare chronic sacroiliac strain). The acute cases, unless properly treated, frequently become chronic.

In this type of backstrain the pain and tenderness are localised at some point or points over the erector spinae muscle, or at the outer border of this muscle, in the lumbar region. Movements, such as bending or lifting heavy objects, which stretch the injured muscle fibres, exacerbate the pain. X-ray examination reveals no abnormality, unless one or more of the lumbar transverse processes has been fractured. The bony injury, in such cases, is not in itself important, but it is associated with tearing of the muscles, i.e. with an acute backstrain which is likely to become chronic.

Men are the subjects of lumbar backstrain much more frequently than women. The association of the injury with laborious and perhaps dangerous occupations favour the development of psychological complications, which are made worse by the mechanism of the Workmen's Compensation Act. For this reason it often happens that the backache caused by a lumbar back strain persists in spite of efficient treatment until, after protracted litigation, a sum of money is paid over by the employers. Recovery may then be very rapid.

Treatment

It is very important to counter the neurotic associations of this injury by every possible means. The patient must be reassured and not allowed to stay in bed. If there is a fracture of one or more transverse processes, it must be explained to him that this is not equivalent to a "broken back." Vigorous active exercises form the basis of the treatment in the acute stage. Radiant heat and massage help to minimise the pain, but the most important thing is to keep the patient up and about, and to prevent stiffness of the back by exercises, performed under skilled supervision.

With this treatment some cases recover quickly, but many pass into a state of chronic lumbar backstrain, with stiffness of the lumbar spine, and persistent pain over the injured spinal muscles. Tender areas will be found on examination (see diagram). For these cases, injection of the tender areas with novocaine has been recommended. In my hands, this procedure has usually failed, or given only temporary relief. Manipulation of the spine, followed by a course of spinal exercises, radiant heat, and deep massage, has been more successful. The manipulation must be more extensive than the simple manoeuvre performed for sacroiliac strain, and anaesthesia is essential. There are four movements to be carried out, namely:—

(1) *Flexion.* (2) *Extension.* (3) *Rotation to the right.* (4) *Rotation to the left.*

Flexion.—The surgeon stands on the right-hand side of the supine patient, and places his right arm under the patient's knees. He lifts the legs up, flexing the hips and knees, and carries the knees upwards until they are pressed on to the patient's chest. The fullest possible flexion of the lumbar spine is thus obtained.

Extension.—The patient is turned on to his face and the surgeon moves to the opposite side of the table. Placing his left arm under the knees, he lifts the legs off the table until they are almost vertical, and with his right hand he presses downwards over the lumbar spine, extending it as much as possible.

Rotation to the right and left has already been described when discussing the treatment of sacroiliac strain.

The after-treatment following manipulation of the spine consists of spinal exercises, radiant heat and massage, and must be commenced as soon as the patient has recovered from the anaesthetic, and certainly no later than the day following the manipulation. The manipulation breaks down the contracted scars which have formed in the injured muscles, and the after-treatment is designed to prevent the reformation of these contractures. If the patient is allowed to lie in bed after the manipulation he will certainly not be cured. He must perform vigorous spinal exercises, and the massage administered must be deep and searching. The masseuse must "get right down" to the painful areas. Superficial stroking is quite useless.

Manipulation is sometimes very successful, but frequently the psychological element perpetuates the symptoms, especially when the question of compensation is involved.

Lumbo-Sacral Strain

This type of backstrain is comparatively rare. The pain is felt over the lower lumbar spine, and forced movements of the spine, especially full flexion and extension, are painful. There is tenderness on deep pressure over the 5th lumbar spine. X-ray examination reveals no abnormality. It has been suggested that the lesion responsible for the pain is a chronic sprain of one or more of the ligaments attached to the 5th lumbar spine, exactly similar to the chronic sprain of the external lateral ligament of the ankle joint, which is so commonly seen, and so easily cured by manipulation. There is much less certainty of cure by manipulation in the case of lumbo-sacral strain. This is not surprising, since it is obviously difficult to stretch effectively the ligaments from which the pain is supposed to originate.

Other methods of treatment have therefore been tried. Injections of novocaine have been used. Bankart recommends excision of the fifth lumbar spinous process, arguing that this procedure removes one attachment of all the ligaments concerned, and therefore prevents any painful strain upon them. The same result can be achieved by running the blade of a scalpel round the spinous process.

Postural Defects

Postural defects arise in adults in the same way as in children (see p. 191). Defective posture is frequently the cause of chronic backache. Women are affected much more commonly than men. The type most commonly seen is an exaggeration of the lumbar lordosis. The cause of the defect in the postural mechanism is usually obscure, but sometimes the adverse influences of malnutrition and overwork are obviously at any rate partially responsible.

In treatment any influences of this sort should if possible be eliminated, and the postural mechanism must be induced to function correctly by suitable remedial exercises. Before the war, Miss Prunella Stack's League of Health and Beauty was an organisation which could be used to teach the exercises, and encourage their regular performance, in a pleasant and social way.

Functional Backache

Something has already been said, when discussing lumbar backstrain, about the functional disorders which may follow industrial injuries of the back. That is a type of functional disorder by which men are affected. Amongst women functional backache of another sort is quite common: there is a postural defect which provides an organic basis for the backache, and superimposed on this "genuine" backache there is an imaginary disability. Enquiry often elicits a sombre account of the patient's life at home.

The patient with a functional backache usually has on her face a long-suffering and evasive expression which suggests the diagnosis at once. She complains too much. The backache is "agonising," "terrible," "sometimes she can hardly move," and so on. There is very great tenderness, even to the lightest touch, all over the back. Active movements of the spine are performed grudgingly through a limited range, and passive movements are spasmodically resisted. If an opportunity arises to observe the patient when she is not aware of it, she will probably be seen performing movements, in tying up her shoe laces for example, which she had been unable to carry out during the clinical examination.

Treatment is likely to be futile unless those adverse influences, in the home, at work, or in sexual matters, which have built up the functional overlay, can be removed.

FIG. 1.—The angular localized gibbus of early spinal caries (a) gibbus.

FIG. 3.— Adolescent kyphosis (a)—stiff and rounded.
(1) normal. (2) adolescent kyphosis.

FIG. 2.—Spinal caries. Intervertebral disc has disappeared. There is some bone loss leading to wedging of the affected bodies and producing localised angulation. (1) normal. (2) spinal caries.

FIG. 4.—A vertical section through two adjacent vertebrae.

FIG. 5.—Epiphyseal Rings.

FIG. 6.—Schematic representation of a developing long bone. To show analogy with developing vertebra.

FIG. 7.—Epiphyseal rings in adolescent.

FIG. 8.—Perthe's disease.

FIG. 9.—Adolescent kyphosis. Note the wedging of the vertebral bodies produced by metaphyseal erosion. Note also that there is no narrowing of the intervertebral spaces. (Contrast with spinal caries.)

FIG. 10.—Calvé's disease.

FIG. 11.—Role of gluteal muscles.
Normal inclination of pelvis x° .
Hollow back. Exaggerated lordosis. Inclination of pelvis $x+^\circ$.
Flat back. Lordosis obliterated. Inclination of pelvis $x-^\circ$.

FIG. 12.—Jury Mast

- A Sacroiliac strain
- B Lumbo-sacral strain
- C Lumbar backstrain

FIG. 13.—Diagram to show typical sites of pain and tenderness

GROUP II.

This group, in which the backache is caused by disease or displacement of the spinal skeleton, includes a large number of lesions, the more important of which are:—

Spinal osteoarthritis.

Rupture of an intervertebral disc with prolapse of the nucleus pulposus.

Secondary deposits in the spine.

Ankylosing spondylitis.

Spondylolisthesis.

Spinal caries.

Paget's disease.

In this group, X-ray examination is important in making or confirming the diagnosis.

Spinal osteoarthritis is a common cause of backache in middle-aged persons. It is especially frequent in those classes whose life is laborious. The spine is stiff, and X-ray examination reveals lipping at the anterior borders of the vertebral bodies, and (in films of good quality) loss of joint space, eburnation, and osteophyte formation, in the lateral joints of the spine.

Physiotherapy may give temporary relief, but in severe cases a change of occupation to something less onerous will be necessary, and the patient must wear a spinal support. The support, by limiting or preventing the movements of the affected portion of the spine, abolishes the pain.

Prolapse of the nucleus pulposus.—The anatomy of the intervertebral discs has already been described. In some cases the nucleus pulposus protrudes backwards through the annulus fibrosus into the spinal canal. The protruded portion, which is usually about the size of a hazel nut, causes pain by pressure on one or more nerve roots which pass over it near the intervertebral foramina through which they make their exit from the spinal canal. Besides this direct pressure effect, the prolapse induces hypertrophic changes in the ligamentum subflavum. The intervertebral disc loses its elasticity when the nucleus pulposus is protuded or extruded into the spinal canal, and abnormal strain is therefore thrown upon the corresponding ligamentum subflavum, which undergoes a hypertrophic change. This change further increases the risk of pressure on nerve roots, since the ligamentum subflavum forms the posterior boundary of the corresponding intervertebral foramen. The pathological changes described above are usually limited to one segment, but may be multiple. The disc most commonly affected is that between the fifth lumbar and first sacral vertebrae.

Prolapse of the nucleus pulposus occurs, as a rule, in young patients as the result of injury, which may be either a severe strain of the back as in lifting a heavy weight, or a sudden violent and excessive movement of the spine. In a typical case the pain comes on immediately after the injury. In some instances there is no history of injury, and in these it is possible that the nuclear prolapse occurs as the result of degenerative changes in the disc, from some cause unknown; or it may be that an injury was sustained, and passed unnoticed.

The clinical evidence of the nuclear prolapse consists of pain over the affected portion of the spine, usually in the lower lumbar region, radiating along the course of the nerve roots which are pressed upon; that is, in the sciatic distribution in the common case of a lesion of the lumbo-sacral disc. The root pains are usually unilateral. There is sometimes a "sciatic scoliosis," i.e. the lumbar spine deviates to one or other side, usually away from the side on which there is sciatic pain, but sometimes towards it. The movements of the lumbar spine are restricted. Extension in particular is limited and painful. Objective neurological signs are sometimes, but not always, present. On the affected side, the ankle jerk may be absent, the dorsiflexors of the foot may be weak, and there may be a belt of hypoaesthesia on the outer side of the leg and foot. Clinical diagnosis is seldom easy and never certain, since objective signs may be present in the absence of a nuclear prolapse, in cases of sciatica due to other causes. Conversely, in some cases of nuclear prolapse there are no objective neurological signs. If it is observed that the pain is made worse by sneezing, coughing, or straining, and if there is any irregularity of the sphincters, the suspicion of a pressure lesion inside the spinal canal is increased.

Epidural injection will not relieve the pain caused by a nuclear prolapse, and often makes it worse. Cerebro-spinal fluid withdrawn by lumbar puncture at or near the level of the prolapse may have an abnormally high protein content, but this sign, like the neurological findings, is ambiguous.

It is customary, when there is reasonable suspicion of a nuclear prolapse, to make certain by X-ray examination after the injection of 5 c.c. of lipiodol into the theca. The patient lies on a tilting table, so that the lipiodol can be caused to run up and down over the suspected portion of the spine. The column of lipiodol is observed on a fluorescent screen and photographs are taken of any apparently abnormal areas. By this means it is possible to localise a pressure lesion, the presence of which causes a filling defect in the column of lipiodol. This is a useful procedure, but it has some serious disadvantages which in my view should preclude its use. Lipiodol is an irritant substance which is capable of causing inflammatory changes in the meninges and nerve roots with which it comes into contact. I have seen several cases in which gross changes of this kind have occurred after the injection of lipiodol, and I have now ceased to employ this method of diagnosis. Air can be used as a contrast medium, but a satisfactory and reliable technique has not yet been evolved. At present, therefore, in spite of the difficulties involved, the surgeon should base his decision upon the evidence provided by a neurological examination, and by analysis of the cerebrospinal fluid. It is a process of weighing probabilities.

The operation to be performed is a laminectomy or hemilaminectomy. Bone must be removed to permit excision of the hypertrophied ligamentum subflavum and prolapsed nuclear material. The site of tenderness in the back will help in deciding upon the level at which the laminectomy should be performed. In many cases there is localised tenderness on deep pressure over the interspinous space corresponding to the intervertebral disc which is at fault. It will be remembered that the lesion occurs most commonly in the lumbo-sacral disc. The disc between the fourth and fifth lumbar vertebra is the next most common site, and these two discs between them contribute the vast majority of the lesions. Very little bone need be removed to permit exploration of these two discs.

The immediate results of the operation are excellent. The pain is almost always completely cured, and at once. It is obvious, however, that the lesion of the disc must impair the mechanical efficiency of the spine, and may cause arthritic changes which will cause pain at a later date. It is therefore possible that spinal fusion should be the final stage of the operation.

N.B.—The type of nuclear prolapse in which the protrusion is *backwards* into the spinal canal is of course quite different in its pathology and its clinical effects from a nuclear prolapse through the cartilage plate into the adjacent vertebral body. The latter type occurs in adolescent kyphosis, and can also be demonstrated radiologically in many adult spines, both painful and otherwise.

It must be emphasised that prolapse of the nucleus pulposus is a *rare* cause of backache.

Secondary deposits in the spine.—This is a grave possibility in diagnosis which must always be borne in mind when there is intractable, severe, and constant backache. There may be some angulation of the spine. The discovery of a primary growth, and the demonstration of the spinal deposit by radiography, will settle the diagnosis. If the primary growth has not been discovered, the diagnosis will rest on X-ray examination alone. In most cases the X-ray will show a destructive lesion with some degree of collapse of the affected body or bodies. There are, however, osteosclerotic types of secondary deposit which do not lead to collapse. Prostatic growths, for instance, may produce this kind of metastasis. Paget's disease, affecting the spinal column, can closely simulate this variety of malignant growth. Radiographs of the skull and pelvis will usually show diagnostic changes in a case of Paget's disease.

With regard to treatment, the opinion of an expert should be sought concerning the application of radiotherapy. A spinal support will help to relieve pain.

Ankylosing Spondylitis. *Synonyms.*—*Marie-Strumpell disease. Spondylitis ankylopoietica.*

This is a disease of young people, usually in the third decade of life. It is characterised by progressive stiffness and flexion deformity of the spine. The pathological basis appears to consist of an infective arthritis in the sacroiliac and spinal joints, and ossification of some of the spinal ligaments.

The patient is usually a tall, wasted and ill-looking young man (rarely a woman), who complains at first of pain in the lower part of his back, radiating into the lower limbs, and round the trunk. In a few weeks or months rigidity and flatness of the lumbar spine will be noticed. The rigidity gradually spreads to include the dorsal and cervical parts of the spinal column, and a flexion deformity of the spine appears. Eventually, the spine becomes absolutely rigid, and markedly flexed, the back being rounded, and the head thrust forward, with the face directed downwards. Ankylosis of the hip joints sometimes occurs, and in rare instances of

the shoulder joints also. In the final stage, when the rigidity has become absolute, the pain disappears. The horrible deformity is permanent, and is a very severe handicap, since the patient cannot lift his head up, but must forever look at the ground. If the hip joints have become utterly rigid he can walk only with the greatest difficulty. Fortunately the progress of the disease to this sombre issue is not always complete. It may be arrested at any stage. It is therefore advisable, when the disease is diagnosed at an early stage, to give a guarded prognosis.

Opportunities for post mortem examination in the early and intermediate stages of the disease are rare, but the pathological changes can be followed in X-ray photographs.

In the initial phase, when backache and pains in the limbs are the clinical characteristics, radiographs show arthritic changes in the sacroiliac joints. The articular surfaces of these joints are eroded in an irregular fashion, and there is a fairly wide zone of sclerosis in the surrounding bone of ilium and sacrum. Sclerosis around the sacroiliac joints is the earliest radiological sign of ankylosing spondylitis. It is a diagnostic feature.

At a later stage, when the spine becomes stiff, corresponding changes can, in films of good quality, be seen to involve the lateral joints of the spine. As the spinal rigidity increases in depth and extent calcification of some or all of the ligaments of the spine makes its appearance in the X-ray photographs, and the calcified areas eventually ossify. This change may involve the interspinous, interarticular and intertransverse ligaments, and may also be seen in the peripheral portions of the intervertebral discs. When the intra-articular ligaments are involved in each side, the X-ray shows a double line of ossification—the so-called “*tramline spine*.” The name “*bamboo spine*” has been applied to the appearance produced by ossification in the peripheral parts of the intervertebral discs. This ossification of ligaments produces a bony fusion of the affected portion of the spine, and results in the absolute rigidity which is characteristic of the later stages of the disease.

The pathological changes in the hip joints, if they are involved, are similar to those which occur in the sacroiliac joints. There is at first a narrowing of the joint space, with irregular erosion of the articular surfaces. At a later stage, in a fully developed case, both hip and sacroiliac joints become solidly ankylosed by bone.

In some cases, an irregular erosion of each ischium near the tuberosity, and of the under surface of each os calcis, may be seen radiographically.

The cause of this disease is unknown, and there is no certain knowledge of the nature of pathological changes. Nearly all the available information has been obtained by radiography. Treatment must therefore be symptomatic. If any septic focus is discovered, it should be dealt with. For pain, analgesic drugs will be required. A plaster bed will make the patient more comfortable at night. During the day, a spinal support is worn to relieve pain, and to counteract, as much as possible, the tendency to flexion deformity.

Spinal Caries.—A discussion of the pathology, signs and treatment of spinal caries is outside the scope of this article, but it is very important to bear it in mind as a possibility in every case of adult backache. It is frequently overlooked, with unfortunate results for the patient. From time to time, patients are seen in consultation who have complained for months of backache, which has been mistakenly regarded as lumbago or fibrositis or backstrain. On examination, the angular kyphosis, with or without an abscess and an extensor plantar response, indicates the correct diagnosis. The kyphus in early cases of spinal caries is very small, but it is characteristic. If such a kyphus is present, X-ray examination will confirm the diagnosis.

Never regard and treat any patient with backache as a case of fibrositis, lumbago, or back-strain until the more serious conditions such as spinal caries, secondary deposits, and ankylosing spondylitis have been excluded.

It is not possible to describe in this paper the remaining constituents of this group, such as spondylolisthesis, Kummel's disease, etc. If clinical evidence of their presence is not sufficient to make the diagnosis clear, radiography will do so.

BACKACHE IN OLD AGE

The stiff and painful spine which is sometimes seen in old age is the result of osteoarthritic changes in the lateral joints of the spine and degenerative changes in the intervertebral discs. The discs become less deep, so that the vertebral bodies are closer together, and may actually be in contact with one another anteriorly.

Treatment is of course symptomatic. Exertion and fatigue must be avoided. Radiant heat will have a sedative effect. In severe cases a corset or spinal support may be prescribed.