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Disorders of the Skeletal System: Spondylolisthesis

Uptodate

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University of London Audio-Visual Centre, 1976.

Produced by Michael Tomlinson.

Black-and-white

Duration: 00:25:45:09

00:00:00:00

<Opening titles>

< Newman to camera>

The term spondylolisthesis was first used by Killian in 1854 to describe a slowly developing luxation of the fifth lumbar vertebra. Essentially it was a construction of the German word Wirbel schieben [?] meaning a slipping vertebra. Acute dislocation or fractured dislocation are not included under this term. A constant thrust forward is present in the lordotic of the erect lumbar spine seated above a sloping sacrum. This is well demonstrated in a patient of fifteen [...]

<Newman narrates over x-ray>

[...] with osteogenesis imperfecta showing elongation of the pedicles especially at the 3, 4 and 5 levels where the thrust is greatest.

<Newman narrates over a series of diagrammatic slides>

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This latent tendency to sit forward is imposed by the bony hook, whereby the inferior facet of the vertebra above hooks behind the superior facet of the vertebra below.

The bony hook includes the pedicle, part of the neural arch known as the pars interarticularis and the inferior facet.

<Next slide> This cartoon demonstrates the angle at the top of the sacrum and the hook mechanism guarding against the tendency to slip. <Next slide> The presence of a lesion across the pars interarticularis, so often associated with spondylolisthesis, was not discovered until later, but when it became properly established and subsequently found radiologically, it assumed such importance that in some schools this characteristic lesion was called spondylolisthesis, which of course is quite wrong. The correct term is spondylolysis.

< Newman to camera >

It is fair to say that the deficiency of the bony hook predisposes to spondylolisthesis in so much that the different types of lesion of the bony hook are *pari passu* of the causes of spondylolisthesis.

< Newman narrates over tables >

Possible lesions of the bony hook are divided into three categories: facet deficiency, neural arch deficiency and bone deficiency. Firstly, facet deficiency. Congenital deficiency occurs in displacement of the sacrum and this is labelled group 1 – congenital. Acquired deficiency from an acute fracture may be associated with dislocation. This is a fracture dislocation, not spondylolisthesis. Acquired deficiency from degenerative disease is common and is labelled group 4 – degenerative.

Secondly, neural arch deficiency. A congenital lesion of the pars interarticularis or even the pedicle was a commonly held theory, but has mostly now been abandoned and I believe it to be non-existent. An acquired lesion may occur as an acute fracture, allowing subsequent slipping. This is rare and has been labelled group 3 or traumatic. The common lesion of the pars interarticularis is almost certainly a stress

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fracture. It is the commonest cause of spondylolisthesis and has been labelled group 2 – spondylolytic.

Thirdly, bone deficiency. General or local bone disease can give rise to mechanical deficiency. These causes have been labelled group 5 – pathological.

<Next table>

These five groups have been called, and these have been chosen from a total of 319 patients, group 1 – congenital; you'll notice there were 66 cases or 21%; group 2 – spondylolytic, 164 cases, 51%; group 3 – traumatic, 3 cases, 1%; group 4 – degenerative, 80 cases, 25%; group 5 – pathological, 6 cases or 2%.

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Numerically it will be seen that group 2 is common, groups 1 and 4 comparatively common, and groups 3 and 5 rare. I shall talk almost entirely about the three commonest groups: 1, 2 and 4. They each have a distinctive morbid pathology and clinical syndrome, and the treatment required is quite different.

<Newman narrates over a series of slides>

Diagrammatically, here they are: on the left you'll see the normal anatomical relationship of the lumbar-sacral facets. On the right is group 1, the congenital type – note the lumbar-sacral facets have given way. <Next slide> Here is group 2, spondylolytic type, with a typical lesion through the pars interarticularis. <Next slide> And this is group 4 with severe osteoarthritis and luxation of the lumbar 4/5 facet joint.

<Next slide> Now for some diagrams, and notice the difference in age of the onset of the symptoms. Group 1 – mostly in adolescence; group 2 – astride the years and group 4 – in middle age and old age.

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<Next slide> The sex incidence is interesting: females are more commonly affected in groups 1 and 4, but males in the commonest spondylolytic type, group 2.

<Next slide> The percentage of patients with abnormal neurological signs is, as would be expected, highest in the degenerative type.

Now for the individual groups: <Next slide> and this is group 1, the congenital type. Group 1, there were 66 cases or 21% – 20 males, 46 females, and neurological signs were found in 15%. <Next slide> There is insufficient development of the sacral neural arches and it is common and familial. The superior sacral facets are dysplastic and may be insufficient to hold the lumbar thrust. <Next slide> The last lumbar vertebra gradually slips off the sacrum, its inferior facets grinding over or between those of the sacrum. <Next slide> The neural arch is carried with the body to a point of stabilisation. Then the neural arch attenuates and may break. The degree of slip is liable to be severe and an uneven degree of slip gives scoliosis.

<Newman narrates over series of x-rays>

Here is the spine of a child aged 6, showing a moderate amount of slip with an intact neural arch. <Next x-ray> And this shows more slip in an adolescent of 14 years. <Next x-ray> And here is a maximal degree of slip with the body of the fifth lumbar vertebra hanging down into the pelvis.

<Newman narrates over photograph>

Here is a bony specimen from the museum at University College Hospital, showing a maximal amount of slip with secondary bony fusion between the fifth lumbar vertebra and the top of the sacrum.

<Newman narrates over x-rays>

The next two slides show the sclerotic deficient lumbar-sacral joints. This is a constant lesion which distinguishes it from the other types. <Next x-ray> The giving

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way of the lumbar-sacral facets, in that the inferior facets of lumbar 5 slip over or between the superior sacral facets.

<Newman narrates over diagrammatic slide>

Clinically, these patients nearly always present in adolescence. In this diagram, you will see that 45 out of 51 reported, between the ages of 8 and 19, are females on average 2 years earlier than males which is characteristic of the onset of puberty.

<Newman to camera>

The complaint is of stiffness, pain in the lower back and legs and tingling or numbness of the feet. The parents may have noticed a difference in the shape of the back. More severe symptoms of loss of sensation in the thighs and buttocks and altered micturition occasionally occur.

<Newman narrates over a series of photographs>

The back has a characteristic shape. *<Next photograph>* The patient, when asked to bend forwards, typically gets the fingertips no further than the knees. *<Next photograph>* Notice the shortness of the trunk compared to the lower limbs and the backward tilting of the pelvis on the figure on the right. And on the left, you'll notice severe scoliosis. *<Next photograph>* Straight leg raising is very limited and characteristically if the leg is forced higher, the buttock rises from the couch, not necessarily with pain increase.

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<Newman to camera>

Abnormal neurological signs are often absent but weak ankle jerks and mild alteration of sensation are quite typical. The patient walks with a wide base and guarded gait.

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<Newman narrates over a slide>

It is found anatomically that the advancing neural arches of lumbar 4 and 5, away from the posterior part of the first sacral part of the vertebral body, cause tension of the theca cauda equina nerve routes.

<Newman narrates over an x-ray>

Here is an x-ray showing a foetal head engaging below the prominent vertebra; the arrow indicates the fifth lumbar vertebra. Traditionally, pregnancies have often been terminated or caesarean sections performed for this condition, [...]

<Newman to camera>

[...] but in our experience of 28 pregnancies in patients with severe spondylolisthesis, only 1 showed any delay in delivery. There were no foetal deaths and no caesarean sections were performed.

Now let us consider treatment. Almost all patients have been treated surgically, in all but 4 cases by simple posterolateral fusion. This is to relieve symptoms and to prevent increase of slip, which can easily occur in late adolescence and in early adult life especially during pregnancy. <Narrates over x-ray> This shows increase in slip during one pregnancy of an adolescent at the age of 16.

<Newman narrates over series of slides>

Here are the indications for simple stabilisation: for severe slipping during growth, and for chronic pain and stiffness, to relieve pain and muscle spasm, and to prevent further slip and increase of neurological defect. Four cases had retention of urine and numbness over the buttocks and back of the thighs and were decompressed and fused.

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<Next slide, x-ray> Myelography shows the obstruction to occur just above the posterior half of the body of the first sacral vertebra. <Next slide> And here is the diagram again to show the exact site of the constriction in the spinal canal.

<Next slide> Operative treatment. At operation a transverse incision between the iliac crest is made with a slight concavity upwards. The lumbar fascia is incised bilaterally at the junction of the outer one and inner two thirds of the sacrospinalis muscle. <Next slide> The ala of the sacrum, the transverse processes of lumbar 4 and 5, the facets and the outer half of the laminae are decorticated bilaterally. The gutter is filled with bone slivers from the outer aspect of the ilium. <Next slide, x-ray> Here is the appearance of a good graft, the bone extending from the transverse process of 4 and 5 to the ala of the sacrum.

<Newman narrates over series of photographs>

These photographs show results before and after operation. Notice the disappearance of scoliosis. <Next two photographs>

<Newman narrates over series of slides>

Group 2. This is the commonest group who are 164 cases or 51 %. 93 males and 71 females with neurological signs in 13%. <Next slide> The constant lesion in this group is a break in the pars interarticularis. The facets are intact and the degree of slip is moderate. Evidence suggests that the lesion is a stress fracture secondary to soft tissue instability or excessive strain. Symptoms occur at any age, frequently such a lesion seen <Next slide, x-ray> radiologically will remain symptom free throughout life, or remain so for a time and then become unstable as a result of trauma or strain. Low back pain and pain down both sides is typical. Root pain indicates nerve root entrapment and is more frequent when the lesion is proximal to the fifth lumbar vertebra. Here you see a lesion at the lumbar 4/5 level.

<Next slide, x-ray> The site of the bony lesion is constant across the pars interarticularis just at the top of the superior facet of the vertebra below. It is seen in

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the lateral or, as here, in the oblique view. It is almost certainly an acquired lesion as shown by Stewart's[?] figures.

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<Next slide> Stewart examined 800 skeletons and found an increasing incidence with age. <Next slide> On clinical examination, the back shows increased lordosis with a step.

<Newman to camera>

No treatment whatever is required for a symptom-free lesion. Short-term backache is treated in the same way as temporary lumbar strain, but, of course, it is a very useful standby.

<Newman narrates over series of slides>

Surgical treatment for group 2 – for simple stabilisation for chronic pain of more than 1 year and for increasing slip; and decompression and fusion for nerve root involvement and spinal stenosis. <Next slide, x-ray> This radiograph shows the increase in slip in a boy of 8 years old during 1 year. <Next slide, x-ray> And this shows the increase in slip in an adult in 2 years.

<Next slide> Spondylolysis with minimal slip and persistent pain can be treated by a bilateral screw through the lesion with a small local bone graft. <Next slide, x-ray> Here is an x-ray before operation showing the lesion in the pars interarticularis and notice that there is no slip. <Next slide, x-ray> And in this radiograph, you'll see the two screws in the correct position.

<Newman to camera>

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Fusion is indicated for unstable lesions with slip, either by a posterolateral approach or anteriorly for an interbody fusion. When root entrapment or spinal stenosis is present, removal of the loose neural arch is indicated.

<Newman narrates over series of slides, including x-rays>

The following three slides show a typical lesion which heals after posterolateral fusion. Here you see the lesion in the pars interarticularis of lumbar 5. <Next slide, x-ray> In this view, the anteroposterior view, you see the graft, the two screws to fix the graft into the sacrum. <Next slide, x-ray> And in this view, you see that the lesion in the pars interarticularis has entirely healed.

<Next slide, x-ray> Here is an unstable lesion at the level of lumbar 4 treated by fusion. <Next slide, x-ray> This x-ray shows the posterolateral fusion of the transverse process of 4 to 5 on each side. <Next slide, x-ray> This slide shows decompression by removal of the neural arch with a fusion on both sides.

<Next slide> Now for group 4, degenerative spondylolisthesis. There were 80 cases or 25%, 22 of these were males and 58 females and there were abnormal neurological signs in 32%. It starts with a longstanding soft tissue instability causing undue play and stress at one level, generally the lumbar 4/5 level. This is followed by joint degeneration and disc degeneration. And subsequently, there is grinding in of the facets with a mild degree of forward slipping. There is no lesion in the neural arch and all cases seen in this series were more than 40 years old. It was reckoned that the slip increases 1/12 of an inch every 4 years.

<Next slide> This group is most prone to nerve root lesions caused by throttling of the cauda equina or by pressure on the fifth lumbar roots in the lateral recess. <Next slide> Junghans was the first to describe this type and here is his original illustration. It shows a slight slip, an intact neural arch and osteoarthritic lipping at the zygapophyseal joints.

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<Next slide, x-ray> These three radiographs show a typical case of this type of spondylolisthesis. In the anteroposterior view, you notice the severe osteoarthritic changes at the 4/5 level. <Next slide, x-ray> In the lateral view, you see the moderate degree of slip and the intact neural arch, <Next slide, x-ray> and in the oblique view you see the complete obliteration of the joint space. <Next slide, x-ray> This radiograph shows the degree of slip which occurred over a period of 8 years.

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<Next slide> Here are three bony specimens which show characteristics of the lesion. In this lateral view, you see a moderate degree of slip and the subluxation forward of the fourth facet between the fifth facet. <Next slide> In this view, you notice the marked osteoarthritic changes. <Next slide> And this view shows the obliteration of the lateral process in the left hand picture.

<Next slide> This is a drawing to show the gradual subluxation forward of the inferior facets of lumbar 4 inside the superior facets of lumbar 5. You'll notice the two facets in their correct relationship in diagram 2; and in diagram 3, you'll notice the subluxation forward of the inferior fourth facet. And in the final picture, number 4, the osteoarthritic lipping has been superimposed to show how it encroaches on the theca posterolaterally and also compresses the fifth lumbar roots in the lateral recess. <Next slide> Myelography may show a complete block or an hour glass deformity.

<Newman to camera>

Such a lesion may be symptom-free, but most patients have some degree of chronic backache and this is generally well controlled with a corset.

<Newman narrates over series of slides, including x-rays>

Now the indications for surgery. Simple stabilisation is occasionally necessary for persistent back pain which is unrelieved by wearing a corset, but much more important is decompression which is indicated for nerve root involvement or for spinal

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stenosis. *<Next slide>* This diagram shows the entrapment of the fifth lumbar root between the osteoarthritic joints posteriorly and the body of the vertebra anteriorly. It is relieved by partial vertical facetectomy.

<Next slide> Now I'm going to show you five diagrams to show you the stages of the decompression operation. This shows the normal picture of the lumbar 4/5 level. Here are the typical hypertrophic osteoarthritic joints. *<Next slide>* And this diagram shows that a partial vertical facetectomy has been performed on the right hand side of the inferior facet of lumbar 4. Beneath it is the remaining superior facet of lumbar 5. *<Next slide>* Now this diagram shows that a bilateral partial facetectomy has been performed on each facet, decompressing the fifth lumbar root which is seen on each side. *<Next slide>* In this diagram, in order to decompress pressure on the theca, the lower half of the neural arch and the spinous process have also been excised.

<Newman to camera>

This classification has recently been discussed at the International Society for the Study of the Lumbar Spine, and modifications have been suggested.

<Newman narrates over slide >

Group 1, congenital, will now become dysplastic. And group 2, spondylolytic, will become isthmic with two subtitles – lytic and elongated. Groups 3, 4 and 5 remain the same, except the degenerative now becomes group 3 because it is more common, traumatic – group 4, and pathological remains the same.

00:25:07:22

<Newman to camera>

Knowing the nature of these different lesions facilitates the diagnosis of the real cause of pain. And if this is known, treatment becomes much more effective.



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<End credits>