THE PATHOGENESIS OF THE CLINICAL PICTURE IN SCIATICA

Captain I. MACNAB

It is now widely accepted that a large proportion of cases of sciatica are associated with a prolapsed lumbar intervertebral disc. There is, however, very little agreement on how a prolapsed disc gives rise to symptoms and signs. I thought it would be useful to discuss some of the experimental work we have done on this problem.

First of all—why do these people get backache? In this respect it is relevant to discuss spondylolysis. In this condition a defect occurs in the pars interarticularis on one or both sides (fig. 1). There is no agreement as to the aetiology of this lesion. It may be due to a lack of fusion between two centres of ossification on each side of the neural arch. No one, however, has convincingly shown that these double centres occur. It has been suggested by Galluccio, Roberts and others that these defects occur as a result of stress fractures, such as are seen in the foot, the tibia, the neck of the femur and the inferior ramus of the pubis.

In the short time that we have been looking for this lesion, we have seen several examples and agree with Roberts that the lesion occurs more frequently than we commonly suppose.

The reason why it is not more generally recognized is that the laminar

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**Fig. 1.**

*Diagram to show site of defect in neural arch in spondylolysis (the outline of the bodies of the vertebrae have been omitted for clarity).*

**Fig. 2.**

*Oblique view of lumbar spine showing defect in pars interarticularis of the fifth lumbar vertebra.*
I. Macnab

The defect is not easily seen in the routine A.P. and lateral views but is only shown up convincingly on 30 degrees oblique views of the lumbar spine (fig. 2).

When the lesion is present, abnormal movements of the spine are permitted. The upper vertebrae may slip forwards on the one below it, as in spondylolisthesis, and, in addition; in flexion and extension there is an abnormal movement of the body of the vertebra in relation to the neural arch.

This is best demonstrated by a diagram (fig. 3).

![Diagram of spinal vertebrae](image)

**Fig. 3.**—On flexion the two halves of the neural arch separate thus increasing the distance between the adjacent spinous processes. Any sudden unguarded flexion movement will thereby strain the supraspinous ligaments.

This type of movement puts an excessive strain on the posterior longitudinal ligament and ligaments in relation to the neural arch and, in particular, the supraspinous ligament. Kellgren showed that injection of hypertonic saline into the supraspinous ligament gave rise to backache and sciatica. Spondylolysis of the lower lumbar vertebrae may likewise give rise to a referred sciatica on account of repeated strains of the supraspinous ligament.

In prolapsed lumbar intervertebral discs, there occurs a similar type of excessive mobility. The lumbar vertebrae are normally held apart by the turgor of the nucleus pulposus. When the nucleus prolapses, the distracting force is no longer present, the ligaments become lax allowing excessive movement of the vertebrae in relation to each other and resulting ligamentous strain.

In other words, some of the backache and sciatica associated with a prolapsed disc may be due to ligamentous strain. The other point arising out of this is the question whether cases of prolapsed disc associated with spondylolysis should have a spinal fusion performed in addition to removal of the disc.

**Pain in the Leg**

Kellgren showed that injection of hypertonic saline into the supraspinous ligaments gave rise to sciatica and muscle spasm. Elliot, following up
Kellgren's work, showed that the tender areas in the leg in sciatica were associated with local muscle spasm.

That some degree of muscle spasm is present cannot be doubted. Limitation of straight leg raising is due to a muscle spasm which is not abolished till the third stage of the third plane of anaesthesia.

Captain Sugden has given curare to two patients with sciatica. As the drug took effect, the pain gradually went and the straight leg raising was increased. The last case was of particular interest. After 15 mg. of curare were given by intramuscular injection, his straight leg raising increased from 30 degrees to 60 degrees but his pain was hardly altered. He was then given 5 mg. of curare by intravenous injection and following this he had difficulty in breathing, swallowing, and speaking.

Synchronizing with this change, his pain stopped, and his straight leg raising increased to 90 degrees. This suggests that there is a close relation between pain and muscle spasm.

Major Ellis has mentioned that with skin traction the patient can be relieved of his leg pain. We have found that coinciding with the disappearance of pain, the straight leg raising is increased. This suggests that traction cures pain by overcoming muscle spasm. In one case heavy traction did not relieve the pain, and it was discovered that the patient had placed a pillow under his knee. When the pillow was removed, and the traction allowed to stretch the hamstrings, by hyperextending the knee, the pain went.

That some degree of muscle spasm is present in these cases is certain, and I suggest that these observations indicate that some of the pain in sciatica is due to this spasm.

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**Fig. 4.**—A portion of prolapsed nuclear material 0.4 c.c. in volume (equivalent in size to B.) was put in water for twenty-four hours and its volume then remeasured. It was found to have increased in volume to 3.8 c.c. C. An internal semilunar cartilage (A.) also left in water did not increase in volume.
PERIODICITY

Another difficult problem in these cases is a history of periodicity. Mr. Young has told us that a prolapsed disc is capable of "popping" in and out, and this by itself would explain the periodicity. However, there is another possibility that must be considered.

Deucher and Love have demonstrated that discs removed at operation were frequently oedematous. We have shown that prolapsed nuclear material is remarkably hygroscopic (fig. 4). It is possible that a prolapse occurs, constant trauma produces oedema, the prolapsed material expands and symptoms are produced. Rest in bed, or local support, would allow the oedema to subside and the patient is temporarily relieved of symptoms.

Epidural injections of procaine, by breaking the local reflex arc, would likewise allow the oedema to subside, producing a remission of symptoms. A comparable lesion, as shown by Leriche, is seen in the ankle-joint, where the oedema following a strain subsides after infiltration with local anaesthetic.

In conclusion I feel that when considering the pathogenesis of the clinical picture in prolapsed lumbar intervertebral discs, we must consider the part played by ligamentous strain in the production of backache, the part played by muscle spasm in the production of pain in the leg, and the part played by oedema of the prolapsed disc in producing the typical history of remissions and exacerbations.

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