

**RADIOLOGICAL EVALUATION OF RECURRENT SYMPTOMS AFTER
LAMINECTOMY DONE FOR LUMBAR DISC HERNIATION**

THESIS

**SUBMITTED IN PARTIAL FULFILLMENT FOR MASTER
DEGREE IN RADIO-DIAGNOSIS**

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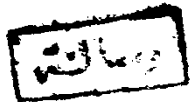
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INTRODUCTION AND AIM OF WORK

It was found that many patients after lumbar surgery for disc herniation develop what is known as failed back surgery syndrome, which is characterized by intractable pain and varying degrees of functional incapacitation. The cause of this syndrome may be due to epidural fibrosis or due to persistent disc herniation or its recurrence.

Radiology and imaging play an important and indispensable role to diagnose causes of failed back surgery syndrome and its follow up.

CT is able to differentiate the various soft tissue structures within the vertebral canal. Enhanced images can differentiate between postoperative fibrosis and recurrent disc herniation, while myelography is not accurate as CT in this differentiation.

MR has important role to differentiate between postoperative fibrosis and recurrent disc herniation when enhanced images by Gd-DTPA is used.

A N A T O M Y

LUMBER VERTEBRAL ANATOMY

The ^{area} (lumber spine) contains five vertebral bodies. These vertebrae are the largest units of the vertebral column, increasing slightly in size from the first lumbar one to the fifth lumbar. The elements and processes of the neural arches are also heavier than other spinal area. This reflects both their increased weight-bearing function and the larger muscle forces to which they are subject.

Distinctive features of the lumbar vertebrae include:

- 1- Vertebral bodies (centra) have a large transverse than anterior posterior diameter, with their vertical height being their smallest diameter.
- 2- The pedicles (as in the lower thoracic region) are basically oriented in the anterior-posterior plane except for L 5. L 5 pedicles are directed posterolaterally.
- 3- The upper lumbar transverse processes are slightly behind the posterior plane of the spinal neural canal, whereas the lower lumbar transverse processes are directly lateral to this canal.
- 4- The laminae are very short and attach to relatively broad, thick spinous process.

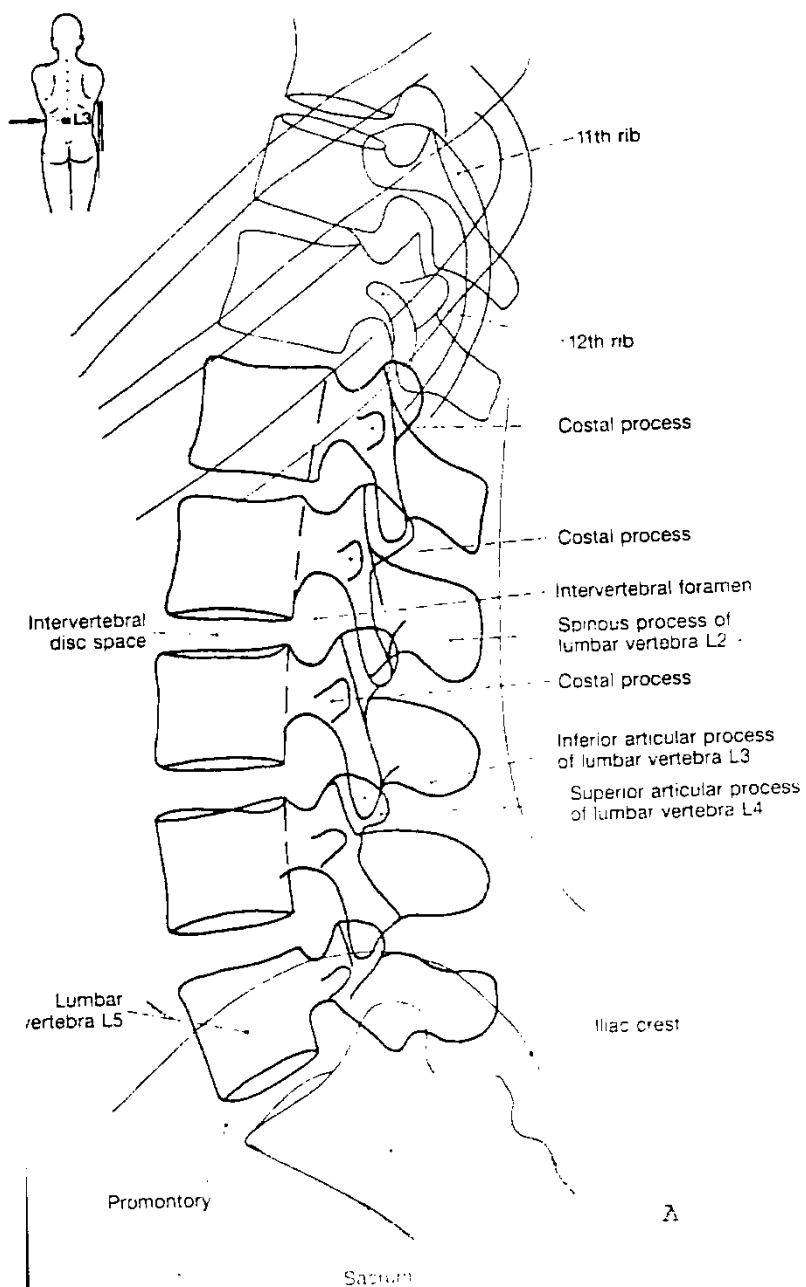


Fig.1
Quoted from Wick L.;1987

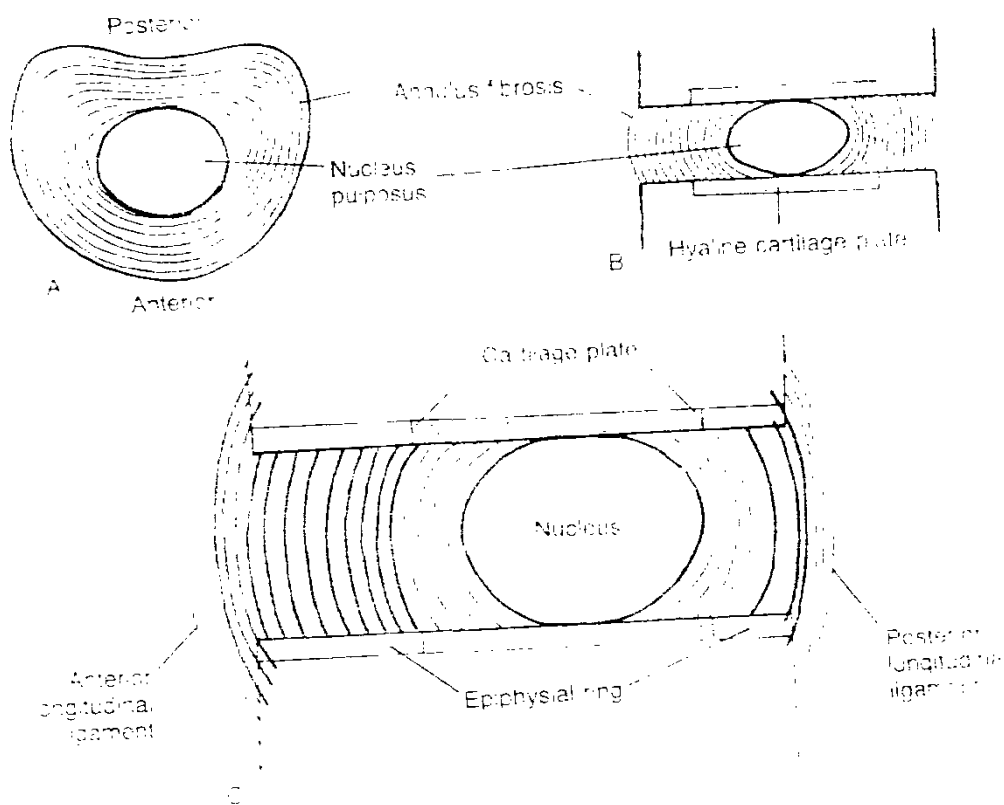


Fig. 1.
Quoted from Teplitz J.G. and Huskin M.F.;
1983

- 5- The articular facet joints are basically oriented 45° postero-laterally away from the midline plane, a little less so in the upper lumbar region.
- 6- The spinal neural canal is triangular with the base of the triangle formed by the posterior surface of the vertebral body. It becomes progressively smaller from above downwards. It is closed anteriorly by the vertebral bodies, the intervertebral discs and the posterior longitudinal ligament and posteriorly by the laminae and the ligamenta flava. Laterally, it is occupied by the pedicles, which are narrower than the height of the vertebral bodies. Thus a series of intervertebral foramina is produced between adjacent pedicles (Fig. 1). Each intervertebral foramen is bounded in front by the lower part of the body of a vertebral and its adjacent intervertebral disc, and bounded behind by the capsule of the synovial joint between adjacent neural arches. The intervertebral foramina ^(admit) the spinal nerves and posterior root ganglia and give passage to the spinal arteries and veins [Last, 1984].

The bodies of adjacent vertebrae are held together by the strong intervertebral disc, which is a secondary cartilaginous joint, or symphysis. The upper and lower surfaces of each vertebral body are covered completely by a thin plate of hyaline cartilage (Fig. 2).

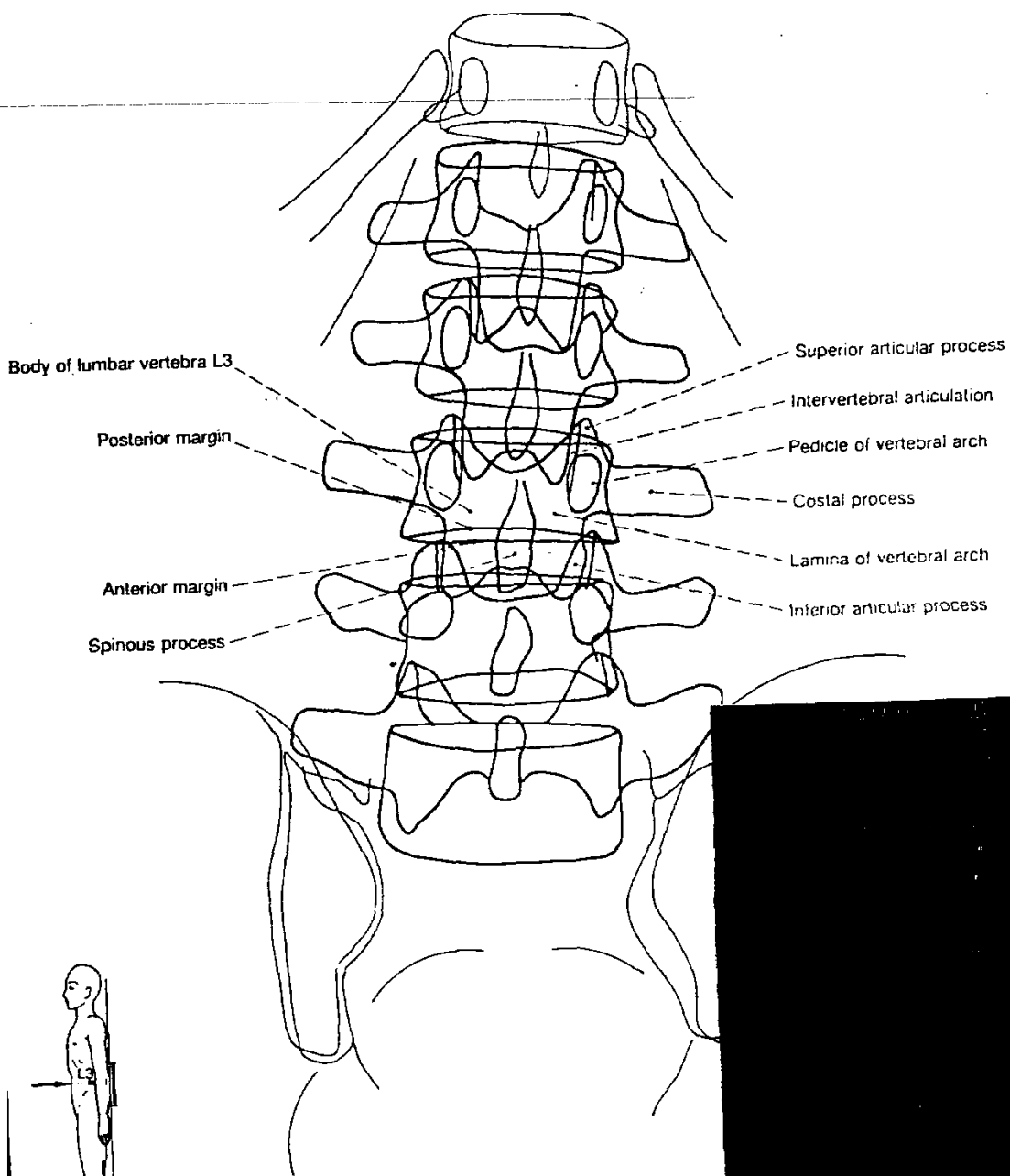
These plates are united by a peripheral ring of fibrous tissue, named the annulus fibrosus. The annulus fibrosus consists of concentric laminae, the fibres of which lie at 45° with the bodies of the vertebrae. Alternate layers of the annulus fibrosus contain fibers lying alternatively in the 45° slope at right angle to each other.

By this means in the annulus fibrosus is a bubble of semi-liquid gelatinous substance known as the nucleus pulposus. It is derived from the embryonic notochord. The nucleus pulposus in the embryo lies at the centre of the disc. Subsequent growth of the vertebral bodies and disc occurs in a vertebral and lateral direction. Thus in the adult the nucleus pulposus lies nearest to the back of the disc and if it herniates through the annulus fibrosus it will be most likely to do so posteriorly. Another cause making posterior disc herniation more likely is that the anterior longitudinal ligament is thicker and stronger than the posterior longitudinal ligament.

Note that there is no dividing interface between the annulus fibrosus and the nucleus pulposus. Peripherally the oblique fibres of the annulus are extremely densely packed, with interchange of fibers between adjacent laminae. Centrally the fibers become gradually less dense but they penetrate the nucleus pulposus. Similarly the nucleus pulposus is centrally a gel and becomes gradually less albuminous peripherally until it is replaced by ordinary tissue fluid.

The annulus fibrosus and not the nucleus pulposus, that act as a shock absorber. The annulus fibrosus is not compressed between adjacent vertebrae, for the incompressible nucleus pulposus effect. In lateral projection, the vertebral bodies, disc spaces, pedicles and intervertebral foramina are visible, as are the profiles of the spinous processes but the laminae are not visible because they are foreshortened.

In anteroposterior projection, vertebral bodies and pedicles are clearly visible. The pedicles of the fifth lumbar vertebra diverge posterolaterally but the



(Anatomical details labeled only on the third lumbar vertebra)

A

Fig.3
Quoted from Wick L.;1987

B

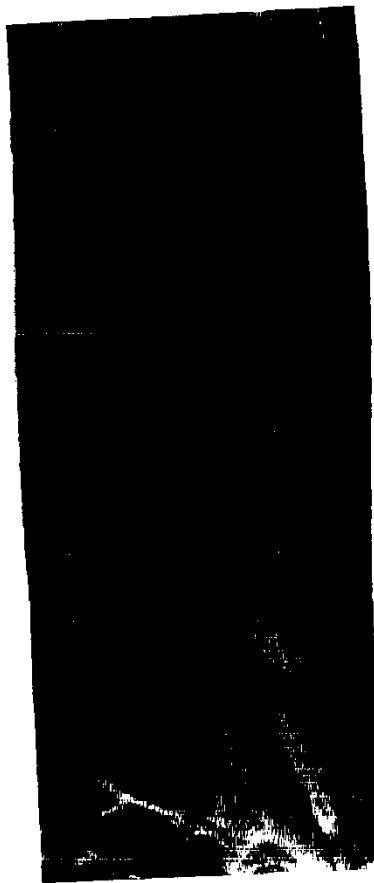


Fig.4
Quoted from Wick.L.;1987

median borders are usually visible. The shortest distance between the median borders of a pair of pedicles represents the width of the spinal canal at the level (Fig. 3).

In left and right posterior oblique projections, the well known "Scottie dog" image is made up of the right transverse process which represents the snout; the right pedicle-in right posterior oblique, seen end-on, the head and eye; the pars interarticularis the neck; the superior articular process the ear; the inferior articular process the front leg, and the right lamina-On this position, the anterior part of the body of this composite image (Fig. 4).

To visualize the spinal canal soft tissue contents, contrast media is injected in the subarachnoid space. Contrast media may pass no further caudally than the last disc space, or may reach the third sacral segment. Its termination may be pointed, bulbous, even concave, but is usually smooth and symmetrical. The subarachnoid space extends with gravity, and constricted during a valsalva maneuver.

In lateral projections a smooth, regular gap of up to one cm between the contrast medium and the posterior surface of the lumbar vertebrae and discs. However, the anterior margin of the contrast medium (myelogram) is usually convex towards the bone having indentation opposite each lumbar disc; these are normal appearance, and should not be confused with disc herniation. Posterior to the dura mater, on either side of the midline, lie the ligamenta flava, which connect the laminae of the vertebrae throughout the spine.

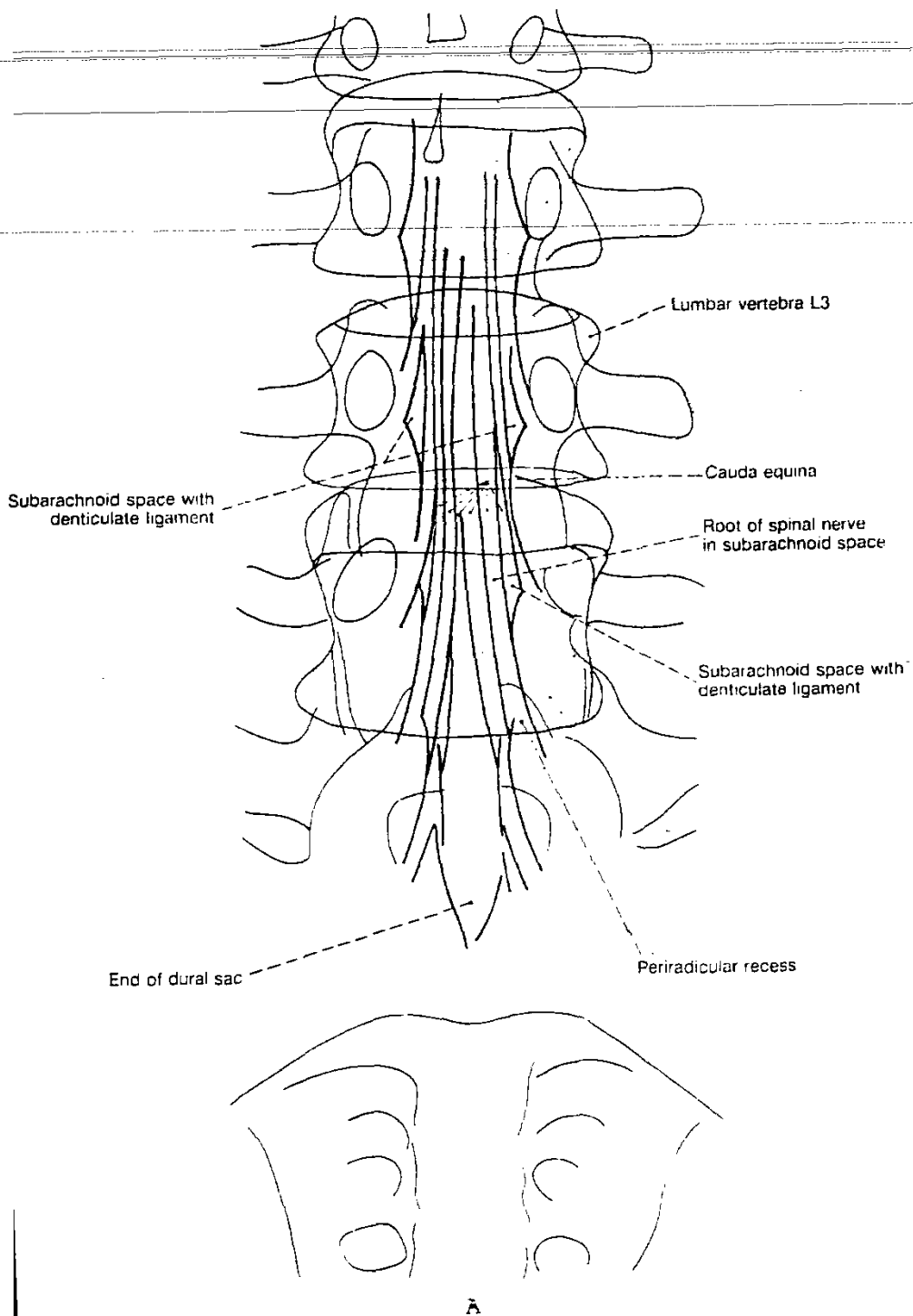


Fig.5
Quoted from Wick L.;1987