

ANATOMICAL STUDIES ON LUMBAR DISC DEGENERATION

BY

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Dr. *Carl Hirsch* and I have been making a study during the past few years of the pathological anatomy, pathophysiology and clinical features of the lumbar spine. To-day, I shall describe one aspect of these investigations, that in which we have tried to determine the pathological-anatomical factors which underly instability of the lumbar discs.

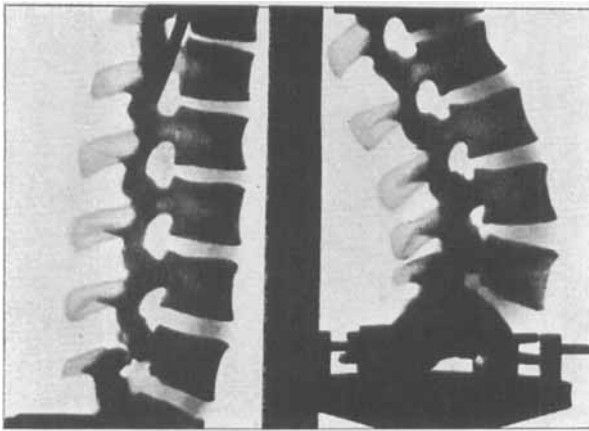
At operation an abnormal mobility of the disc is sometimes seen in connection with disc degeneration. Our roentgenologist, *Folke Knutsson*, observed, a couple of years ago, that in some cases of spinal insufficiency, instability between two lumbar vertebrae could be demonstrated roentgenographically, the cranial vertebra being in anteposition to the caudal in flexion of the spine and in retroposition in hyperextension. We considered this to be an early sign of degeneration of the interlying disc, although we had no proof that our assumption was correct.

We have so far examined 100 lumbar specimens, or 500 intervertebral discs and 1,000 intervertebral joints. The distribution in the various age groups can be seen from table 1.

The lumbar spines were removed together with the sacrum; the sacrum was fixed in a vice and as soon as possible after death the specimens were flexed and extended without forcing and were roentgenographed in various positions of flexion and extension. After a short period of formalin fixation the discs were cut horizontally and macrophotographed. A histological investigation is in progress. The intervertebral joints were re-

TABLE 1.

1-10 years		9
11-20	..	4
21-30	..	21
31-40	..	17
41-50	..	21
51-60	..	12
61-70	..	12
71-80	..	3
81-90	..	1
Total		100

*Fig. 1.*

When the spine is hyperextended, a slight posterior displacement is seen in the 4th disc.

moved separately and decalcified, and sections were cut from all spaces in order to study the relation between disc and joint changes; these investigations have not yet been concluded.

Histological examination of disc material shows that regressive changes in the nucleus occur early, but they can probably be interpreted as a sign rather of a normal age involution than of pathological degeneration. The difficulty lies in deciding when degeneration is present and when it is not. As the age increases the amount of fluid in the nucleus decreases, fibrosis increases,

and the borderline between the disc and the annulus becomes less distinct. All this seems to take place without causing any clinical signs or degeneration symptoms. Undoubted degeneration must, however, be said to have occurred when fissure formation is found in the annulus.

In the anatomical investigation, the type of the degeneration and its position in the disc showed variation according to the level in the lumbar spine. In the upper discs the degeneration showed in part a concentric arrangement; fissure formation was observed all round the disc. In the two lower discs the degenera-



Fig. 11.

A transverse section through the 4th disc in Fig. I.

tion was situated mainly in the posterior portion and had a special form. A sagittal path was seen going from the nucleus dorsally to the posterior longitudinal ligament, running out on both sides in the form of a T and often extending to a point slightly lateral to the intervertebral foramen. *Schmorl-Jungmanns, Güntz* and others point out that in the thoracic region disc degeneration has a special character, that here the anterior portion of the disc is affected owing to the fact that after the

disappearance of the nucleus pulposus the pressure becomes greater over the anterior than over the posterior portion of the annulus. When one sees the uniformity of the degeneration in the discs in the lower section of the lumbar region it seems logical to assume that it is not only the increased mechanical factors in the region as such, that have given rise to the fissures, but also—and perhaps to an equally high degree—the posterior concavity in this section of the vertebral column, in other words the lordosis. The disc degeneration that is so often observed in the lumbar region would thus, to a certain extent, constitute still another reminder of the fact that we have not yet adjusted ourselves to walking on two legs; the erect position may perhaps not be wholly an advantage to the lumbar region.

The following information was obtained from the roentgenograms in our material (see table 2).

TABLE 2.

	Total no. of lumbar spines	L. I.	L. II.	L. III.	L. IV.	L. V.	Total no. of intervertebral discs.
No changes	46						
Instability	15			1	12	4	17
Disc degeneration	17	2	3	4	9	11	29
Vacuolation	10		1	1	5	3	10
Spondylosis deformans	20						
Stable retroposition	5		1			4	5
Spondylolisthesis	2					2	2
Osteoporosis	1						
Bechterew's disease	1						
Undiagnosable cases	2						

Disc degeneration was found in the backs of 32 cases and disc prolapse in 11 discs. Thus, disc degeneration was more common, and in cases where prolapse was observed extensive degenerative changes were also present. This investigation has confirmed my findings in previous experimental studies, namely,

that prolapse must be regarded as evidence of an earlier degeneration.

The specimens were systematically examined for the presence of instability. It was found that in all cases where a disc showed roentgenological instability without other roentgenographic indication of disc degeneration—reduction in the height of the



Fig. III.

Another disc with instability. A rather large defect is seen in the fibrous ring. Fresh bleedings in the cavity.

disc, osteophytes on, and sclerosis of, the vertebral bodies—fairly widespread fissure formation was nevertheless present in the annulus, especially posteriorly.

Instability may thus be said to be an early clinical sign, but it implies the presence of advanced changes in the disc.

In addition to the view already expressed of the doubtful merits of the erect position, the observations described here give rise to certain reflections of interest to clinicians.

1. The health insurance aspect. In the course of these studies I have become more and more convinced that in almost every case a prolapse is the result of previous destruction of disc tissue, and thus that the trauma in question only plays the part of the liberating factor. Not infrequently health insurance

certificates contain a statement to the effect that the roentgenogram of the lumbar spine was negative; thus that the back was sound at the time the injury was sustained and that the diagnosed disc rupture must therefore have been due to trauma. Such a statement must be regarded as over-hasty. A negative roentgenogram does not preclude the existence of fairly advanced changes in the disc.

2. I should like to stress the advisability of caution with regard to explorative laminectomy. There has previously been a tendency, and there still is, in some quarters, to regard lumbosciatic disorders and disc herniation as one and the same thing. We are convinced from clinical experience over many years, that disc degeneration occurs more often than disc rupture, and that the latter, important as it may be, is only one aspect of the whole problem. These anatomical studies have given strong support to this view, and I would ask my listeners to recall the picture I showed earlier in which there was a T-shaped fissure formation in the disc. Here, there was a pathologico-anatomical basis for suspecting both lumbago and bilateral sciatica but, if anything, a contra-indication to laminectomy. We all too frequently meet patients who have had laminectomy of one, two or three spaces—not infrequently without myelographic examination—for a diagnosis of possible rupture of a disc, and who state afterwards that though the sciatic pains are bearable the pain in the back causes complete disablement; these back symptoms are not always easy to relieve.

3. On the other hand, I would recommend increased operative activity with regard to lumbosacral osteosynthesis. The anatomical studies I have described demonstrate that instability is, from the clinical standpoint, a relatively early symptom. We know that degeneration up to the stage of complete collapse of the disc is a very slow process extending over a long period, even over several decades. We see in the Clinic patients with instability who several years earlier have been said to have insuffientia dorsi with a negative roentgenogram, and a few more years seem to elapse from this stage of instability to the later stage with its well-known signs of degeneration (reduced space, osteo-

phytes and sclerosis of the surfaces of the vertebral bodies). When the degeneration has reached the stage of sclerosis of the surfaces of the vertebral bodies with osteophytes, instability is not often present; by this time some healing has taken place. We are at present completing a follow-up investigation, which has been carried out by Dr. *Unander-Scharin*, on our lumbosacral osteosynthesis operations, of which we have experience extending over more than ten years. Considering the type of material, the results are fairly good, and in my opinion it seems that the stage of instability ought to be the right time for such an intervention; the patients would then be spared several years of pain. On the other hand, however, our studies have shown that lumbosacral osteosynthesis gives unsatisfactory results in those cases where extensive laminectomies have been performed previously.