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DISC DEGENERATION AND LUMBAGO-ISCHIAS

By

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In the nineteen-thirties *Schmorl* and his associates published several fundamental contributions to our knowledge of the anatomy, pathology and roentgenology of the intervertebral discs. In 1927 he described "Knorpelknötchen", ruptures of the nucleus pulposus into the spongiosa, and two years later "hintere Knorpelknötchen", resembling posterior ruptures towards the spinal canal.

Mixter & Barr's (1934) observation of the importance of disc rupture in the lower lumbar spine in the development of the sciatic syndrome was followed by an increased roentgenologic interest in these changes.

A roentgenologic decrease in the height of a disc has been taken as evidence of disc degeneration, which is one of the conditions necessary for the development of disc protrusion. As far as the lumbosacral disc is concerned, *Badgley* (1937) found it to be decreased in height in 57 per cent of 447 unoperated cases of lumbago-ischias and *Williams* (1937) in 71 per cent of 400 similar cases. *Hodges & Peck* (1937) stated: "Narrow lumbosacral joint space is more common in patients with low back pain radiating along the sciatic nerves than in patients without this symptom-complex. Ratio 4.5: 1". (447 cases of sciatica, 538 controls).

However, it is difficult to state what should be regarded as normal disc height, the normal physiological range of variation evidently being fairly wide. This applies especially to the lumbosacral disc, because this interspace also varies congenitally (*Willis* 1941). Thus, since decreased disc height by itself is not a reliable criterion of disc degeneration, the establishment of a diagnosis requires further roentgenologic signs, a requirement which can be filled by the demonstration of simultaneous evidence of sclerosis of the vertebral margins and/or osteophytes. Another roentgenologic change is sagittal displacement

of the vertebrae in relation to one another. Decreasing height of a disc can result in a downward and backward displacement of the vertebra above because of the dorso-posterior decline of the plane of the joints of the transverse processes in the lumbar spine (*Williams* 1937).

A functional test of the stability of the disc junction is mentioned by *Knutsson* (1944). On the basis of roentgenograms taken in the bent forward and backward position he concluded that "in normal cases parallel displacement does not take place between the vertebral bodies and the tilting between the vertebrae is harmonious and similar all over. When the disc is degenerated, there often appear signs of instability in the form of parallel displacement and abnormal tilting movements between the vertebrae".

As signs of such instability can be demonstrated in a disc showing neither decreased height nor other roentgenographic signs of disc degeneration, there is reason to suppose disc degeneration to be common, but not always demonstrable by routine roentgen examinations. This has been confirmed by *Friberg & Hirsch* (1949). On the basis of post-mortem roentgenologic and anatomic studies of 100 lumbar spines they concluded that "a normal radiograph does not exclude an important degeneration in a disc". But they also found that "when the radiograph showed reduced disc space, sclerosis or osteophytes, the corresponding disc was severely damaged".

A method described by *Lindblom* (1948) for puncturing the disc made possible the detection of changes in the disc not demonstrable by routine roentgenography. Contrast medium in the disc can thus reveal advanced degenerative changes even in the absence of decreased intervertebral space. This method is however technically difficult and its use therefore limited.

It should also be mentioned that *Friberg & Hirsch* (1949) studied the roentgenograms of as many as 9,000 patients with lumbar pain. They claimed that radiography could not give satisfactory information of the condition of the disc in cases of lumbar pain.

Especially in the beginning of the era of intervertebral disc surgery there was evidently a tendency to suppose that a roentgenographically degenerated disc in a patient with sciatica was always the one responsible for the symptoms. However, with increasing frequency it was observed at operations that the protruded disc producing the symptoms of sciatica was not always the one that had shown roentgenographic signs of degeneration. On the contrary, the protruded disc was often of normal roentgenographic appearance. The limited value of routine roentgenography, *i.e.* without contrast medium, in the diagnosis of the level of the disc rupture was pointed out by *Brav, Molter & Newcomb*

(1948) who said that "narrow disc on the roentgenogram cannot be considered clinical evidence of posterior disc protrusion".

In the light of our present knowledge of the mode of development of disc rupture, there is no reason why the protrusion responsible for sciatica should not extend from a roentgenographically normal disc rather than from one with roentgenographic signs of degeneration, since it appears that a certain degree of turgor in the nucleus pulposus is necessary for the development of a disc protrusion. Moreover, the degree of turgor is evidently related to some extent with the height of the intervertebral space. With advancing age the disc undergoes dehydration with consequent decreasing risk of disc protrusion. This implies that the clinical manifestation of such protrusion—lumbago ischias—after reaching a maximum frequency in the 35–45 year age classes gradually becomes less frequent, and in patients above 60 years acute sciatic symptoms are practically hardly never due to disc ruptures, but to some other changes such as vertebral metastases.

The material forming the basis of the investigation accounted for below covered the years 1930–1945 and consisted of 310 conservatively treated patients with lumbago-ischias and with neurologic signs at the time of hospitalisation. The interval between hospitalisation and clinical review was 8–23 years.

Roentgenograms of the lumbar spine taken during hospitalisation of 193 patients and at the time of the review of 91 patients were studied[1]. In 61 cases it was possible to compare the roentgenograms taken at the time of hospitalisation with those taken at the review.

At the roentgen examination an attempt was made to determine the frequency and severity of disc degeneration in the lumbar spine. The conditions to be fulfilled for a roentgen diagnosis of disc degeneration were above all the occurrence of lipping and/or sclerosis of the vertebral margins and the formation of osteophytes, but also changes in the height of the intervertebral discs. Below, then, the term *disc degeneration* is to be understood as lipping and/or sclerosis of the vertebral margins and/or osteophytes. *Pronounced disc degeneration* is to be understood as these changes plus decreased intervertebral space. These terms have been used earlier by *Hult* (1954).

The purpose of the investigation was to reveal a correlation, if any, between the roentgenographic changes and the clinical course.

The occurrence of disc degeneration and pronounced disc degeneration in the 193 patients roentgenographically examined in the course

[1] We beg to express our thanks to Professor Olle Olsson for kindly permitting examination of some of the patients at the Department of Diagnostic Radiology, Lund.

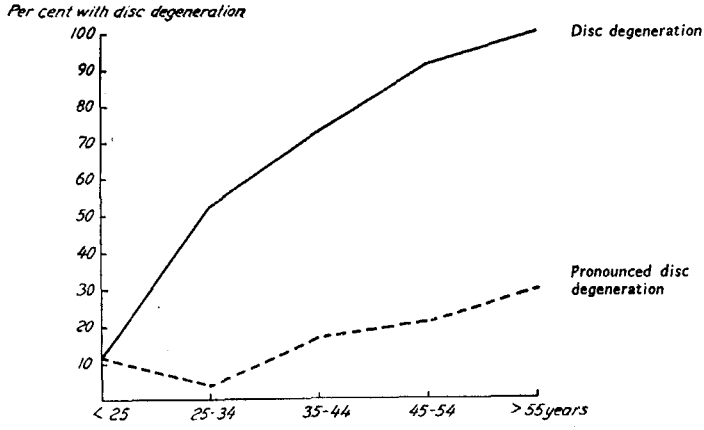

Diagram 1.
Roentgenographic signs of lumbar disc degeneration in 193 patients with lumbago-ischias.

of the years 1930–1945 in association with acute lumbago-ischias is accounted for in Diagram 1. The frequency of lumbar disc degeneration rapidly increases with age and in the 45–54 year age class signs of disc degeneration were seen in as many as 92 per cent. No signs of disc degeneration were demonstrable in 33.2 per cent.

Diagram 2 shows the frequency of degeneration in each disc separately. Such degeneration was most common in the fourth lumbar disc.

Owing to the smallness of the groups, disc degeneration and pronounced disc degeneration are taken together in the diagrams below.

It was thought of interest to compare the frequency of disc degeneration at the time of hospitalisation of heavy workers (85) with the remainder (108) with regard to the frequency of disc degeneration. Disc degeneration was practically equally common in both groups (Diagrams 3 and 4).

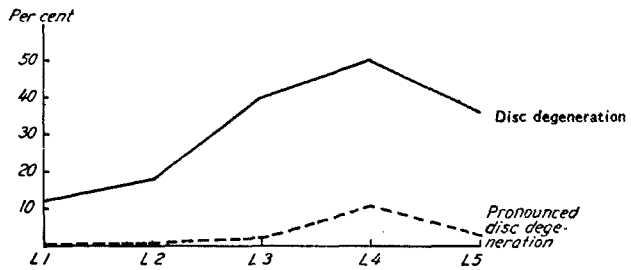

Diagram 2.
Incidence of disc degeneration in the different lumbar discs in 193 patients with lumbago-ischias.

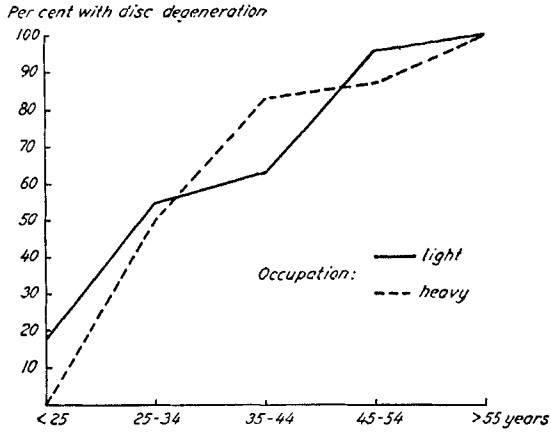

Diagram 3.
Roentgenographic signs of lumbar disc degeneration in 85 heavy workers and in 108 patients with light occupations.

The 91 patients roentgenographically examined at the review were also compared in this way. Most of them were still doing the same type of work as earlier. Strangely enough, the frequency of disc degeneration tended to be higher among those not doing heavy manual labour, but no statistically significant difference was found between the two groups. The frequency of pronounced disc degeneration was highest among those not doing heavy work (34 as against 22 per cent).

The frequency of the symptoms was likewise higher among those not doing heavy work. In these 60 patients some kind of back trouble with or without radiating pain was reported in 57 per cent, as against 32 per cent in the 31 doing heavy work.

It thus appeared that heavy manual labour does not predispose to disc degeneration, but the material is too small to permit any valid conclusions.

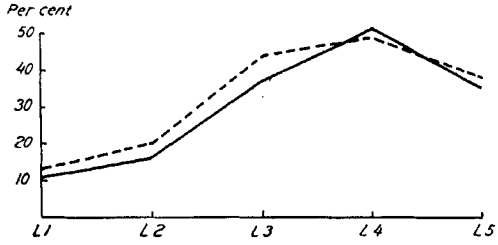

Diagram 4.
Incidence of disc degeneration in the different lumbar discs in 85 heavy workers and in 108 patients with light occupations.

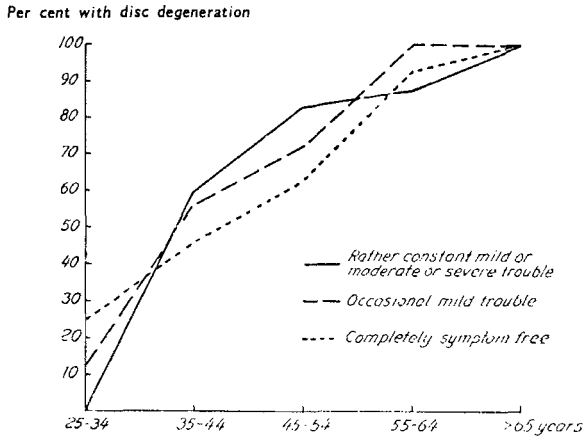

Diagram 5.

Roentgenographic signs of lumbar disc degeneration at hospitalisation in patients who were within the course of 8 years completely symptom-free (69), who had occasional mild trouble (62), and who had rather constant mild or moderate or severe trouble (62).

A question that presents itself is whether it is possible to predict the further clinical course of the disease from roentgenograms taken during the acute stage.

Within the course of 8 years 69 of the 193 patients became completely symptom-free, 62 had only occasional mild trouble, while the remaining 62 had rather constant mild or moderate or severe trouble. Of this last group 82 per cent had some kind of back pain with or without radiating symptoms. Roentgen examination at the time of hospitalisation (Diagrams 5 and 6) did not show a higher frequency of disc degeneration for those with an unfavourable later course.

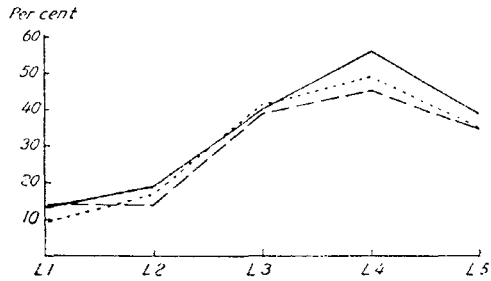

Diagram 6.

Incidence of disc degeneration in the different lumbar discs at hospitalisation in patients who were within the course of 8 years completely symptom free (69), who had occasional mild trouble (62), and who had rather constant mild or moderate or severe trouble (62).

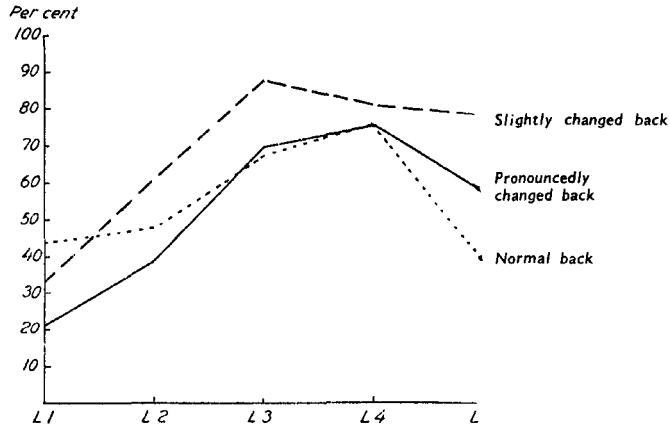

Diagram 7.

Incidence of disc degeneration in the different lumbar discs in patients with normal back (25), with slightly changed back (33), and with pronouncedly changed back (33).

It thus seems that in acute lumbago-ischias roentgenography alone is of little or no prognostic value.

It was also considered of interest to determine any correlation between the clinical state of the back and the frequency of disc degeneration. This possibility was studied in the 91 patients roentgenographically examined at the review. The cases were classed according to the appearance and flexibility of the back into three groups, those with a normal back being assigned to group I (25 cases), with slightly changed back to group II (33 cases), and with pronouncedly changed back to group III (33 cases).

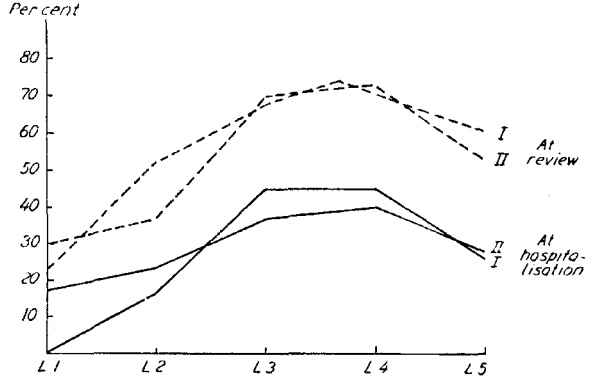

Diagram 8.

Incidence of disc degeneration in the different lumbar discs at hospitalisation and at review in 31 patients without (I) and in 30 patients with (II) back trouble.

Group I consisted of those patients without demonstrable abnormal curvature of the spine in the frontal or sagittal plane and without what the examiner (Söderberg) considered decreased flexibility of the lumbar spine.

Group II comprised those cases which in either or both of these respects showed uncertain or certain but slight deviations from what was considered normal (Group I).

Group III covered those cases with obvious and pronounced spinal changes such as pronounced scoliosis, aplanation of lumbar lordosis, muscle contractures in the lumbar region, decreased flexibility of the spine.

In the first two groups the frequency of back trouble was approximately the same, but in the third it was much higher. Thus, 56 per cent were symptom-free in group I, 54 per cent in group II, but only 21 per cent in group III. The observations made in the clinical examination of these 91 patients thus suggested a correlation between the trouble reported by the patients and pronounced deviations from what was considered a normal back. However, the roentgen examination did not show such a correlation. Disc degeneration was regularly seen in most of the age classes (at the time of roentgen examination practically all of the patients were of a fairly advanced age). The incidence of disc degeneration in the different lumbar discs did not differ widely, and was at any rate not less for those with a normal back than for those with a markedly changed back (Diagram 7). Signs of pronounced disc degeneration were, however, seen more frequently in those patients

TABLE 1

Incidence of vertebral changes classed as Scheuermann's disease.

	Lumbago-ischias material			Control series		
	Males	Females	Total	Males	Females	Total
	%	%	%	%	%	%
Extensive (advanced) changes of type seen in Scheuermann's disease, with kyphosis, wedged vertebrae and irregular-shaped end-plates	15	12	14	6	2	4
Smaller but distinct changes with wedged vertebrae and irregular-shaped end-plates	35	24	32	10	8	9
Uncertain changes with isolated wedged or slightly wedged vertebrae and slightly deformed end-plates ...	24	12	21	19	13	16
No changes of type seen in Scheuermann's disease	26	52	33	65	77	71

with a markedly changed back. Thus the frequency for group I was 23 per cent, for group II 28 per cent and for group III 38 per cent.

Sixty-one of the patients were examined both at the time of hospitalisation and at the review, so that in this material direct comparisons of the roentgenograms could be made. The interval between the first and second roentgen examination was on the average 12 years. At the review 31 of these 61 patients were found to be symptom-free, while the remainder had some kind of back trouble (Diagram 8). Nor did the groups differ here with certainty regarding the frequency of disc degeneration in the acute stage or at the review. At the review pronounced disc degeneration was observed in about 40 per cent of each group.

It has been stressed by *Huwyler* (1952) and *Brocher* (1953) of Switzerland that the occurrence of vertebral body changes classed as Scheuermann's disease are fairly common in patients with sciatica caused by disc rupture. *Huwyler* thus found such roentgenographic changes in two thirds of his cases.

We thought it worth while analysing the roentgenograms from this point of view. In 106 of our cases (80 males and 26 females) roentgenograms were taken of both the thoracic and the lumbar spine. Table 1 shows that in our material vertebral body changes of the type seen in Scheuermann's disease were twice as common as in a control series consisting of roentgenograms taken before electric shock treatment of 200 in-patients (100 males and 100 females) from a mental hospital.

As is apparent from the table, some of the changes were classed as doubtful (21 per cent in the lumbago-ischias series and 16 per cent in the control series). If these doubtful changes be included, the frequency of changes of Scheuermann's type would be 67 per cent in the lumbago-ischias material, as against 29 per cent in the control series. If these doubtful uncertain changes be excluded the corresponding figures would be 46 per cent and 13 per cent.

Our findings thus appear to agree well with those reported by *Huwyler* and *Brocher*.

SUMMARY

An account is given of a series covering the years 1930–1945 and consisting of 310 conservatively treated patients with lumbago-ischias and with neurologic signs at the time of hospitalisation.

Roentgenograms of the lumbar spine taken during the acute stage of the condition in 193 patients and of 91 patients at the review were analysed. Comparative studies were made in 61 cases in which roent-

genograms had been taken both during the acute stage and at the review.

The frequency of disc degeneration was studied. Comparative clinical and roentgenologic analyses were made from four points of view:

1. in heavy workers and others;

2. in patients with and without persistent symptoms during the first 8 years following the acute stage;

3. in patients with an apparently normal back, with a slightly changed back and with a pronouncedly changed back.

4. in patients with and without back trouble at the review and examined roentgenographically both in the acute stage and at the review.

In none of these respects was any certain correlation found between the clinical picture and the roentgenographic signs of disc degeneration.

On the basis of this material it seems that the roentgenographic appearance and severity of disc changes cannot predict the later course of lumbago-ischias.

In a comparison of 106 patients of the present material with 200 controls, vertebral body changes of the type seen in Scheuermann's disease were more common in the lumbago-ischias series (67 per cent as against 29 per cent).

RESUMÉ

Il est rendu compte d'une enquête portant sur un matériel d'observation se rapportant aux années 1930 à 1945 et comprenant 310 malades souffrant de sciatique lombaire. Ces malades avaient été soumis à un traitement conservateur et présentaient des signes neurologiques au moment de leur hospitalisation.

Les radiographies de la colonne lombaire prises à l'état aigu de la maladie chez 193 malades et à l'occasion du réexamen chez 91 malades one été analysées. Des études comparées ont été faites dans 61 cas pour lesquels des radiographies avaient été prises à la fois pendant l'état aigu de la maladie et au moment où le malade a été réexaminé.

La fréquence de la dégénération du disque a été étudiée. Des analyses cliniques et radiologiques comparées ont été faites en partant des quatre points de vue suivants:

1. ouvriers fournissant un travail dur et autres;

2. malades ayant eu ou n'ayant pas eu de symptomes persistants durant les 8 années qui ont suivi l'état aigu de la maladie;

3. malades chez lesquels le dos était apparemment normal, ceux

chez lesquels les altérations étaient faibles et ceux chez lesquels les altérations étaient prononcées;

4. malades ayant souffert ou n'ayant pas souffert de douleurs dorsales au moment du réexamen et radiographiés aussi bien au moment de l'état aigu qu'à celui du réexamen.

Sous aucun de ces rapports l'on n'a trouvé de corrélation entre le tableau clinique et les signes radiologiques de la dégénération du disque.

Sur la base de cette documentation, il semble que l'aspect radiologique et la gravité des altérations du disque ne peuvent rien prédire du cours ultérieur de la sciatique lombaire.

En comparant 106 malades appartenant au matériel d'observation avec 200 malades de contrôle, les altérations du corps vertébral du type constaté dans la maladie de Scheuermann étaient plus communes dans la série des sciatiques lombaires (67 % contre 29 %).

ZUSAMMENFASSUNG

Es wird über ein Krankengut berichtet, das sich über die Jahre 1930–1945 erstreckt und das 310 konservativ behandelte Patienten mit Lumbago-Ischias und neurologischen Symptomen zur Zeit der Aufnahme in das Krankenhaus, enthält.

Die Röntgenbilder der Lendenwirbelsäule von 193 Patienten, die im akuten Stadium der Erkrankung gemacht wurden, und von 91 Patienten, die bei der Nachuntersuchung fotographiert wurden, werden analysiert. Vergleichende Studien wurden in 61 Fällen vorgenommen, in denen Röntgenbilder während des akuten Stadiums und bei der Nachuntersuchung erhalten worden waren.

Die Häufigkeit der Entartung der Zwischenwirbelscheiben wurde untersucht. Vergleichende klinische und röntgenologische Analysen wurden von vier Gesichtspunkten aus gemacht.

1. Schwerarbeiter und andere.

2. Patienten mit und ohne Symptome während der ersten acht Jahre, die dem akuten Stadium folgten.

3. Patienten mit einem scheinbar normalen Rücken, mit einem leicht veränderten und einem ausgesprochen veränderten Rücken.

4. Patienten mit und ohne Rückenbeschwerden bei der Nachuntersuchung, die sowohl im akuten Stadium als auch bei der Nachuntersuchung röntgenologisch untersucht worden waren.

In keiner dieser Gruppen konnte eine sichere Übereinstimmung zwischen dem klinischen Befunde und den röntgenologischen Veränderungen der Zwischenwirbelscheiben gefunden werden.

Auf grund dieses Krankengutes erscheint es unmöglich aus der Schwere der Diskusveränderungen im Röntgenbilde den späteren Verlauf der Lumbago-Ischias vorauszusagen.

Ein Vergleich von 106 Patienten des vorliegenden Materiales mit 200 Kontrollen zeigte, dass Wirbelkörperveränderungen wie man sie bei der Scheuermann'schen Erkrankung sieht, häufiger bei Patienten, die an Lumbago-Ischias litten, beobachtet wurden (das Verhältnis war 67 %: 29 %).

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