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## DISCOGRAPHY IN LOW BACK PAIN AND SCIATICA

### *Analysis of 73 Operated Cases*

*By*

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#### INTRODUCTION

It can now be regarded as an established fact that pathologic changes in the intervertebral discs play a prominent role in low back pain and sciatica. The use of various myelographic techniques—of which myelography with water-soluble contrast medium seems to be the most suitable—has facilitated the diagnosis of disc herniation and provided a basis for rational therapy.

Myelographic examination cannot, however, disclose all types of disc prolapse. The herniation may be so small or at such a site that it does not make any impression in the dural sac or in the opacified root sheath; this applies to the lumbosacral disc in particular.

As far as the reliability of myelography is concerned, Hirsch (1947) reported 23 cases of low back pain and sciatica in which lumbar facetectomy was performed, with negative myelograms in 17 cases. In 15 of these cases, definitely prolapsed discs were removed, whereas in 2 cases compression of the nerve root was ascribed to the presence of osteophytes. Friberg and Hult (1951) found, in an analysis of 103 operated cases, agreement between the findings at operation and a positive myelogram in 95 % of the cases with herniation in the fifth intervertebral space. A prolapsed disc was found at operation in 24 of the 62 cases with a negative myelogram. In 129 cases with a positive myelogram in the fourth intervertebral space, 90 % were positive at operation, whereas operation disclosed herniation of a disc in 14.5 % of the cases with a negative myelogram.

Great interest was aroused by the discographic method of examination for clinical use elaborated by Lindblom and by Hirsch (1948, 1949). This method could be expected to disclose which disc was responsible for the pain, as well as the type of pain produced by it, *i.e.*, lumbago or

sciatica. With this technique, the diagnosis is established both by the roentgenologic appearance of the disc, and by reproduction of the actual pain, by means of injection of contrast medium into the disc spaces, which produces a rise in pressure in the disc.

This method has also been applied in Scandinavia by Fernström and by Walk (1953), the latter author having reported 67 cases.

#### PRESENT INVESTIGATION: CASE MATERIAL

Since 1948, discography has been performed in more than 500 cases at the Roentgen Diagnostic Department of Karolinska Sjukhuset. A detailed clinical and roentgenologic analysis has been made of 73 patients who underwent operation. In most of these cases, both myelography and discography of the three lowest lumbar discs were performed.

TABLE I  
*Case material in the present investigation.*

| Clinical signs of<br>root involvement | Orthopaedic Clinic,<br>Karolinska Institutet |       |    | Military Dept. of Surgery,<br>Karolinska Sjukhuset |       |    |
|---------------------------------------|----------------------------------------------|-------|----|----------------------------------------------------|-------|----|
|                                       | Men                                          | Women | %  | Men                                                | Women | %  |
| Negative .....                        | 14                                           | 9     | 55 | 4                                                  | 2     | 19 |
| Uncertain .....                       | 5                                            | 3     | 19 | 5                                                  | 3     | 25 |
| Positive .....                        | 8                                            | 3     | 26 | 14                                                 | 3     | 56 |
| Total .....                           | 27                                           | 15    |    | 23                                                 | 8     |    |
|                                       | 42                                           |       |    | 31                                                 |       |    |

It can be inferred from Table I that the case material consists of patients from the Orthopaedic Clinic of Karolinska Institutet and from the Military Department of Surgery, Karolinska Sjukhuset<sup>1</sup>. The former cases comprise a more complicated and atypical series from the clinical point of view, whereas the latter represent the more average type of cases of low back pain and sciatica.

#### DISCOGRAPHIC EXAMINATION AND CRITERIA

For the technical details of discographic examination, reference is made to the publications of Lindblom (1948, 1950, 1951). Evaluation of

<sup>1</sup> We take this opportunity of thanking Docent Sture Rödén, former Surgeon-in-Chief of the Military Department of Surgery, Karolinska Sjukhuset, for his kindness in placing the case records of the department at our disposal.

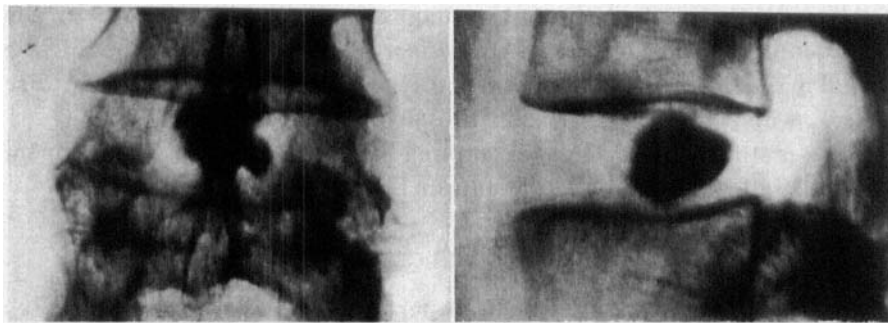


Fig. 1.  
Normal discogram.

the findings is based both on a roentgen-anatomic analysis of the disc, and on recording of the pain felt by the patient on puncture of the posterior longitudinal ligament, as well as distension of the disc spaces by the contrast medium injected. The contrast medium then also serves as an indicator that the disc has been entered on injection. If the pain thus elicited has been of the same nature as the patient's usual pain, it has been denoted as typical, otherwise as atypical. In some cases no pain was elicited. The fact that injection of contrast medium does not constitute a chemical irritation but a mechanical one has been demonstrated by Hirsch (1949), who produced a similar reaction by injection of physiologic saline into the discs.

The *anatomic features* of the discograms were evaluated according to the following criteria:

*Normal disc.* Two different types of normal discogram are seen. One has the appearance shown in Fig. 1, with a large, relatively well delimited space lying somewhat dorsally in the disc. The other type shows two opacified layers, lying one above the other, and communicating through a narrow, central channel.

*Severe disc degeneration* (Fig. 2). The opacified disc space is greatly enlarged as far as the periphery of the disc, and its outline is irregular.

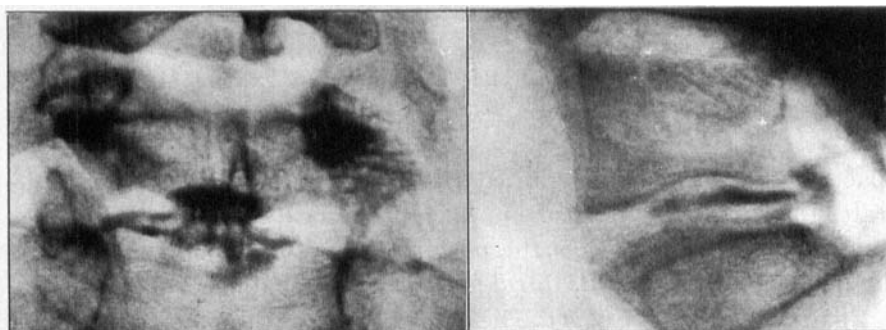
*Dorsolateral rupture without leakage.* From the usually enlarged disc space, a more or less sharply delimited streak of contrast medium runs posteriorly or postero-laterally. The rupture extends to the periphery of the disc. Roentgenologically, the appearance is the same as in the following group, except for the demarcation of the retrodiscal space seen in the latter (Fig. 3).

*Ruptured disc with demarcated retrodiscal leakage.* From the disc



*Fig. 2.*

Severe disc degeneration. The opacified disc space is greatly enlarged as far as the periphery of the disc. Its outline is irregular.



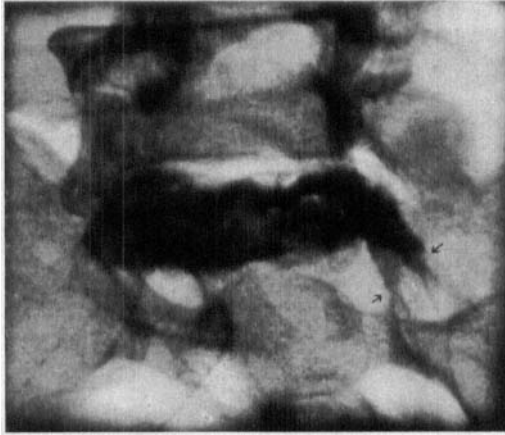
*Fig. 3.*

Ruptured disc with demarcated retrodiscal leakage. A more sharply delimited rupture runs posteriorly from the disc space. It penetrates the disc surface, and is seen as a local accumulation of contrast medium *below* the posterior longitudinal ligament (bulging disc).



*Fig. 4.*

Epidural leakage. The disc space communicates through a posterior rupture with the epidural space. Note leakage in form of opacified streaks (arrow).



*Fig. 5.*  
Perineural leakage (arrow).

space, a more sharply delimited rupture runs posteriorly and penetrates the surface of the disc, appearing as a local accumulation of contrast medium, either *below* the posterior longitudinal ligament (bulging disc) (Fig. 3) or *on its dural aspect* (perforated disc rupture).

*Epidural leakage* (Fig. 4). The disc space shows the aforementioned signs of degeneration. In addition, there is a usually well-defined posterior rupture, which has perforated the posterior longitudinal ligament. The disc space communicates through the herniation with the epidural space; this is shown by the leakage of streaks of contrast medium around the dural sac.

*Perineural leakage* (Fig. 5). Leakage of contrast medium around the nerve roots in the intervertebral foramina occurs in the same way if the rupture runs more postero-laterally, and thus does not involve the actual spinal canal. On the discogram, disc degeneration is visible, and a rupture from which opacified streaks extend laterally and downwards into the intervertebral foramina.

Similarly, perforated ruptures running anteriorly may produce paravertebral leakage of contrast medium. In the present series, this was uncommon. In some cases with anterior herniation, injection of contrast medium produced pain, localized by the patient to the abdomen.

## OPERATIVE FINDINGS

Operation generally consisted of partial hemilaminectomy with removal of the ligamentum flavum. The extradural approach was used. The operative findings were classified as follows:

- Herniated disc
- Bulging disc
- Negative findings

By herniated disc is meant a local, delimited prolapse of the posterior or postero-lateral surface of the disc. Protrusion or bulging disc, on the other hand, consists of a more generalized bulging of the posterior part of the disc. If sequestra have penetrated both the annulus and the posterior longitudinal ligament, a perforated disc is present. However, herniation of a disc according to the foregoing criteria does not necessarily produce compression or displacement of a nerve root. This is nevertheless generally the case, since clinical signs of compression cannot arise until this occurs.

The findings at operation are recorded in Tables II and III.

EVALUATION OF THE RELIABILITY OF DISCOGRAPHY  
AND MYELOGRAPHY

Evaluation of the reliability of discography and of myelography was based on the findings at operation. It must, however, be pointed out that prolapse of an intervertebral disc can be regarded as an inconstant, mobile phenomenon, and that it may vary with such factors as the curvature of the spine and the results of manipulation. This variability is also indicated by the terms "concealed and naked herniations" used in the English-speaking countries.

The correlation between the results of discography and myelography and the findings at operation in the fourth and fifth intervertebral spaces is shown in Tables II and III. No discographic symptom or symptom complex typical of herniation of the disc can, as is seen, be inferred from the tables, the symptoms being fairly evenly distributed in the three groups of operative findings.

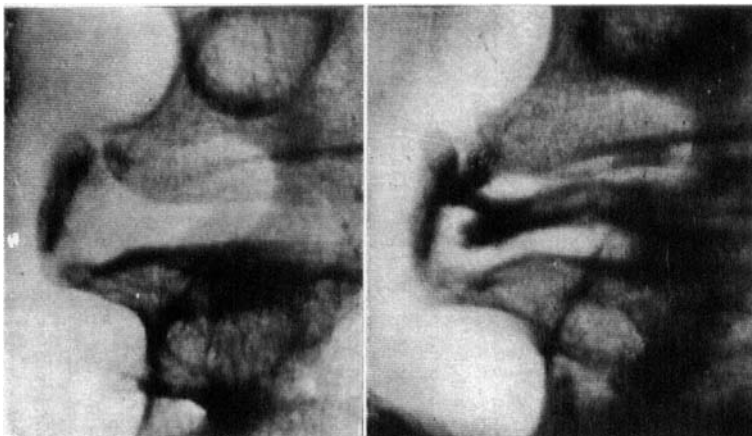
The most remarkable feature is that not even the typical pain on injection—which, theoretically, was expected to be a criterion of herniation of a disc compressing the posterior ligament or the nerve root—shows any uniformity. More than 50 % of the patients in whom no disc herniation was found at operation stated that they felt "typical

TABLE II  
*Correlation between discography, myelography and operative findings in L<sub>4</sub>-L<sub>5</sub>.*

| Discographic findings                            | Herniated disc<br>15 cases | Bulging disc<br>10 cases | Negative laminectomy<br>23 cases |
|--------------------------------------------------|----------------------------|--------------------------|----------------------------------|
| Normal disc .....                                | 0                          | 0                        | 13 0/0                           |
| Severe disc rupture .....                        | 66.5 0/0                   | 50 0/0                   | 39 0/0                           |
| Dorsolateral rupture .....                       | 27 0/0                     | 50 0/0                   | 39 0/0                           |
| Demarcated retrodiscal leakage .                 | 56 0/0                     | 30 0/0                   | 32 0/0                           |
| Rupture with epidural leakage...                 | 20 0/0                     | 40 0/0                   | 8.7 0/0                          |
| Rupture with perineural leakage                  | 0                          | 0                        | 8.7 0/0                          |
| Pain on puncture of post.<br>longitud. lig. .... | 53 0/0                     | 60 0/0                   | 43.5 0/0                         |
| No pain on injection .....                       | 20 0/0                     | 20 0/0                   | 22 0/0                           |
| Atypical pain on injection .....                 | 27 0/0                     | 30 0/0                   | 26 0/0                           |
| Typical pain on injection .....                  | 47 0/0                     | 50 0/0                   | 61 0/0                           |

Myelograms (hatched areas = herniations).

| Herniation<br>7 cases | Bulging disc<br>10 cases | Negative laminectomy<br>14 cases |
|-----------------------|--------------------------|----------------------------------|
| 100 0/0               | 20 0/0                   | 7.2 0/0                          |



*Fig. 6.*

Relation between disc degeneration and formation of osteophytes (cf. Table IV).

pain" on injection of contrast medium. This may be due to many reasons. Correct evaluation of the patient's statements, when he compares the pain elicited by injection of contrast medium into the disc with his "own" spontaneous pain, *e.g.* that of sciatica, requires great exactitude and critical ability on the part of the examiner. A drawback in large roentgenologic departments is that several physicians deal with such highly specialized investigations as discography, in which analysis of the patient's sensation of pain is, in fact, of paramount importance. Due consideration to these points of view would presumably lead to better diagnostic results of discography.

Moreover, it can be emphasized that the case material from the Orthopaedic Clinic differs from the ordinary series of cases of herniated disc. This is also evident from Table I. The material contained several cases with uncertain neurologic symptoms, earlier treated conservatively, as well as various kinds of cases for investigation, with atypical, sciatica-like symptoms. A more typical series of disc herniations would certainly be better amenable to discographic analysis, particularly with respect to comparison between the pain produced on discography and the patient's spontaneous pain. This was apparent from analysis of the case material from the Military Department of Surgery. The latter series alone is, however, too small for a statistical analysis.

A comparison was also made between the findings on conventional roentgenograms and on discograms. The development of changes associated with rising age can be inferred from Table IV. Moreover, it is

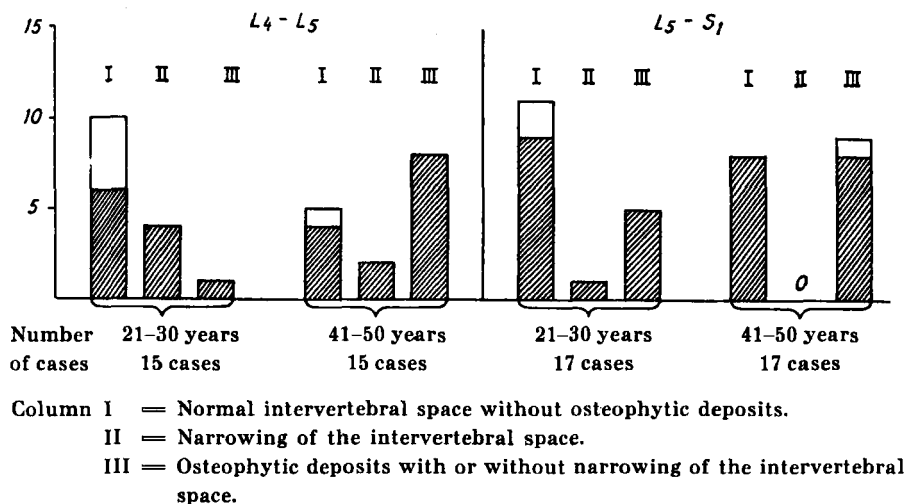
TABLE III  
Correlation between discography and operative findings in L<sub>5</sub>-S<sub>1</sub>.

| Discographic findings                            | Herniated disc<br>10 cases | Bulging disc<br>8 cases | Negative laminectomy<br>25 cases |
|--------------------------------------------------|----------------------------|-------------------------|----------------------------------|
| Normal disc .....                                | 0                          | 12.5 0/0                | 8 0/0                            |
| Severe disc rupture .....                        | 70 0/0                     | 63 0/0                  | 52 0/0                           |
| Dorsolateral rupture .....                       | 30 0/0                     | 25 0/0                  | 36 0/0                           |
| Demarcated retrodiscal leakage .                 | 20 0/0                     | 38 0/0                  | 16 0/0                           |
| Rupture with epidural leakage...                 | 40 0/0                     | 0                       | 12 0/0                           |
| Rupture with perineural leakage                  | 10 0/0                     | 0                       | 8 0/0                            |
| Pain on puncture of post.<br>longitud. lig. .... | 50 0/0                     | 63 0/0                  | 40 0/0                           |
| No pain on injection .....                       | 0                          | 22.5 0/0                | 20 0/0                           |
| Atypical pain on injection .....                 | 30 0/0                     | 25 0/0                  | 24 0/0                           |
| Typical pain on injection .....                  | 70 0/0                     | 50 0/0                  | 56 0/0                           |

Myelograms (hatched areas = herniations).

| Herniation<br>7 cases | Bulging disc<br>7 cases | Negative laminectomy<br>14 cases |
|-----------------------|-------------------------|----------------------------------|
| 86 0/0                | 29 0/0                  | 7.2 0/0                          |

TABLE IV  
Correlation between the age groups 21-30 years and 41-50 years on conventional roentgenograms and discograms.



seen in this table that narrowing of the intervertebral space and the presence of osteophytes (Fig. 6) implies degeneration of the relevant disc. It must, however, be borne in mind that an intervertebral space of normal width and the absence of osteophytes do not necessarily mean that the disc is normal.

In the present series, no complication occurred in connection with discography, but in the whole series of about 500 cases at Karolinska Sjukhuset, spondylitis appeared in three cases. It healed without complications following customary antibiotic therapy.

#### CONCLUSIONS

The following conclusions can be drawn from the present investigation. There seems to be good reason, at the present time, to stick to the use of myelography with injection of water-soluble contrast medium in routine examination for disc herniation producing nerve-root compression in patients with low back pain and sciatica.

Discography, on the other hand, can be used as a complementary method of examination. The indications for discographic examination in routine clinical work can be briefly summarized as follows:

1. Cases of low back pain and sciatica in which myelography has, for some reason, given no grounds for a local diagnosis, and in which operation is regarded as indicated on account of the clinical features. This often applies when operation has been performed earlier, and the postoperative myelographic changes cannot be distinguished with certainty from recurrent disc herniation. In such cases, a complementary discographic examination, with particular attention focused on the pain elicited by injection of contrast medium, may allow localization of the pathologic disc responsible for the current symptoms.

2. Cases of chronic low back pain with a negative myelogram, in which indications for operation are regarded to be present for the same reason as in the preceding group.

3. Cases for investigation, particularly insurance cases, with obscure pain. A discogram may then contribute to establishing the origin of the pain, and provide a basis for subsequent therapy.

#### SUMMARY

A roentgenologic analysis has been made in 73 cases of low back pain and/or sciatica. Operation had been performed in every case, and the majority had undergone both myelography and discography.

The investigation has been unable to show that discography is superior to myelography for routine diagnosis of herniation of an intervertebral disc. It is, however, pointed out that it is difficult, in part of the present series, to make a discographic analysis.

Il a été procédé à une analyse radiologique dans 73 cas de douleurs lographic examination. In severe cases of low back pain and sciatica, where conservative treatment has failed and the myelographic findings are inconclusive, discography should be of value. Also in cases with pain of uncertain origin, in which spinal osteosynthesis is contemplated, and insurance cases when a complete roentgenologic analysis is desirable, discography is useful. Discography should also be used to complement myelographic examination in cases of suspected recurrence of disc-herniation in which the myelographic findings are inconclusive.

#### RESUME

Il été procédé à une analyse radiologique dans 73 cas de douleurs dans le bas du dos et/ou de sciatique. L'opération a été pratiquée dans tous les cas et chez la majorité des malades, il a été effectué aussi bien la myélographie que la discographie.

L'enquête n'a pas été en mesure de montrer que la discographie est supérieure à la myélographie pour poser le diagnostic routinier de l'hernie d'un disque intervertébral. Il est souligné, néanmoins, qu'il est difficile de faire une analyse discographique dans une partie de la présente série.

Il est suggéré d'utiliser la discographie comme complément à l'examen myélographique. Dans les cas graves de douleurs dans le bas du dos et de sciatique où le traitement conservateur n'a pas donné de résultats et lorsque les trouvaillies myélographiques sont inconclusives, la discographie peut avoir de la valeur. Elle est utile également dans le cas de douleurs d'origine incertaine dans lesquels une ostosynthèse spinale peut être prise en considération ou dans les cas où, pour des questions d'assurance, il est préférable d'avoir une analyse radiographique complète. La discographie doit aussi être utilisée comme complément à l'examen myélographique dans les cas suspectés être des récidives d'une hernie discale, lorsque les trouvaillies myélographiques sont inconclusives.

#### ZUSAMMENFASSUNG

In 73 Fällen von Lumbago und-oder Ischias wurde eine röntgenologische Analyse ausgeführt. Operation war in jedem Falle vorgenommen worden und die Mehrzahl der Patienten waren mittels Myelographie und Diskographie untersucht worden.

Die Untersuchung vermochte nicht aufzuzeigen, dass die Diskographie der Myelographie bei der Diagnose des Bandscheibenforfalles überlegen ist. Es wird jedoch hervorgehoben, dass die Deutung der Diskographie in einem Teil der vorliegenden Reihenfolge schwierig ist.

Man schlägt daher vor, dass die Diskographie als eine die Myelographie ergänzende Untersuchung angewendet werden sollte. In schweren Fällen von Lumbago und Ischias, in denen konservative Behandlung vergebens war und die myelographischen Befunde unsicher sind, dürfte die Diskographie wertvoll sein. In Fällen mit Schmerzen unbestimmten Ursprungs, in denen eine Wirbelsäulenversteifung in Betracht kommen kann und in Versicherungsfällen, in denen eine vollständige röntgenologische Analyse wünschenswert erscheint, ist die Diskographie ebenfalls nützlich. Die Diskographie sollte auch in Fällen von Verdacht auf Rezidiv von Bandscheibenvorfall, in denen die myelographischen Befunde nicht überzeugend sind, angewendet werden, um die myelographische Untersuchung zu ergänzen.

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