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THE COMPARATIVE RELIABILITY OF PREOPERATIVE DIAGNOSTIC METHODS IN LUMBAR DISC SURGERY

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The purpose of the present study is to review a large series of operations with a view to assessing the reliability of different diagnostic methods in cases of suspected lumbar disc herniation.

MATERIALS

The series, which comprises 1986 cases, is made up of all the patients who were operated for suspected lumbar disc herniation at the Orthopaedic Department of Karolinska Institute during the period 1939-64. Cases that had already been operated under this diagnosis at another hospital and reoperated at this Department have been excluded.

The distribution by age and sex is shown in Table 1.

Table 1. Age at operation

	Less than 20 years	20-29 years	30-39 years	40-49 years	50-59 years	More than 60 years	Total
Men	11	210	475	398	150	34	1278
64%							
Women	14	105	291	208	70	20	708
36%							
	25	315	766	606	220	54	1986

METHOD

Relevant data obtained by a thorough perusal of all case records have been processed in a computer.

Table 2. Operative findings

Herniations	Negative	Other findings	Total
1475	271	240	1986
74.3%	13.6%	12.1%	100%

DEFINITIONS AND RESULTS

The findings at operation are given in Table 2.

Herniations: Prolapsed discs with or without free sequestra as well as protruding discs that in the surgeon's opinion exert pressure on the nerve root. *Negative:* Normal conditions or disc degeneration without protrusion. *Other findings:* Disc protrusion without involvement of the nerve root, markedly dilated "varicose" paradiscal vein plexa, crowding due to osteophytes, remarkedly thick ligamentum flavum, radiculite with adherences.

The distribution of definite positive findings in cases with normal anatomy (5 lumbar vertebrae) is shown in Table 3. Positive findings in the presence of anomalies such as transitional vertebrae and six or four lumbar vertebrae have not been included because at operation in

Table 3. Distribution of herniations at operation

L ₃ -L ₄	L ₄ -L ₅	L ₅ -S ₁	Total
35	696	672	1403
2.5%	49.6%	47.9%	100%

Table 4. Total material accordance between operative and diagnostic findings

	Right	Wrong	Total
Neurol.	797	939	1736
Diagnosis	46%	54%	100%
Myelography	1227	251	1478
	83%	17%	100%
Discography	12	28	40
	30%	70%	100%
Plain	533	1058	1591
X-ray	34%	66%	100%

such cases it was not possible to determine which root was involved (72 cases).

Three methods—neurological examination, myelography with positive contrast and discography—had been used for preoperative diagnosis of level. The diagnosis with each of these methods was correlated to the findings at operation with the results shown in Table 4.

As a rule, the preoperative investigation also included a plain X-ray examination of the lumbar spine, partly in order to visualize the anatomy and partly to ensure that the patient's pain was not due to non-discogenic causes. Although this examination was not in fact used as an aid for diagnosing the level of the lesion, the results of plain X-ray were correlated to the findings at operation in the same way as the other methods (Table 4), because it has sometimes been stated, particularly in older literature, that an X-ray examination may be of some help in this respect.

The result of an examination was classified as "right" only if it unequivocally agreed with the finding at operation: in other words, if the method would have been sufficient by itself for an exact diagnosis of level.

In the neurological diagnosis, only objective findings were accepted. Loss or impairment of the Achilles reflex with or without paresis of triceps surae was taken to indicate affliction of S1, paresis of foot or toe extensors (or pronators of the foot) for affliction of L5 and loss or impairment of the patellar reflex with or without paresis of quadriceps for involvement of L4.

Data on the neurological diagnosis of level proved insufficient in 250 cases.

In the case of myelography, impressions in the dural sac, dislocation of root sheath or unilateral absence of contrast filling of a root sheath were taken to indicate herniation of a disc.

In the case of discography, the diagnosis was based on the location of injection pain rather than the presence of disc rupture.

In the case of plain X-ray, the diagnosis was accepted as correct if the disc height was reduced only at the level or levels at which herniation was discovered during the subsequent operation.

DISCUSSION

According to the criteria listed above, a plain X-ray examination gave a correct diagnosis in 34 per cent of the cases. This agrees with observations by Friberg (1941) in a series of 44 cases, for which the figure

was 32 per cent. Norlén (1944) had 20 per cent correct diagnoses in a series of 96 cases.

It seems clear that this method of examination is of no value as an aid for diagnosing the level of disc herniation.

Discography was used in the present series only as a complementary examination in cases where an exploration seemed to be called for in spite of negative myelography. This is one of the uses of discography proposed by Nordlander et al. (1958). In the present series, however, discography was of no assistance in the matter of level, giving a correct diagnosis in only 30 per cent of the cases. Furthermore, Fernström (1961) has convincingly shown that discography cannot be used to establish the presence of a herniated disc.

Myelography with positive contrast gave a correct diagnosis in 83 per cent of the cases. This result is in good agreement with those published by several other authors. Friberg & Hult (1951), for instance, reported a figure of 75 per cent (including previously operated cases), Knutsson (1961) 79 per cent, Lansche et al. (1960) 81 per cent, and Hirsch & Nachemson (1963) 86 per cent.

Concerning the neurological examination, the present study was confined to findings that are relatively amenable to objective assessment.

According to Knutsson, pain projection, impaired sensibility, muscle atrophy and Lasègue's sign are of little value for a clinical diagnosis of level. In the case of pain localization, confirmation of this opinion can be derived from experimental studies by Norlén (1944). On mechanical stimulation of nerve roots exposed during operation, only 19 out of 89 cases displayed pain characteristic of various syndromes as defined by Norlén.

The findings at operation clearly agreed with the neurological diagnosis in 46 per cent of the cases in the present series. This figure is in good agreement with the results of Friberg & Hult (54 per cent) and Knutsson (42 per cent).

The neurological diagnosis of level thus seems to be so unreliable that it may be wrong as often as it is right. This may seem odd, particularly in view of the experimental observations by Norlén, for instance, that the first sacral root is of primary importance for the Achilles reflex in preoperative root blockade. A reasonable explanation seems to be that a herniated disc frequently involves more than one nerve root. At the same time, there may be other circumstances which rule out an exact neurological diagnosis of level. Some patients, for example, may have residual neurological symptoms after an earlier bout of sciatica with compression of another nerve root. Furthermore,

a number of herniated discs may pass undetected, as at this Department it is the custom not to expose several levels once a positive finding has been made. A lateral sequester may compress only the root issuing from the space immediately above. In addition, there will be a certain proportion of innervation anomalies.

SUMMARY AND CONCLUSIONS

In a series of 1986 operated patients, preoperative X-ray examination of the lumbar spine was performed in 1591 cases, discography in 40, a neurological examination in 1736 and myelography with positive contrast in 1487 cases.

The proportion of undoubtedly correct level diagnoses was 34 per cent for plain X-ray, 30 per cent for discography, 46 per cent for the neurological examination, and 83 per cent for myelography.

It is concluded that plain X-ray, like discography, is of no value for diagnosing the level of herniated disc, that the relative unreliability of the neurological diagnosis is probably largely due to prolapse of a disc often involving more than one nerve root, and that myelography is indispensable unless one is prepared to expose several spaces as a routine procedure in operations for disc herniation.

REFERENCES

- Fernström, U. (1960) A discographical study of ruptured lumbar intervertebral disc. *Acta chir. scand.*, Suppl. 258.
- Friberg, S. (1941) Low back and sciatic pain caused by intervertebral disc herniation. *Acta chir. scand.*, Suppl. 64.
- Friberg, S. & Hult, L. (1951) Comparative study of abrodil myelogram and operative findings in low back pain and sciatica. *Acta orthop. scand.* 20, 303.
- Hirsch, C. & Nachemson, A. (1963) The reliability of lumbar disc surgery. *Clin. Orthop.* 29, 189.
- Knutsson, B. (1961) Comparative value of electromyographic, myelographic and clinical-neurological examination in diagnosis of lumbar root compression syndrom. *Acta orthop. scand.*, Suppl. 49.
- Lansche, E. W. & Ford, L. T. (1960) Correlation of the myelogram with clinical and operative findings in lumbar disc lesions. *J. Bone Jt Surg.* 42 A, 193.
- Nordlander, S., Saleń, E. F. & Unander-Scharin, L. (1958) Discography in low back pain and sciatica. *Acta orthop. scand.* 28, 90.
- Norlén, G. (1944) On the value of the neurological symptoms in sciatica for the localization of lumbar disc herniation. *Acta chir. scand.*, Suppl. 91.

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