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THE SIGNIFICANCE OF NEUROLOGICAL SIGNS AND MYELOGRAPHIC FINDINGS IN THE DIAGNOSIS OF LUMBAR ROOT COMPRESSION

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It is generally held that the result of lumbar disc surgery depends entirely on whether one manages to detect and remedy compression of a root (Hirsch 1965 and others). It is consequently most important to make the diagnosis as definite as possible. This is primarily a question of determining whether a root compression is present and, if so, where. The two main methods available for this preoperative diagnosis are neurological and myelographic examinations. The reliability of these and other diagnostic methods was investigated in a previous study comprising a series of 1986 operated patients. It was found that myelography with positive contrast (performed in 1478 cases) definitely gave the right diagnosis of level in 83 per cent, whereas the corresponding figure for neurological diagnosis (performed in 1736 cases) was 46 per cent. In other words, myelography is definitely superior for an exact diagnosis of level. Since about 95 per cent of all disc herniations concern the two lowest lumbar spaces (Aronson & Dunsmore 1963), many surgeons refrain from myelography and simply explore these spaces as a matter of routine (Bradford & Spurling 1947, O'Connel 1951, Semmes 1964).

If the decision to operate is based chiefly on the presence of neurological signs, it is important to know the extent to which these signs reflect disc herniation. This incidence has been reported as 89 per cent by Friberg & Hult (1951) and as 83 per cent by Hirsch & Nachemson (1963).

It would also be useful to know if some particular neurological sign was specially reliable as an indicator of the presence of disc herniation. This question does not appear to have been studied at all closely in the literature, however; the same applies to the ques-

tion of whether there is any difference in the incidence of disc herniation with isolated neurological signs compared with cases having signs from several roots.

The straight leg raising test introduced by Lasègue (1864) has been accorded great importance in the diagnosis of lumbar root compression; Waris (1948) regarded a positive Lasègue as a precondition for undertaking an operation. Crossed Lasègue, in particular, has been regarded as almost pathognomonic for root compression.

The myelographic examination is associated with a certain, though slight incidence of complications and is therefore not undertaken without definite indications. In view of this, might not myelography be omitted in the group of cases that display a monoradicular loss of function? The diagnosis of level as analyzed by Ståhl (1949) appears to be almost as reliable as the myelographic method: 80 per cent of cases with isolated impaired Achilles reflex had disc herniation at the level of L5–S1, and 83 per cent of extensor pareses as the sole symptom corresponded to disc herniation at the level of L4–L5.

Myelographic findings are reported to agree with the findings at operation in between 80 and 90 per cent of most large series (Friberg & Hult 1951, Lansche & Ford 1960, Hirsch & Nachemson 1963, Hakelius & Hindmarsh 1972). The incorrect diagnoses, which thus amount to between 10 and 20 per cent, may be false positive or false negative. In the case of the latter, it would be interesting to know in which space disc herniation most frequently escapes myelographic diagnosis. According to Friberg & Hult, false negative findings tend to refer to the space L5–S1.

Certain cases of severe, prolonged sciatica will always oblige the orthopaedic surgeon to operate, even though there are neither neurological nor myelographic signs of a prolapsed disc. It is naturally of interest to know how often disc herniation is actually found in such cases (Hirsch & Nachemson reported positive findings in 11 per cent of such cases) as well as where any positive findings are located.

The present paper is therefore concerned with the following questions:

1. What is the frequency of positive operative findings among cases presenting the common neurological signs of lumbar disc herniation?
2. Does the incidence of prolapsed discs differ between monoradicular and polyradicular syndromes?

3. What connection is there between different degrees of Lasègue's sign and the incidence of detected prolapsed discs?
4. How reliable is the diagnosis of level in the presence of monoradicular signs?
5. Where are positive surgical findings located after negative myelography?
6. How often and where can one expect to find prolapsed discs in the absence of both neurological and myelographic signs?

MATERIAL

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.

METHODS

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

DEFINITIONS

Positive: 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, remarkably thick ligamentum flavum, radiculite with adherences.

RESULTS

The findings at operation in all the patients who presented one of the six objective neurological signs registered are shown in Tables 1–6. The total proportion of positive findings is much the same for each type of sign, varying between 75 and 80 per cent. It will also be seen that the incidence of disc herniation among patients with loss of Achilles reflex is 10 percentage points higher than among those in

Table 1. Operative findings in all cases with disturbance of the patellar reflex

	Pos.	Other	Neg.
Patellar reflex absent	59% 16/27	19% 5/27	22% 6/27
Patellar reflex weak	79% 97/123	8% 10/123	13% 16/123
Total	75% 113/150	10% 15/150	15% 22/150

Table 2. Operative findings in all cases with disturbance of the Achilles reflex

	Pos.	Other	Neg.
Achilles reflex absent	84% 442/530	8% 44/530	8% 44/530
Achilles reflex weak	74% 319/421	13% 51/421	13% 51/421
Total	80% 761/951	10% 95/951	10% 95/951

Table 3. Operative findings in all cases with paresis or paralysis of extensor hallucis

	Pos.	Other	Neg.
Paralysis of extensor hallucis	76% 16/21	5% 1/21	19% 4/21
Paresis of extensor hallucis	78% 525/668	11% 72/668	11% 71/668
Total	79% 541/689	10% 73/689	11% 75/689

Table 4. Operative findings in all cases with more extensive paresis or paralysis of dorsal extensors

	Pos.	Other	Neg.
Paralysis of dorsal extensors	72% 10/14	7% 1/14	21% 3/14
Paresis of dorsal extensors	76% 277/367	13% 50/367	11% 40/367
Total	75% 287/381	14% 51/381	11% 43/381

whom this reflex was weak (Table 2). On the other hand, patients with loss of patellar reflex had an incidence of disc herniation 20 percentage points lower than those in whom this reflex was weak (Table 1). Furthermore, the proportion of positive findings at operation was slightly smaller among patients with extensive pareses of dorsal exten-

Table 5. Operative findings in all cases with paresis or paralysis of triceps

	Pos.	Other	Neg.
Paralysis of triceps	100% 1/1	0% 0/1	0% 0/1
Paresis of triceps	77% 84/109	9% 10/109	14% 15/109
Total	77% 85/110	9% 10/110	14% 15/110

Table 6. Operative findings in all cases with paresis or paralysis of quadriceps

	Pos.	Other	Neg.
Paralysis of quadriceps	0% 0/0	0% 0/0	0% 0/0
Paresis of quadriceps	79% 11/14	7% 1/14	14% 2/14
Total	79% 11/14	7% 1/14	14% 2/14

Table 7. Operative findings in isolated and combined neurological signs

	Pos.	Other or neg.
Patellar reflex absent or weak	56% 20/36	44% 16/36
Ditto + other neurological sign(s)	82% 93/114	18% 21/114
Achilles reflex absent or weak	80% 481/599	20% 118/599
Ditto + other neurological sign(s)	80% 280/352	20% 72/352
Paresis or paralysis of extensor hallucis	79% 179/226	21% 47/226
Ditto + other neurological sign(s)	78% 362/463	22% 101/463
More extensive paresis or paralysis of dorsal extensors	75% 146/194	25% 48/194
Ditto + other neurological sign(s)	75% 141/187	25% 46/187

Table 8. Lasègue's sign in relation to operative findings

	Pos.	Other	Neg.
Lasègue $< 30°$	85% 600/707	8% 56/707	7% 51/707
Lasègue 30–60°	76% 629/835	16% 105/835	16% 101/835
Lasègue 60–90°	63% 182/291	18% 53/291	19% 56/291
Lasègue positive, total	77% 1411/1833	12% 214/1833	11% 208/1833
Lasègue negative	45% 56/126	20% 25/126	35% 45/126
Lasègue crossed	87% 407/468	7% 32/468	6% 29/468

Table 9. Operative findings in isolated neurological signs
(Positive findings by level)

	L. III–L. IV	L. IV–L. V	L. V–S. I	Other level	Other or neg. Find
Patellar reflex	14%	36%	3%	3%	44%
Absent or weak	5/36	13/36	1/36	1/36	16/36
Achilles reflex	0%	14%	60%	6%	20%
Absent or weak	2/599	86/599	361/599	32/599	118/599
Paresis or paralysis of dorsal	1%	60%	12%	4%	23%
Extensors and/or extensor hallucis	5/420	252/420	52/420	16/420	95/420

sion than among those with pareses of extensor hallucis only (Tables 3 and 4).

The four most common neurological signs are compiled in Table 7 to give a comparison of the findings at operation when a sign occurred in isolation and when it was combined with some other objective sign or signs. Whether isolated or combined, these signs appear to carry the same incidence of positive findings at operation with the exception of disturbances to the patellar reflex. As an isolated sign this is much less frequently connected with positive findings at operation than when it is combined with some other neurological sign or signs.

Lasègue's sign is related to the findings at operation in Table 8. This test was applied to 1959 patients, and the figures in the table are based on the lowest degree reported preoperatively. Altogether 77 per cent of the cases with positive Lasègue had a positive finding at operation. The degree of Lasègue's sign as classified in the table was inversely proportional to the percentage of positive findings at operation. Disc herniation was found in 87 per cent of the patients with crossed Lasègue. The frequency among those with negative Lasègue was 45 per cent.

Table 9 gives the location of positive findings at operation together with the frequencies of negative or other findings in patients with isolated neurological signs. It will be noted that among cases with absence or impairment of the patellar reflex, disc herniation was located to the space L4–L5 considerably more often than to L3–L4. With disturbances to the Achilles reflex and extensor pareses (paralyses), positive findings at operation tended to be located to the space L5–S1 (60 per cent) and the space L4–L5 (60 per cent) respectively.

Table 10. Location of positive operative findings after negative myelography

	L. III–L. IV	L. IV–L. V	L. V–S. I	Other level
Negative myelography	2% 2/100	24% 24/100	68% 68/100	6% 6/100

Table 11. Operative findings after negative myelography and absence of neurological signs

Herniation L. IV–L. V	Other find L. IV–L. V	Herniation L. V–S. I	Other find L. V–S. I	exploration Neg.
2% 3/156	3% 5/156	18% 28/156	18% 28/156	59% 92/156

The distribution of positive findings at operation between the various levels in cases with negative myelography is shown in Table 10. The level L5–S1 predominates, with no less than 68 per cent of disc herniations compared with 24 per cent at the level L4–L5.

An operation was performed in 156 cases, even though they presented no objective neurological findings or myelographic signs of root compression. The findings at operation are registered in Table 11. Herniation was detected in 20 per cent of the cases and was located to L5–S1 in 28 of the total of 31 patients (90 per cent).

CONCLUSIONS

In the light of these results, the questions listed in the introduction can be answered as follows:

1. The presence of neurological signs corresponds to positive findings at operation in between 75 and 80 per cent of cases. None of the six neurological signs registered here appears to be superior to the rest as an indicator of a prolapsed disc. The absence of an Achilles reflex is a more reliable sign of disc prolapse than impairment of this reflex. (The difference in frequency reported in Table 2 is statistically significant: $0.01 > P < 0.001$.)
2. Disc herniation occurs with the same frequency in mono- as in polyradicular syndromes.
3. Positive Lasègue corresponds to positive findings at operation in 77 per cent of the cases. Crossed Lasègue appears to be the most definite clinical sign of a prolapsed disc.

4. Isolated symptoms of neurological impairment point to the correct level in the two lowest spaces in only about 60 per cent of the cases, and consequently myelography is necessary for an exact diagnosis in these cases as well. The disturbance to the patellar reflex that is customarily associated with disc herniation between L3 and L4 seems to be elicited more frequently by herniation between L4 and L5.
5. More than two-thirds of the prolapsed discs detected after false negative myelography are located to the space L5–S1.
6. Disc herniation is detected in only one-fifth of cases without both myelographic and neurological signs, being located as a rule to L5–S1.

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