

COMPARATIVE STUDY OF ABRODIL MYELOGRAM AND OPERATIVE FINDINGS IN LOW BACK PAIN AND SCIATICA

By

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Abrodil myelography has now come into general use in Scandinavia. Therefore, we considered it would be worth while to correlate clinical symptoms and myelographic and operative findings in an attempt to determine the value of the method, and also the indications for its use in the diagnosis of rupture of the intervertebral disks.

In forming an opinion on a case of sciatica in which operation is considered, there are two questions which demand an answer:

1. Does the patient have an operable ruptured disk?
2. If so, at what level?

The clinical symptoms may be useful in determining which root is exposed to pressure. The following schedule is helpful in this respect:

a) *Pressure on the fourth lumbar nerve root:*

- 1) Pain radiating to the hip and the anterior aspect of the thigh, often not below the knee.
- 2) Knee-jerk absent or weakened.
- 3) Adductor tenderness in the thigh.

The herniation is located laterally in the fourth interspace or possibly in the third interspace.

b) *Pressure on the fifth lumbar nerve root:*

- 1) Radiating pain in the great toe.
- 2) No alterations in reflex activity.
- 3) Paresis in the dorsal extensors of the great toe or the other toes, and often in the pronators of the foot.

- 4) Altered sensibility within the fifth lumbar segment (antero-laterally on the calf, the dorsum of the foot and the great toe).

The herniation is situated in the fourth space or far laterally in the fifth space.

c) *Pressure on the first sacral nerve root:*

- 1) Radiating pain in the heel.
- 2) Ankle-jerk absent or weakened.
- 3) Paresis of the triceps surae and possibly also atrophy of the calf.
- 4) Altered sensibility within the first sacral segment (back of the calf, under the heel and lateral part of the foot).

Herniation situated in the fifth interspace.

As we all know, this type of classification is to some extent based on wishful thinking. We sometimes encounter cases of lumbago and sciatica in which the condition is both severe and of long standing, but in which there are no definite symptoms of root pressure according to the classification. The symptom picture is often mixed and suggests involvement of more than one root. It is not unusual to see cases with unmistakable symptoms from one root in which the rupture is not found in the expected interspace and in which operation reveals that it is exerting pressure on another root than the one indicated by the symptoms. Some of these cases can be explained by the fact that the patient either has a supernumerary vertebra or lacks one. This can be determined by counting the vertebrae on the X-ray, beginning with the atlas. However, as we learned from a few cases, the root symptoms according to the classification may be misleading even though the vertebrae are normal in number. Presumably there are individual variations in the area covered by the various roots.

Nor are the clinical symptoms always easily evaluated. It may be difficult to decide whether paresis or disturbed sensibility is present, and even when there are obvious symptoms of one or both it is open to doubt whether these symptoms remain from an earlier attack of sciatica, thus having nothing to do with the present attack.

Supplementary myelography ought to be valuable in view of the above complicating factors. It is important to use satisfactory, non-toxic and absorbable medium for the purpose. A suitable choice is abrodil ($\text{J CH}_2 \text{ SO}_3 \text{ Na}$) in a twenty per cent solution, the use of which in myelography was described in 1932 by Arnell and Lidström. Abrodil is soluble in water and mixes with the spinal fluid in all proportions, thus giving fine pictures of roots and root pockets. Further, it is

quickly absorbed and disappears from the fluid within 30 minutes. This makes it much preferable to certain other contrast media, e.g. air, thorotrast, pantopaque. The acute irritation caused by abrodil is eliminated by concurrent lumbar anesthesia. The method now used was described by Lindblom in *Acta Radiologica* in 1946.

This method has been employed regularly at the Orthopedic Clinic of the Karolinska Institutet in Stockholm for the majority of clinically certain as well as suspected cases of sciatica pain since the end of 1944. On the basis of our series of more than 1000 cases of abrodil myelography, we consider ourselves justified in stating that this is a safe method of examination. However, there have been some complications. In about 10 cases convulsions and sometimes loss of consciousness developed 4-8 hours after myelography, but these symptoms disappeared in a few minutes and had no disagreeable consequences. The most severe of these cases gave the impression of being typical epileptic attacks. The cause of this complication is unclear, but probably has something to do with the presence of free iodine in the contrast medium. It is also important to check the effectiveness of lumbar anesthesia; if not, there may be severe radiating pains in both legs. The usual complications of lumbar puncture and lumbar anesthesia—headache, nausea and giddiness—were, of course, also observed in some cases, but lasted only a short while. During the years 1945-1948 operations were performed in 322 cases of sciatica, which had been examined myelographically. These are the cases that make up the following material.

This is classified according to the following system:

I. Operated cases with positive myelography	259
A. Herniation in the fifth interspace	107
B. Herniation in the fourth interspace	144
C. Herniation in the third interspace	3
D. In more than one interspace	5
II. Operated cases with negative myelography	62
III. Non-operated cases with positive myelography	22

The data on the clinical symptoms was unclear in some cases, the myelographic findings were uncertain and, occasionally, the operation did not give a final verdict one way or the other. As a result, some of the cases in the series were not included in the present study.

I. A. *Myelography indicative of herniation in the fifth lumbar interspace.*

119 cases altogether

4 „ not included for various reasons

12 „ not operated upon (assembled in a special group).

103 cases thus remain for consideration.

- 1) In 95 of these 103 cases operation revealed a herniation in the fifth interspace. Of these 95:—
 - a) 76 cases showed clear and unmistakable clinical symptoms of pressure on the first sacral root.
 - b) 8 cases showed clinical symptoms from the fifth lumbar and the first sacral nerve roots.
 - c) 2 cases had clinical symptoms from the fifth lumbar root only.
In one case the herniation was situated far laterally in the fifth interspace with pressure on the fifth lumbar nerve root.
 - d) 9 cases had no neurological symptoms.
- 2) In 8 cases operation revealed no herniation in the fifth interspace: This group may be subdivided as follows:
 - a) 2 cases had no definite neurological symptoms (myelography was uncertain in one of them).
 - b) 5 cases showed neurological symptoms, in two of them only from the first sacral, and in the rest, from several nerve roots. Four of the five had been operated upon earlier, which illustrates the difficulty of diagnosing cases that have previously undergone surgery.
 - c) 1 case had symptoms originating from both the fifth lumbar and the first sacral. Operation revealed herniation in the fourth interspace.

TABLE 1
Positive myelography in the fifth interspace.

Clinical picture	Total	Operation positive	Operation negative
First sacral syndrome	78	76	2
Fifth lumbar and first sacral syndrome	12	8	4 ¹
Fifth lumbar syndrome	2	2	0
No clinical symptoms indicating site of herniation	11	9	2
Total	103	95	8

¹ In one case operation revealed herniation in fourth interspace.

I. B. *Myelography indicative of herniation in the fourth interspace.*

154 cases altogether

15 „ not included for various reasons

10 „ not operated upon (assembled in a special group).

129 cases thus remain for consideration.

- 1) In 116 cases of the 128 cases (90 %), operation revealed herniation in the fourth interspace. Of these 116:—
 - a) 55 cases (48 %) had unmistakable symptoms of pressure on the fifth lumbar root.
 - b) 21 cases (18 %) had symptoms of pressure on the fifth lumbar and the first sacral roots.
 - c) 15 cases (13 %) had symptoms of pressure on the first sacral root only.
 - d) 2 cases had symptoms of pressure on the fourth lumbar root.
 - e) 23 cases (20 %) had no definite neurological symptoms.

- 2) In 13 cases operation revealed no definite herniation in the fourth interspace.

These cases may be subdivided as follows:

- a) 8 cases had no definite neurological symptoms. One case showed herniation in the fifth interspace. Four of the cases had been operated on earlier, and in three others the myelograms were uncertain.
- b) 1 case had symptoms of pressure on the first sacral root.
- c) 1 case showed signs of pressure on the fourth and fifth lumbar nerve roots.
- d) 3 cases showed symptoms of pressure on the fifth lumbar root, for which reason both the myelography and clinical signs were misleading; two of these cases had already been operated upon.

TABLE 2

Positive myelograms in the fourth lumbar interspace.

Clinical picture	Total	Operation positive	Operation negative
Fifth lumbar syndrome	58	55	3
Fifth lumbar and first sacral syndrome	21	21	0
First sacral syndrome	16	15	1
Fourth lumbar syndrome	2	2	0
Fourth to fifth lumbar syndrome	1	0	1
No clinical symptoms	31	23	8
Total	129	116	13

I. C. Myelography indicative of herniation in the third interspace.

There were 3 cases altogether. Herniation was verified at operation in all three.

None of the patients had symptoms of pressure on the fourth lumbar root; one case showed no neurological symptoms, one had first sacral syndrome and one had both fifth lumbar and first sacral syndrome. The last two cases both showed a sacralized fifth lumbar vertebra, which suggested that vertebral anomalies were responsible for the discrepancy in the symptoms.

I. D. Myelography indicative of herniation in both fourth and fifth interspaces.

There were 5 cases altogether. The myelographic findings were verified at operation in four of these cases, while in the fifth case herniation in the fifth interspace was the only defect to be found. The last-mentioned case showed symptoms of the first sacral syndrome only. Of the first four, three had symptoms of the fifth lumbar and the first sacral syndrome and one of the first sacral only.

II. Operated cases in which myelograms were negative.

There were 62 cases altogether.

- 1) 29 cases showed no herniation at operation. Of these:—
 - a) 18 cases had symptoms of nerve root pressure, in 7, on the first sacral, in 5, on the fifth lumbar, and in 6, on both fifth lumbar and first sacral. Three of these cases were not explored, in accordance with the clinical findings. The condition of all three remained unchanged after operation. Of the other 15 operated on, 9 improved and 6 remained unchanged.
 - b) 11 cases showed no definite clinical signs of nerve root pressure, the only symptom being radiating pain without any sure point of origin. In five cases the Lasègue sign was negative. Two of the eleven improved and nine remained unchanged.
- 2) 24 cases were revealed by operation to have herniation in the fifth interspace. Of these:—
 - a) 16 cases showed clinically sure signs of the sacral syndrome. Fourteen of them were either completely free from signs and symptoms or greatly improved following the operation, while two showed no appreciable change for the better.
 - b) 5 cases had symptoms of the fifth lumbar as well as the first sacral syndrome. Three of them recovered—in two of them the

herniation was situated far laterally,—while two showed no appreciable improvement. The fourth intervertebral disk was not explored in these two cases, and it is therefore possible that a herniation in that location was the cause of the poor result.

- c) 3 cases had symptoms of the fifth lumbar syndrome. Two of them, one with a high lateral site, recovered, and one remained unchanged (the fourth disk was not explored).

3) 9 cases were revealed by operation to have herniation in the fourth interspace. Of these:—

- a) 7 cases had definite clinical signs of the first sacral syndrome.
- b) 1 case had a somewhat doubtful first sacral syndrome (intermittent absence of ankle-jerk).
- c) 1 case had the fourth lumbar syndrome. The herniation was situated far laterally.

Eight of these nine cases showed improvement, and the ninth, in which operative findings were not entirely convincing, showed only a slow change for the better.

TABLE 3
Negative myelograms.

Clinical picture	Total	Operation pos. 5th interspace	Operation pos. 4th interspace	Operation negative
First sacral syndrome	24	16	1	7
Fifth lumbar syndrome	15	3	7	5
Fifth lumbar and first sacral syndrome	11	5	—	6
Fourth lumbar syndrome	1	—	1	—
No clinical symptoms indicating disk rupture	11	—	—	11
Total	62	24	9	29

III. *Twenty-two cases with positive myelograms not operated upon.*

The majority were given follow-up examinations in May 1949, one to three years after myelography. The reason they were not operated on was that the symptoms had diminished at the time of myelography. All these patients managed to live an approximately normal life; some were completely free from symptoms but the majority had mild attacks of sciatic or back pain, without being obliged to seek treatment. Occasionally the neurological symptoms had completely disappeared,

but in most cases they were unchanged or had improved slightly. This shows that even manifest herniations have a tendency to cease exhibiting symptoms and that consequently we should not give up our preference for conservative treatment without having very good reason to recommend operation.

TABLE 4

Clin. Syndrom.	Number of cases	Pos. op. L ₅ - S ₁	Pos. op. L ₄ - L ₅	Pos. op. L ₃ - S ₄	Pos. op. L ₄ - L ₅ - S ₁	Total Pos. op.	Neg. op.
S ₁	121	93 (77%)	16	1	1	111	10
L ₅ + S ₁	48	13 (27%)	22 (46%)	1	3	39	9
L ₅	75	5	62 (83%)	—	—	67	8
L ₄ + L ₅	1	—	—	—	—	0	1
L ₄	3	—	3	—	—	3	—
No neuro- M + logical	43	9	23	1	—	33 (77%)	10
symptoms M —	11	—	—	—	—	0	11
Total	302	120 40%	126 42%	3 1%	4 1%	253 84%	49 16%

M + = positive myelography.

M — = negative „

CONCLUSIONS

Definitely positive myelograms are confirmed by operation in 95 per cent of the cases, even if the clinical picture is unclear. If the myelograms are ambiguous, perhaps only showing a widened root or a slight root sheath defect, it is wiser not to operate unless the clinical picture is strongly positive. Furthermore, positive myelograms may prove unreliable in cases which have previously been operated on for ruptured disk and which have recurrent sciatica due to the fact that the impression in the dural sac may be caused by a scarred contraction of the dura or by pressure of scar tissue outside the dura, making it difficult to determine from the myelogram whether the picture represents a true ruptured disk. Unfortunately, neurological symptoms also are not to be relied upon, unless there has been an opportunity to observe them before the recurrence took place, since it is often impossible to determine whether they refer back to the earlier attack of sciatica or are due to mistreatment of the roots at the previous operation, or to the current attack of sciatica. In these difficult cases the only sign one has to go by is often the radiating pain.

A *negative myelogram* does not obviate the possibility of a ruptured

disk. This is particularly true of the fifth interspace where the dural sac is relatively large. In these cases the herniation must be fairly extensive if it is to make an impression in the dural sac. In the fourth interspace, too, herniations are seen which cannot be observed on the myelogram. Herniation was found in 64.5 per cent of the 51 patients with neurological symptoms and negative myelograms who were operated on. This figure reflects a weakness in myelography, which although it is understandable in view of the anatomic conditions is nevertheless an appreciable disadvantage. It must, therefore, be borne in mind that patients with definite neurological symptoms which can be attributed to a current attack of sciatica should, with proper regard to the operative indications, be submitted to operation even if the myelograms are negative. In reality, negative myelograms in some of these cases yield certain positive hints as to the site of the rupture which are valuable at operation. They may, for example, indicate a lateral rupture into the "interspace below", which usually requires considerably more extensive dissection and which therefore affects the indications. On the other hand, in certain cases with pronounced signs of pressure on more than one root and with positive myelograms of one interspace only, dissection of the other interspace, too, should be considered. The size and site of the rupture in the interspace first dissected on the basis of the positive myelogram should be decisive; complete reliance cannot be placed on the negative myelogram of the other interspace.

There is no infallible method of determining the presence or the position of a ruptured disk. Both the symptom picture and the myelograms have their limitations, but there is no doubt that a combination of the two yields considerably more informative pre-operative data than one or the other alone.

On the basis of the foregoing, we appear justified in setting up the following indications for abrodil myelography in cases of sciatica in which operation is considered:

- 1) Cases with uncertain or no neurological symptoms at all ought to be myelographed. In these cases the myelographic finding is decisive as far as operation or non-operation is concerned. Even in cases of pure chronic lumbago the myelogram can show a herniation, which causes the symptoms.

- 2) Cases with neurological symptoms originating from more than one root should be evaluated individually. Herniation in two interspaces is sometimes, though rarely, encountered. In general it is assumed that if symptoms of fifth lumbar as well as first sacral root are present the herniation is situated in the fourth interspace. Never-

theless, it should be remembered that the rupture may be large and situated relatively far laterally in the fifth interspace with pressure on both fifth lumbar and first sacral. Myelograms in these cases usually yield valuable information.

3) Cases with severe and long-standing symptoms from one root only, in which it is certain that the symptoms do not date back to a previous attack, may be operated on without myelography. It should be borne in mind, however, that the clinical signs are by no means infallible and that, even if they appear unmistakable, positive or negative myelograms will yield valuable information as to the position of the rupture, which can be of appreciable help in the operation.

S U M M A R Y

The clinical symptoms and the myelographic and operative findings in 322 cases of sciatica are correlated. Herniation was present in the fifth interspace in 77 per cent of the cases showing only the fifth sacral syndrome, and in the fourth interspace in 83 per cent of the cases with only the fifth lumbar syndrome. Cases with both the fifth lumbar and the first sacral syndrome revealed herniation in the fifth interspace in 27 per cent and in the fourth interspace in 46 per cent. Cases operated on without neurological symptoms showed herniation in 61 per cent. Symptoms of sciatica were sometimes observed without herniation. Neurological symptoms are helpful in setting up a preliminary diagnosis, and myelography is valuable in deciding whether herniation is present and, if so, where it is located. Unnecessary exploration at operation is thereby avoided. Good correspondence between the operative findings and positive myelograms was found. The disadvantage of myelography is that a negative myelogram does not prove that no herniation is present. In cases of this kind the course of the disease and the neurological symptoms will have to serve as the decisive factors. The operative findings were negative in all the cases in which the myelograms were negative and neurological signs were lacking. Twenty-two patients with positive myelograms who were not operated on following myelography were examined one to three years later and found to be back at work, some of them entirely free from symptoms. This would suggest that it is advisable to postpone operation until prolonged conservative treatment has proved fruitless.

R E S U M E

Etude des symptômes cliniques et des trouvailles myélographiques et opératoires dans 322 cas de sciatique. Il a été constaté des

hernies dans le 5^{ème} espace intervertébral dans 77 % des cas chez lesquels il n'y avait qu'un syndrome de la 5^{ème} vertèbre sacrée et dans le 4^{ème} espace intervertébral dans 83 % des cas n'ayant qu'un syndrome de la 5^{ème} vertèbre lombaire. Les cas présentant à la fois un syndrome de la 5^{ème} vertèbre lombaire et de la 1^{ère} sacrée montraient une hernie du 5^{ème} espace intervertébral dans 27 % et du 4^{ème} intervalle dans 46 %. Il y avait hernie dans 61 % des cas opérés chez lesquels aucun symptôme neurologique n'avait été constaté. Des symptômes de sciatique ont parfois été observés sans hernie. Les symptômes cliniques aident beaucoup à établir le diagnostic préliminaire et la myélographie est très appréciable lorsqu'il s'agit de décider s'il y a une hernie et, dans ce cas, où elle est localisée. On évite par là des explorations inutiles au cours de l'opération. On a trouvé une bonne concordance entre les trouvailles opératoires et les myélogrammes positifs. Le désavantage de la myélographie réside dans le fait que les myélogrammes négatifs ne fournissent pas la preuve indubitable qu'il n'y a pas d'hernie. Dans les cas de ce genre, le cours de la maladie et les symptômes neurologiques sont des facteurs décisifs. Les trouvailles opératoires ont été négatives dans tous les cas où les myélogrammes étaient négatifs et chez lesquels les signes neurologiques étaient absents. Vingt-deux malades aux myélogrammes positifs qui n'ont pas été opérés à la suite de la myélographie ont été réexaminés un, deux ou trois ans plus tard et on a constaté qu'ils avaient repris leur travail et qu'ils n'avaient plus aucun symptôme. Ceci porte à suggérer qu'il est sage de remettre l'opération jusqu'à ce qu'un traitement conservateur prolongé se soit avéré infructueux.

ZUSAMMENFASSUNG

Die klinischen Symptome und die myelographischen und operativen Befunde in 322 Fällen von Ischias werden verglichen. In 77 % der Fälle, die Symptome des ersten sakral Segmentes allein aufwiesen, war ein Prolaps der 5. Zwischenwirbelscheibe vorhanden und in 83 % der Fälle, die Symptome des 5. lumbal Segmentes allein aufwiesen, war ein Prolaps der 4. lumbalen Zwischenwirbelscheibe zu finden. Fälle mit Symptomen des 5. lumbal und 1. sakral Segmentes zeigten Prolaps von der 5. Zwischenwirbelscheibe in 27 % und der 4. Scheibe in 46 %. Fälle, die keinerlei neurologische Symptome hatten, zeigten Prolapse in 61 %. Ischiassymptome wurden manchmal beobachtet, ohne dass ein Prolaps gefunden werden konnte. Die neurologischen Symptome sind nützlich in der Aufstellung einer vorläufigen Diagnose und die Myelographie ist wertvoll zur Entscheidung ob ein

Prolaps vorhanden ist und wo er sich befindet. Unnötige explorative Eingriffe während der Operation werden dadurch vermieden. Gute Übereinstimmung zwischen den Befunden bei der Operation und positiven Myelogrammen wurde festgestellt. Der Nachteil der Myelographie ist, dass ein negatives Myelogram kein Beweis gegen das Vorhandensein eines Prolapses ist. In solchen Fällen ist der Verlauf der Krankheit und die neurologischen Symptome das Ausschlaggebende. Die operativen Befunde waren negativ in allen Fällen, in denen das Myelogram negativ war und keine neurologischen Zeichen gefunden werden konnten. 22 Patienten mit positiven myelographischen Befunden, die nicht operiert wurden, waren bei einer ein bis drei Jahre später vorgenommenen Nachuntersuchung arbeitsfähig und einige von ihnen waren vollkommen symptomfrei. Die letztere Beobachtung ist möglicherweise als ein Hinweis darauf anzusehen, dass eine operative Behandlung nicht vorgenommen werden soll ehe sich eine längere konservative Behandlung als ergebnislos erwiesen hat.

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