

LUMBAR MYELOGRAPHY WITH WATER-SOLUBLE CONTRAST IN CASES OF DISC PROLAPSE

By

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In 1930 , in collaboration with *Lidström*, *Arnell* began his experiments with the use of a water soluble contrast medium (abrodil) in myelography. He progressed from experiments on animals to clinical use of it. The first publication appeared in 1931 and a more detailed report was issued in 1944. *Arnell* published his collected experiences in a monograph in 1949.

The method gained recognition as soon as it was known that disc herniation was the cause of sciatica. It was taken up by *Lindblom* for diagnosing disc herniation. He formulated a suitable technique for carrying out the examination. Since that time the method has been employed widely in the hospitals in Sweden and the other Scandinavian countries. I have personally used the method in the orthopedic clinic since 1945 and, during the period 1945-1949 have carried out 900 examinations.

TECHNIQUE

The examinations apply only to the lumbar portion of the dural sac.

1. *The position of the patient.*

The patient is placed in a unilateral position with the affected side downwards: in a right-sided sciatica, on the right side, and in a left-sided sciatica, on the left side. By placing a pillow of suitable size under the waist, an endeavour is made to obtain as straight a continuity of the lumbar spine as possible. The head of the examination table is elevated so that the lumbar portion forms the lowest part of the dural sac where the injected contrast medium is directed by its own specific weight. In cases of scoliosis a suitable position may be

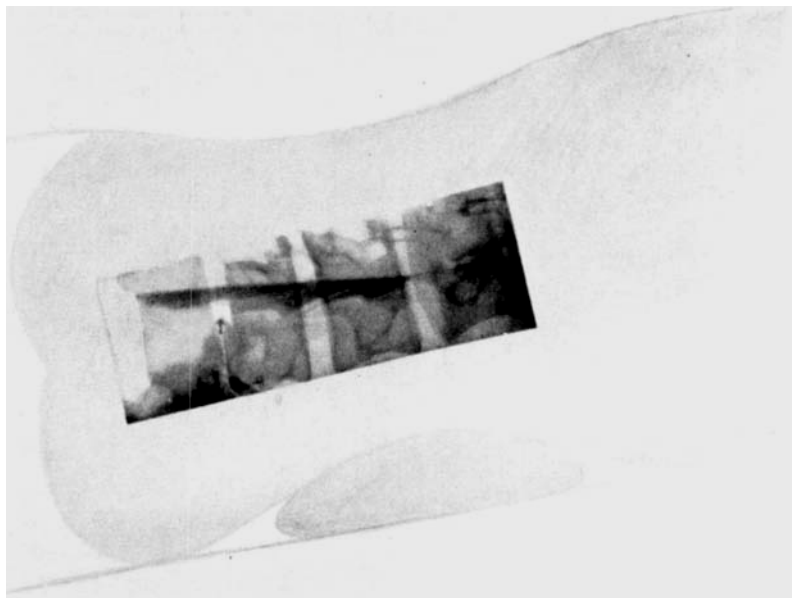


Fig. 1.

Placing of the patient. The head of the table is raised so that the contrast medium collects in the declive part of the dural sac. The patient must lie on one side to be examined. The direction of the rays is horizontal.

difficult to obtain. It is usually possible, however, to influence the curvature in a suitable manner by placing a pillow under the chest and elevating the table sufficiently.

2. Subarachnoid anesthesia.

A lumbar puncture is made in this position and subarachnoid anesthesia is induced. It is sufficient to inject 1 ml 5 % solution of procaine. The contrast medium is an irritant and causes pain unless an anesthetic is used. The puncture needle is left in situ while one waits ten minutes. In order to prevent a fall in blood pressure, an ampule of ephedrine is administered as a prophylactic. The effect of the anesthetic is noticed by the patient first as a feeling of warmth and then as one of numbness in the declive extremity and then gradually in the upper leg.

3. Injection of the contrast medium.

When ten minutes have passed after anaesthetisation, from 8 to 10 ml of the contrast medium are injected. A 20 % solution of abrodil

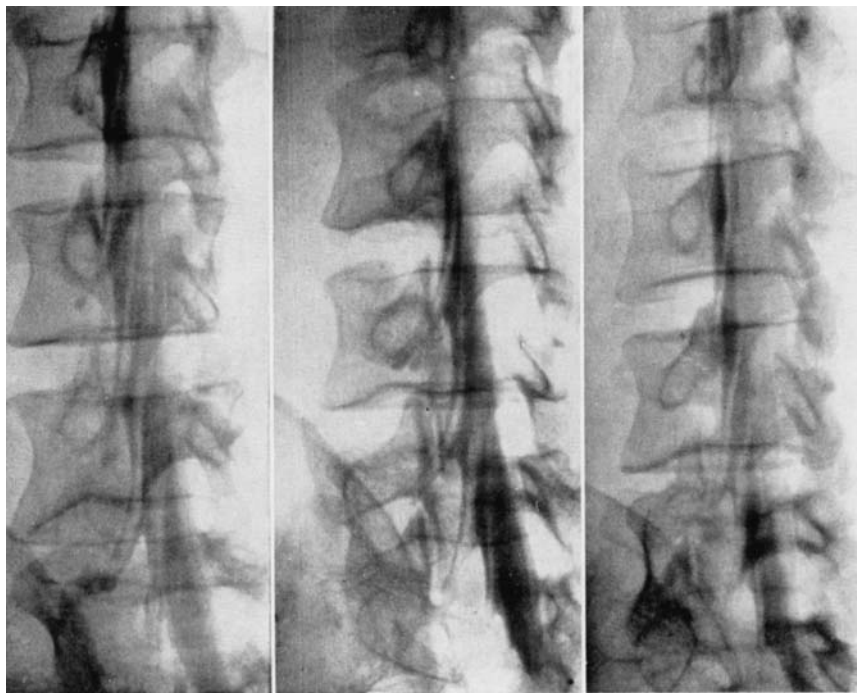


Fig. 2.

Normal myelogram. The water soluble contrast medium to a great extent forces its way into the root sheaths.

is used as a contrast medium (Swedish preparation "Kontrast U"). Our experience is limited to abrodil and this only in a 20 % solution. It has happened by mistake that a 35 % solution of perabrodil was used which set up considerable irritating phenomena, accompanied by epileptiform cramps with fatal results in one case (*Karlén*). The injection should be made slowly so that the contrast medium can precipitate in the lumbar fluid without mixing with it unnecessarily. The lateral position causes the contrast medium to precipitate down to the declive (lateral) portion of the dural sac and the root sheaths.

4. Photography.

Photography takes place in this lateral position with horizontal radiation falling against the abdomen and with the film placed vertically along the patient's back. Secondary rays are scattered off by using the Lysholm grid.

The picture material should properly consist of a frontal picture and a number of oblique pictures when the patient is rotated in various

degrees forward. The rays should be directed in such a manner that a free projection takes place of both the 5th and 4th disc, caudo-ventralward to cephalodorsal.

If the examination applies to the contralateral side, the patient can be rotated in the opposite direction backwards, thus obtaining comparative pictures. In this way the contrast contours will be poorer, as the main part of the contrast medium will stay as a bottom layer on the former declive side of the dural sac.

Direct profile pictures can best be taken with the patient in the prone position. Naturally, if one wishes, these pictures can be complemented by pictures taken with the rays directed vertically.

In cases of unilateral sciatica I usually confine the examination to one frontal and a suitable number of oblique pictures of the declive side.

The examination can be carried out leisurely. Absorption of the contrast medium takes place very slowly and the pictures remain quite sharp for a long time after the contrast medium has been injected.

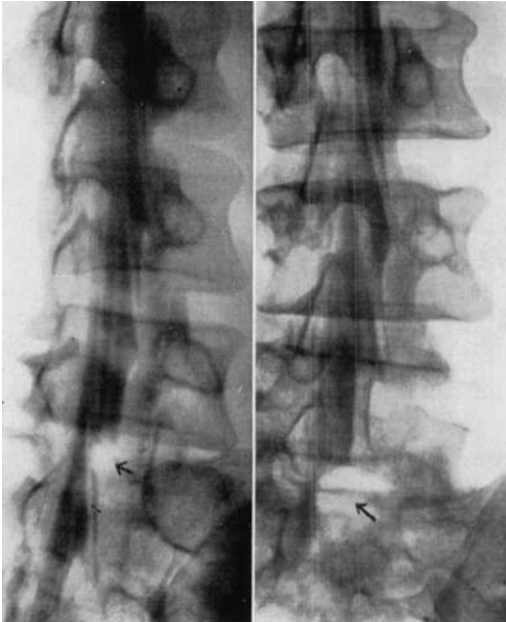
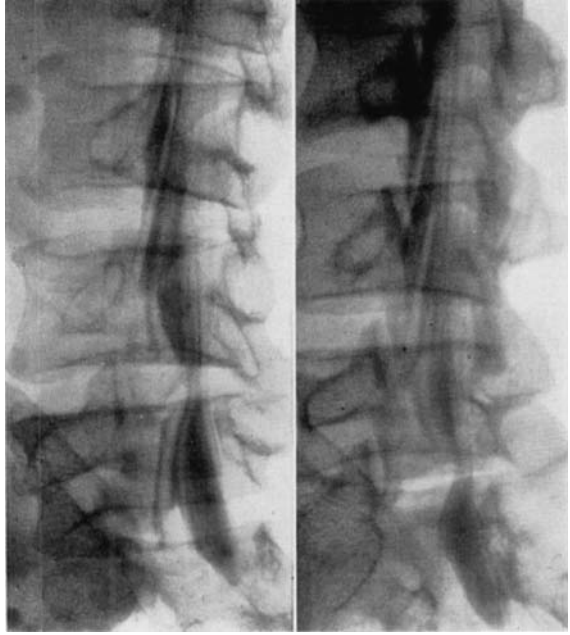
5. *After-treatment.*

When the examination has been completed the patient is put to bed. Transfer of the patient should take place with the patient in the position last used on the examination table so as to ensure that the contrast medium is retained in the lower part of the dural sac. The patient must lie horizontally in bed and be kept in this position for 24 hours.

Absorption of the contrast medium. As the contrast medium is water soluble it is absorbed and therefore there is no need to take it out. It is difficult to say just how quickly it is absorbed or whereabouts in the subarachnoid space this mainly takes place. It is evident that the contrast medium gradually mixes with the cerebrospinal fluid and that, in diluted form, it is finally distributed throughout the whole of the fluid system. By means of a series of cisternal punctures made at different times after the injection, *Denstad* has shown that the concentration of the contrast medium in the cisternal fluid is greater in the prone position than in the half prone and/or sitting posture, which is only to be expected.

Complications. As a rule the patient feels extremely well after the examination and is in no way affected. Slight headaches can occur, as after the administration of a subarachnoid anesthetic.

Complications, however, have sometimes arisen. The patient has had nausea and felt indisposed. A relatively typical form of complica-



Figs. 3 and 4.
Myelogram with typical deform-
ity in the disc prolapse.



Fig. 5.

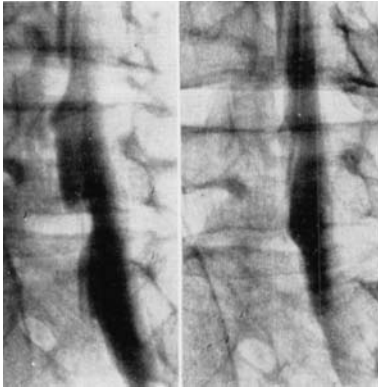
Myelography in double disc prolapse.

tion has set in from 2 to 3 hours after the examination. The patient has suffered from shock with short periods of unconsciousness and epileptiform cramps. As a rule this has passed over quickly.

When an explanation for this late complication was sought for, the possibilities of cerebral irritation caused by the contrast medium were taken into consideration and great importance was attached to the patient's position after the examination. It appears, however, that this latter attack can occur even if, after the examination, the patient has lain in a semi-prone position with the head raised, thus counteracting the passage of the contrast medium towards the head.

I personally experienced this kind of complication on first beginning with the method but have not done so during recent years. It is my conviction that this complication depends on a pollution of the contrast medium with, in all probability, free iodine. One must insist on strict control in respect to the cleanliness of the contrast medium. Should complications arise, one must refrain from using the remainder of the same delivery and go over to a fresh amount in the hope that this is thoroughly pure.

The advantages of the method. It is an evident advantage that the

*Fig. 6.*

Myelography (a) shows an impression in the dural sac at the level of L₅-S₁ and to a lesser degree at the level of L₄-L₅. During operation a herniated disc was extirpated at the level of L₅-S₁. At the level L₄-L₅ there was no herniation but only a general protrusion. At a subsequent myelography (b) both impressions had disappeared.

*Fig. 7.*

Myelography (a) shows an impression in the dural sac at the level L₅-S₁ and during operation a herniated disc was extirpated. At a subsequent myelography (b) an impression in the dural sac is still present. During operation no herniation corresponding to the change in the myelogram was found but only a post-operative cicatrization.

contrast medium is absorbed and need not be taken out by means of a fresh lumbar puncture. The fact that the irritating effect of the contrast medium necessitates the administration of a subarachnoid anesthetic, however small it may be, is a disadvantage.

The superiority of the method as compared with myelography with oil or gas is evident from the quality of the pictures. Extremely sharp pictures are obtained because the contrast medium, being water soluble, mixes freely with the cerebrospinal fluid and so fills up all parts of the dural sac. To a large extent the contrast medium also forces its way into the root sheaths so that they can be judged more thoroughly than in myelography with oil or gas.

DIAGNOSIS

With regard to the diagnosis of disc herniation, to a great extent the same symptomatology is applicable as in myelography with oil or gas. On account of its pressure action on the dural sac, disc herniation causes an impression in the antero-lateral part, and therefore the myelogram is deformed in a typical manner. As in myelography with

oil or air the method fails in the case of disc herniation which, because of its lateral position, has no influence on the dural wall.

Diagnosis is favoured, however, by the clarity of the pictures, the good contrast effects, and the sharp contours. Besides this the frequent filling of the root sheaths with contrast medium is an added gain. If, in this manner, the root sheaths of one side are uniformly filled with contrast medium with the exception of one individual root sheath, a certain value can be accorded to this. Further, it is possible to estimate the thickness of the nerve root (flattening, swelling), as this clearly appears as a defect in the contrast-filled root sheath (*Stenström*). Roentgenology of the root sheath has been treated by *Arnell* and *Lindblom*. Sometimes the root sheath can be closed by a diverticular dilatation (*Arnell*), which, according to *Lindblom's* investigations, is to be regarded as an anatomic variation without clinical significance.

In one work *Knutsson* has studied post-operative effects shown on the myelograms obtained after operations for disc prolapse. It appeared that the myelogram was sometimes fully normal in appearance, after extirpation of a disc prolapse. In other cases a post-operative deformity of the dural sac was manifested, caused by cicatricial formation which could not be differentiated from the deformity brought about by pressure action of the disc prolapse. The roentgenological diagnosis of a recurrent prolapse is thus complicated.

SUMMARY

Myelography with a 20 % solution of abrodil has been much employed in Scandinavian countries in diagnosing disc prolapse in the lumbar regions. *Arnell*, a Swede, has tried out the method. The author gives a detailed report about the technique and discusses the preference for this method to that of myelography with gas or oil. As the contrast medium is water soluble, it mixes with the cerebrospinal fluid and so fills completely all the nooks and crannies of the dural sac. To a great extent the root sheaths are also filled with contrast medium thus making it possible to estimate the thickness of the nerve root. The author has used this method in more than 900 cases.

RESUME

La myélographie avec une solution de 20 % d'abrodil a été fortement utilisée dans les pays scandinaves pour le diagnostic du prolapsus discal de la région lombaire. *Arnell*, un suédois, a étudié à fond

cette méthode. L'auteur donne un compte rendu détaillé de la technique appliquée et discute pourquoi il convient de préférer cette méthode à celle de la myélographie à l'air ou à l'huile. Le contraste étant soluble dans l'eau, il se mélange au liquide céphalo-rachidien et remplit complètement tous les recoins et toutes les fissures du sac dural. Par ailleurs les gaines radiculaires se trouvent aussi remplies par le contraste, ce qui permet de voir quelle est l'épaisseur de la racine nerveuse. L'auteur a appliqué cette méthode dans plus de 900 cas.

ZUSAMMENFASSUNG

Myelographie mit einer 20 % Abrodillösung ist in den skandinavischen Ländern in der Diagnostik des Diskusprolapses in der Lumbalregion oft angewendet worden. Arnell, ein Schwede, hat die Methode ausprobt. Der Verfasser gibt eine genaue Beschreibung der Technik des Eingriffes und bespricht die Vorteile der Methode gegenüber der Myelographie mit Gas oder Öl. Da das Kontrastmittel in Wasser löslich ist, mischt es sich mit dem liquor cerebrospinalis und füllt alle Spalten und Taschen des Durasackes vollständig aus. Die Wurzelscheiden werden ebenfalls in grossem Ausmasse mit Kontrastmittel gefüllt, so dass es möglich ist die Dicke der Nervenwurzeln zu beurteilen. Der Verfasser hat diese Methode in mehr als 900 Fällen angewendet.

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