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THE PRESSURE IN THE EPIDURAL SPACE IN OPERATED CASES OF SCIATICA

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The epidural space, demonstrated by Key Retzius in 1875, is formed as the dura mater is followed into the vertebral canal and its two layers separate, the inner layer enclosing the spinal cord–the real dura–and the outer layer covering the periosteum and ligaments in the vertebral canal. It is occupied by soft fatty tissues and a plexus of veins. All the spinal nerve-roots pass through this interval as they leave the dura and enter the intervertebral foramina. The epidural space is distinguished from other tissues of the body by its negative hydrostatic pressure. The negative pressure in, e.g., the pleura and the jugular veins is entirely due to mechanical factors. How the negative pressure in the epidural space is brought about and maintained is not quite clear. It is thought to be related to the circulation of the cerebrospinal fluid, particularly its absorption at the exit of the nerve-roots from the meninges of the spinal cord. The maintenance of the pressure is therefore of importance in the normal flow of the cerebrospinal fluid and the metabolism of the nerve-roots, which occurs largely through the fluid. It is known that in cases of general infection (e.g. sepsis and pneumonia) there is an associated reaction of the nervous system, localized exactly in the sheaths of the nerve-roots (Veith). The changes involve particularly the regions of the lumbar and cervical roots corresponding to the leg and the arm.

The negative pressure in the epidural space was demonstrated by Heldt and Malony in 1928. By means of a manometer they obtained a negative pressure varying between 14 and 240 mm of water in normal persons. Thorsén, in 1947, reported similar measurements in 36 normal subjects, in whom the pressure varied from 5 to 250 mm of water, with an average of 63 mm, which agrees well with the values obtained by Heldt and Malony.

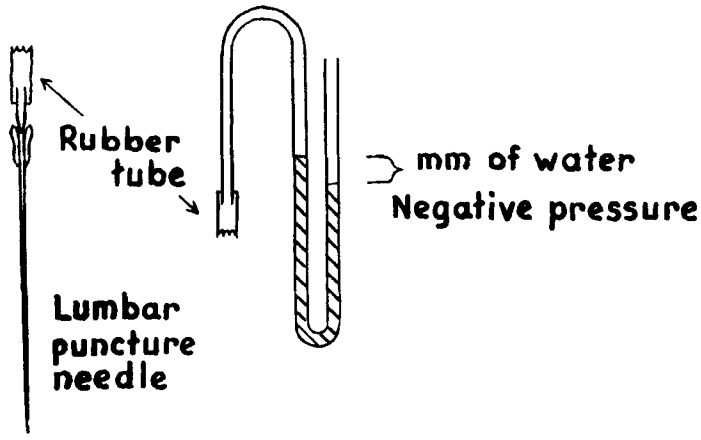

Fig. 1.

I measured the pressure in five "normal" patients who had undergone osteosynthesis for tuberculous spondylitis or degeneration of an intervertebral disc in the lumbar region, but who had not had sciatica and were therefore designated as "normal". The advantage was that in these patients the pressure could be measured under similar conditions (operative exposure under local anesthesia) as in the cases of sciatica. After exposure of the arches the intervertebral spaces were punctured through the *ligamentum flavum* with a fine lumbar-puncture needle. The needle communicated with a doubly-bent glass tube of relatively small diameter. The U-shaped part of the tube was half-filled with water (fig. 1). The advantage of this instrument was that the pressure of water could be directly read in millimetres of water. The disadvantage was that the volume of air between the epidural space

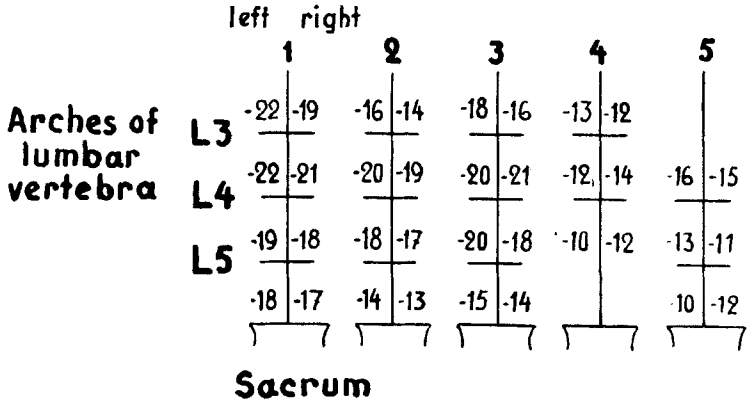

Fig. 2.

The figures denote the epidural pressure in mm of water in the respective intervertebral spaces.

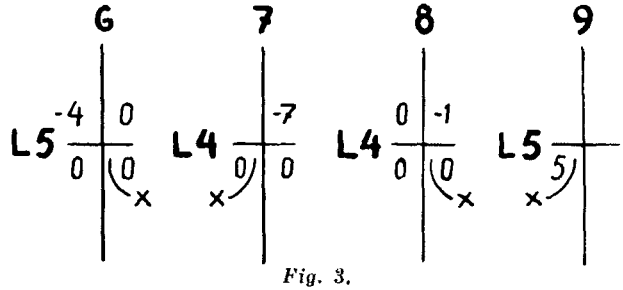

Fig. 3.
The figures denote the epidural pressure in the respective intervertebral spaces.
x = indicates the site of the disc protrusion.

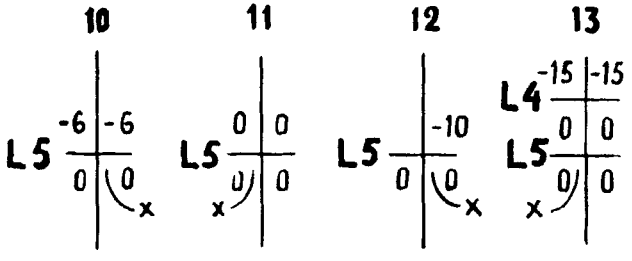

Fig. 4.
The figures denote the epidural pressure in the respective intervertebral spaces.
x = indicates the site of the disc protrusion.

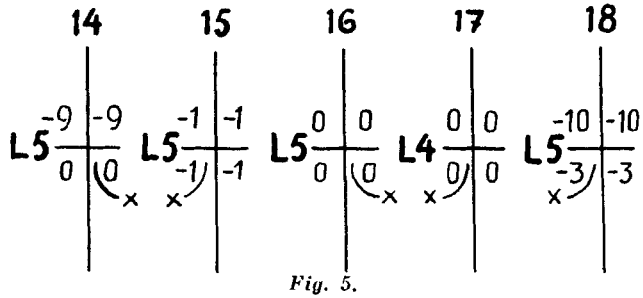

Fig. 5.
The figures denote the epidural pressure in the respective intervertebral spaces.
x = indicates the root with symptoms of root changes.
No disc protrusion at operation.

and the water column may change during the procedure, so that the volume is reduced by the negative pressure and acts in the direction of lessening the negative pressure. This means that when the capacity of the examined interval is small, values of high order tend to become relatively lower. That this must have been the case is evident from the fact that in my five "normal" patients the negative pressure was not as high as in Heldt's and Thorsén's subjects, the values ranging

between 10 and 22 mm of water, with an average of —16 mm (fig. 2). In most cases two or three adjacent spaces were punctured on both sides. The difference in pressure on the two sides and at different heights was insignificant.

By the same technique and under local anesthesia I measured the epidural pressure in 13 patients who had been operated on for sciatica. At operation it was found that in eight cases the disc had herniated (figs. 3 and 4); in the remaining five there was no herniation (fig. 5). The epidural pressure in the interval that corresponded to the affected roots and the site of the disc protrusion was in nine cases ± 0, and in the remaining four between —1 and —5 mm. The average pressure was —1 mm of water. There was no observable difference between the cases with and without disc protrusion. In most cases the pressure was measured both in the affected interval and in the adjacent spaces. It was observed that the negative pressure was gradually restored to normal with increasing distance from the affected root.

These measurements show that the fairly high negative pressure that normally exists in the epidural space had completely or largely disappeared in the examined cases of sciatica. The presence of disc protrusion appeared to be of no importance in this respect.

At this stage the conclusions that can be drawn from these observations are of course merely hypothetical. Personally, I am inclined to regard the disappearance of the negative pressure as a symptom of an exudative inflammatory process in the region concerned. Whether this process is to be looked upon as a metabolic disturbance or a primary inflammation is a matter of opinion. Whatever may be the interpretation, these observations are presented as a contribution to the knowledge of the sciatica syndrome.

SUMMARY

The pressure in the epidural space was measured in 13 patients operated on for sciatica. It was found that the normal negative pressure disappears completely or largely in association with sciatica. The presence of disc protrusion appears to be of no significance in this respect.

RÉSUMÉ

La pression de l'espace épidural a été mesurée chez 13 malades opérés pour des sciatiques. On a constaté que la pression normale disparaît complètement ou presque avec la sciatique. La présence d'un prolapsus discal ne semble présenter aucune importance à cet égard.

ZUSAMMENFASSUNG

In 13 Patienten, die wegen Ischias operiert worden waren, wurde der Druck im epiduralen Raum gemessen. Man fand, dass der normale negative Druck vollständig oder grösstenteils im Zusammenhang mit der Ischias verschwindet. Der Druck des Discusprolapses scheint in dieser Hinsicht ohne Bedeutung zu sein.

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