SPINAL NERVE INJURY IN DORSO-LATERAL PROTRUSIONS OF LUMBAR DISKS

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The fact that in some cases of sciatica there are no signs of disk herniation at myelography and operative inspection of the spinal canal, prompted Lindblom to make an anatomic study of the incidence of lumbar disk degenerations on cadavers. The specimens were taken from 160 patients of 14 to 87 years of age, regardless of clinical symptoms and cause of death. Among these, 60 nerve compressions were found, most of them by dorso-lateral protrusions against the lateral part of the intervertebral canal, where the nerves with their ganglions cross the corresponding disk (Fig. 2b). The incidence of these lateral compressions was found to be correlated to a high occurrence of radial ruptures in dorso-lateral direction of the annulus fibrosus of the disks.

The purpose of the present investigation was to determine the extent of nerve damage in the dorso-lateral disk protrusion. As a background to the histological description, the most important macroscopic findings will first be summarized.

MACROSCOPIC FINDINGS

In young individuals without signs of disk degeneration, the spinal ganglion with the adjacent spinal nerve and nerve roots in the region of the intervertebral foramen were surrounded by fat and vessels, and fixed to the surroundings by loose connective tissue only. The cross section of the ganglion and the efferent nerve was quite round (Figs. 6 and 11). The disks with definite degeneration had a tendency to protrusion of their margins, especially in dorsal and dorso-lateral directions, which agreed with the finding that most of the ruptures occurred in these directions. In cases of ruptured disks that bulged towards the lateral part of the intervertebral foramina, the fat between the disk and nerve tissues was reduced or totally lacking, the ganglions and nerves being more or less flattened or hollowed, in a few cases almost fenestrated by the protruding disk masses (Figs. 7, 8 and 12). Sometimes the ganglion and the nerve adhered to the protruding disk by dense connective tissue, so that their separation from the disk had to be made with a knife. Red lead injected from the ventral side into the centre of the disk passed through the ruptures to the surface of the protrusion and could be found in immediate contact with the nervous tissue. Thus, a communication which might explain the perineural fibrosis between disk ruptures and perineural spaces was demonstrated (Figs. 3, 4 and 5).

According to the macroscopic deformity, the nerve compressions were
graded into stages I and II, stage I being a flattening or slight excavation against the disk protrusion, and stage II a definite hollowing or fenestration. The degree of compression in the cases microscopically examined is noted in Table 1.

In the same table are also recorded, the sex, age, available symptoms of lumbago and sciatica, and the presence of macroscopic disk degeneration and protrusion. Some cases of protruding intervertebral joints were found in which the protrusion was caused by osteo-arthritis changes. These protrusions were situated far medially, directed towards the posterior side of the nerve roots, and only occasionally caused impressions into the nerve roots, as noted in the table.

MICROSCOPIC EXAMINATION

Material and Methods. Out of a total material of 160 cases, mentioned above, 17 were selected for microscopic examination. The age, cause of death, life history, etc., in these cases are listed in Table 1. In all these cases one or more spinal nerves were compressed to varying degrees by dorso-lateral disk protrusions. In each case the compressed spinal nerve or nerves and some normal nerves were taken for microscopic study. In order to obtain a control material with similar effect of age, general disease, etc., on the nerves, the normal spinal nerve opposite to the compressed one was always examined, or, if the compression was bilateral, the normal spinal nerves cranial or caudal to the compressed nerves. Often several normal nerves were examined from each case. The number, segmental localization, etc., of both normal and compressed spinal nerves are shown in Table 1.

The material was obtained within 24-36 hours after death and fixed in 10 per cent formalin. The following tissues were chosen for histologic study: (1) The spinal cord segment of the compressed spinal nerve stained according to Nissl and examined for signs of retrograde degeneration; (2) one or two thoracic cord segments stained according to Kulschitzky in order to bring out ascending degenerations; (3) the proximal parts of ventral and dorsal roots of both normal and compressed spinal nerves stained for axons according to Bodian and for myelin sheaths according to Alzheimer-Mann-Häggqvist (=A.M.H., see Rexed\(^2\)); (4) the spinal nerves sectioned serially from the point of entrance of the roots into the dural sac, through the spinal ganglion and down into the spinal nerve, i.e. well past the compression in the case of compressed nerves. Alternating series were stained according to Bodian (or Davenport) and A.M.H. From the Bodian series sections at regular intervals were stained for connective tissue (Azan or hematoxylin-Weigert-Hansen).

Though the material had been preserved for considerable time (several years in most cases) in a 10 per cent formalin solution, the staining qualities were generally satisfactory and in some cases surprisingly good.

RESULTS

The first step in a search for damages to the spinal nerves by dorso-lateral protrusions of the lumbar intervertebral disks would be to determine the exact localization of the deleterious pressure. The protrusions in question leave the disk in a dorso-lateral direction, and have a chance of reaching the spinal nerve in the depth of the intervertebral canal itself. Here the spinal nerve swerves around the column formed by the bodies of the vertebral and the intervertebral disks, and its general direction is caudal, lateral and ventral. In the first part of this stretch, at the entrance into the intervertebral foramen, the dorsal and ventral roots are still separated and are housed in a funnel or sac of the dura mater, which slowly closes in on them. More