ARACHNOIDAL PROLIFERATION AND CYSTIC FORMATION IN THE SPINAL NERVE-ROOT POUCHES OF MAN

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(Received for publication October 10, 1957)

In preliminary communications in 1947 and 1949 Rexed\textsuperscript{12,13} described certain pathological changes in human nerve-root pouches. The lesion consists of pathological thickening and proliferation of the arachnoidea, in extreme cases deforming and compressing the nerve roots, and often associated with cystic formations in and about the root bundles. The lesion is common, and is not associated with syphilis, tuberculosis, or other specific infections involving the central nervous system. By means of roentgenological studies on cadavers, Lindblom\textsuperscript{7} in 1948 confirmed Rexed’s observations, and demonstrated the cysts as round filling defects in the contrast medium in the root pouch. In these cases there was no communication between the cystic cavity and the subarachnoid space. Arnell\textsuperscript{2} described certain roentgenological changes noted during clinical myelography, which he related to the findings of Rexed. He did not examine the preparations histologically.

A variety of changes of the root pouches have been described in the literature. Pathological proliferations of the membranes associated with cystic formations have been noted in and about the nerve roots in acute and chronic meningeal infections such as tabes dorsalis\textsuperscript{11} and tuberculous meningitis.\textsuperscript{20} In his work on the pathology of the spinal ganglion, Marburg\textsuperscript{9} described cystic changes in the spinal ganglion, which he interpreted as sequelae of haemorrhage. He noted, however, that the arachnoidea in the distal part of the root pouch was sometimes thickened and hypertrophied, “dass es den Anschein einer tumorartigen Wucherung gewinnt.” He did not relate this arachnoidal proliferation to the cystic formation, possibly because he did not make serial sections of the nerve roots from the spinal ganglion and proximal to it. Hinrichs\textsuperscript{6} described a case of multiple cysts in the spinal nerve roots, in which there was also proliferation of the enveloping membranes. Tarlov described during the period 1938–1952\textsuperscript{17–19} macroscopical cysts in the region of the sacral root pouches, which he called “perineurial cysts.” He observed no concomitant proliferation of the arachnoidea. It has been shown by Tarlov\textsuperscript{18,19} and others\textsuperscript{1,4,10,12} that such cystic formations are capable of producing clinical signs of compression. In some cases cysts have been demonstrated by myelography.\textsuperscript{1,4,10,16}

The present work is devoted to a comprehensive study of the incidence and distribution of arachnoidal proliferations and cystic formations in the
spinal root pouches. The changes are examined in relation to the age of the patient, and it is established whether they are confined to isolated pouches or whether they involve the whole spine. The investigation is so far restricted to the lumbar and sacral regions, but it is intended to examine and compare all regions of the spine, and to correlate the roentgenological findings with the histological changes.

MATERIAL

The material consists of 26 lumbar spines from D12 to S2, with nerve roots, ganglia, and part of the spinal nerve removed in one piece with the dura mater. The preparations were obtained shortly after death, and were fixed in 10 per cent formaldehyde. The spinal root, ganglion, and part of the spinal nerve were sectioned serially, and stained by the Alzheimer-Mann-Häggquist technique (AMH). In some cases Bodian’s silver technique was employed, occasionally in conjunction with azan or haematoxylin-Weigert-Hansen staining. In some cases only a few roots were examined, but where pathological changes were present most of the roots round the inferior part of the cord were sectioned serially. A total of 176 spinal nerve roots from 26 cases were examined. The subjects were aged 27–82 years, and had been selected at random from the necropsy material available. Death had been caused by a variety of diseases, only a very few involving the central nervous system. In one case the cause of death was acute tuberculous meningitis, but in none other was there any sign of infection of the brain, spinal cord, or meninges.

RESULTS

Normally the spinal nerve roots, as they enter the foramen intervertebrale, are enveloped by a sheath of dura mater which distally approaches the roots and then becomes continuous with the perineurial tissue of the root bundles immediately proximal to the ganglion. In this way the dural root pouches are formed. The spinal roots lie in this pouch and are surrounded by arachnoidea, which ordinarily forms a thin covering, and which also is connected distally with the perineurial tissue (Fig. 1). Between the root and the arachnoidea is an empty space, narrowing distally, which communicates with the subarachnoid space.

In many cases this normal picture is changed. The arachnoidal tissue is thickened, in some cases only slightly, without producing compression of the root bundles, but in others with great proliferation and marked compression of the roots (Figs. 2B and 5). The arachnoidea is sometimes seen invading the roots, or penetrating parts of the dura mater (Fig. 7). Occasionally the entire dural pouch may be dilated by the proliferative process. Cyst-like cavities may appear in the proliferated arachnoidea. In other cases the proliferation may appear proximally, gradually lessening distally, to be replaced finally by cystic formations (Fig. 2A and D). In a fair number of cases cysts appear even in slight degrees of arachnoidal proliferation. The relatively thin arachnoidea is sometimes split into several layers, between