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BRAIN RESEARCH

Research Report

A morphometric study on the longitudinal and lateral symmetry of the sural nerve in mature and aging female rats

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ABSTRACT

Aging affects peripheral nerve function and regeneration in experimental models but few literature reports deal with animals aged more than one year. We investigated morphological and morphometric aspects of the sural nerve in aging rats. Female Wistar rats 360, 640 and 720 days old were killed, proximal and distal segments of the right and left sural nerves were prepared for light microscopy and computerized morphometry. No morphometric differences between proximal and distal segments or between right and left sides at the same levels were found in all experimental groups. No increase in fiber and axon sizes was observed from 360 to 720 days. Likewise, no difference in total myelinated fiber number was observed between groups. Myelinated fiber population distribution was bimodal, being the 720-days old animals' distribution shifted to the left, indicating a reduction of the fiber diameters. The *g* ratio distribution of the 720-days old animals' myelinated fiber was also shifted to the left, which suggests axonal atrophy. Morphological alterations due to aging were observed, mainly related to the myelin sheath, which suggests demyelination. Large fibers were more affected than the smaller ones. Axon abnormalities were not as common or as obvious as the myelin changes and Wallerian degeneration was rarely found. These alterations were observed in all experimental groups but were much less pronounced in rats 360 days old and their severity increased with aging. In conclusion, the present study indicates that the aging neuropathy present in the sural nerve of female rats is both axonal and demyelinating.

1. Introduction

It is well established that aging affects peripheral nerve function and regeneration, both in humans and experimental models. Also, age related changes to peripheral nerves are not linearly progressive with age (Verdú et al., 2000). However, in aging studies, differences between adult and old animals have often been based on comparisons of only two experimental groups, whereas the life span and the duration of growth periods should be carefully taken into account to ensure

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specifically that adult and old animals are compared (Ceballos et al, 1999). In the last decades, morphometric investigations have benefit neuropathies understanding but still little information is available on morphometric changes of peripheral nerves in aging. Likewise, few literature reports deal with animals aged more than one year.

Rats are widely used in studies of peripheral neuropathies and nerve regeneration but most reports deal with male animals. It is well known that females are less susceptible to development of a spontaneous peripheral neuropathy (Majeed, 1992) and also live longer and in better condition than males (Van Steenis and Kroes, 1971). Moreover, sex-related differences in the outcome of nervous system injuries and disorders have been an important issue in the last years (Jeronimo et al., 2005).

Among the peripheral nerves of rats, the sciatic nerve is by far the most investigated in regards of models of injuries and regeneration while the sural nerve, a sensory branch of the sciatic nerve is less explored. Despite some descriptions of peripheral nerve morphologic alterations in aged rats, most of the studies used motor or sensory-motor nerves, but information on sensory nerves is scanty. The sural nerve in rats is widely used in experimental studies investigating injury and regeneration of the peripheral nervous system. Nevertheless, information on morphological and morphometric aspects of the sural nerve in aged rats is not common in the literature.

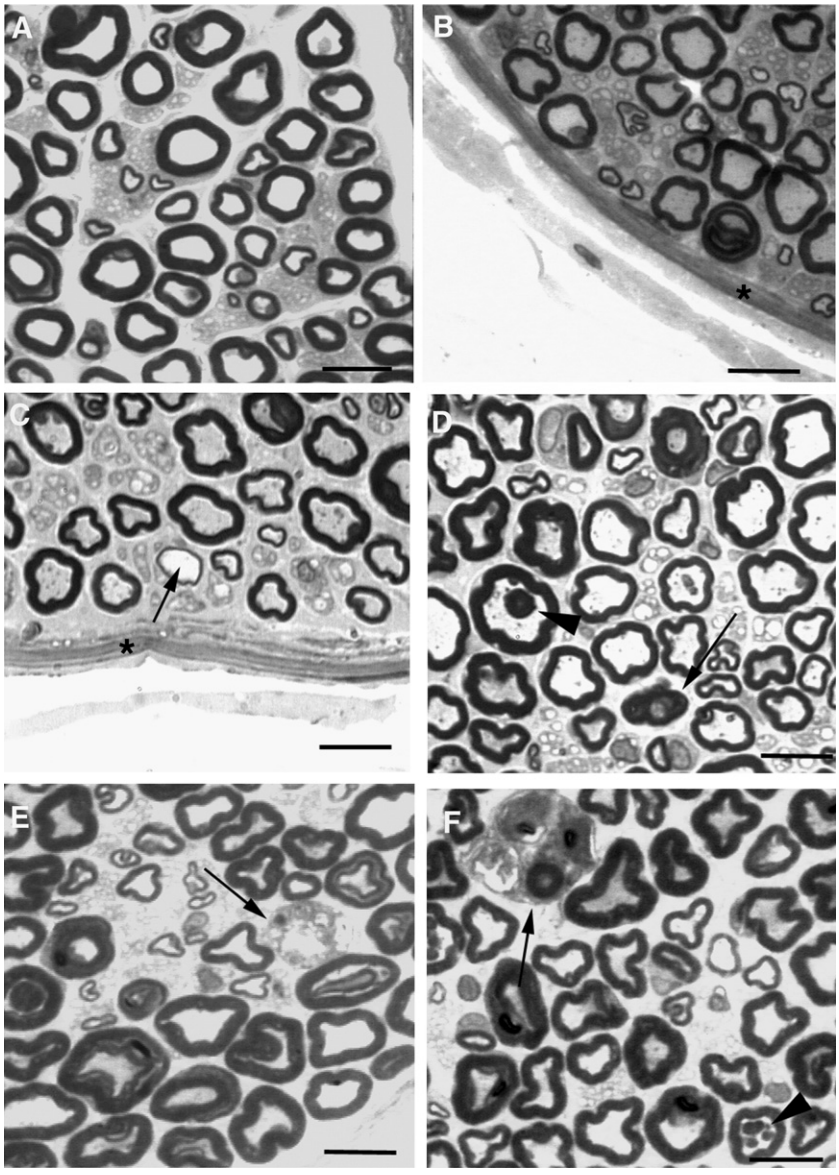

Fig. 1 – Semithin transverse sections of the sural nerve of female Wistar rats aged 360 (A and B), 640 (C and D) and 720 (E and F) days showing typical endoneural structures. Note that, from Group I (360 days old) to Group III (720 days old) there is an increase in the number of myelinated fibers with contorted and infolded myelin sheaths and myelin splitting. In C, the arrow indicates a large myelinated fiber with very thin myelin sheath. In D, the arrow indicates a Wallerian degeneration. The arrowhead shows a ball of the myelin. In E and in F, note the presence of a large number of myelin splitting. Also, the arrows indicate the presence of macrophages in the endoneural space. Arrowhead shows axoplasmatic inclusions in a myelinated axon. * Indicates the perineurium. Toluidine blue stained. Bar = 10 μm.