Nerve Endings in Human Triangular Fibrocartilage of the Wrist: A Preliminary Study Using Fluorescence Immunohistochemistry and Confocal Laser Scanning Microscopy

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Introduction: Recently, increasing interest has been shown in understanding the role of nerve endings in articulating joints, including recent investigations of the wrist joint ligaments(3,6). Previous studies have demonstrated the presence of nerve endings in the TFCC(1,5) using staining techniques such as gold chloride, silver or S-100 staining. Unfortunately, these techniques are plagued by problems associated with non-specific staining, low resolution and limitations to two-dimensional imaging. The purpose of this study is to analyze the innervation of the triangular fibrocartilage complex (TFCC) using a fluorescent immunohistochemical staining technique coupled with the confocal laser scanning microscope to describe distribution and morphologic details of nerve endings in this important stabilizer of the distal radioulnar joint.

Materials and Methods: within 12 to 18 hours of death. The specimens’ ages ranged from 55 to 70 years (mean 61.5 ± 6.35). Donors with a history of upper extremity injury, cervical spine injury, immune disease, rheumatoid disease or neurological disease were excluded. Using the protocol in our previous studies, the tissues were harvested, fixed and sectioned with a cryostat. Serial sections were collected on glass slides and were processed for fluorescence immunohistochemistry using antibody to protein gene product 9.5 and a secondary antibody conjugated to a fluorescent tag (Alexa Fluor 488)(4). The sections were evaluated with an LSM-510 confocal laser microscope and a Kontron KS 400 image analyzer. Labeled nerve endings were counted, mapped and reconstructed.

Results: Our staining method was successful in identifying morphological characteristics of nerve endings. According to classification by Freeman and Wyke, two types of nerve endings could be identified: type I (Ruffini) and type III (Golgi) (Fig. 1). We identified a total number of 20 nerve endings (Fig. 2). The distribution was 16 (mean, ±4.0) in the dorsal, three in the ulnar (mean, ±0.75) and one in the ventral area (mean, ±0.25). The presence of Ruffini-like and Golgi-like nerve endings were higher in the dorsal (80%) than in the ulnar and ventral area. The cylindrical and fusiform shape was predominated in the Golgi-like ending and 90% were located parallel to the collagen fibers.

Discussion: In this preliminary study of the TFCC, we demonstrated the presence of nerve endings and nerve fibers in six specimens. Our results are consistent with others (1) who have reported nerve endings in the TFCC despite the use of conventional staining methods. However, we found discrepancies with those(5) who observed Krause’s and Meissner’s corpuscles in the TFCC. We believe that our reconstructed 3-dimensional images reveal consistent morphology of nerve endings because it has provided enhanced characterization of shape and performed a digital analysis of the size(4). The central area, called the articular disc, showed no nerve endings or vessels consistent with previous studies(2). We also observed that in the ulnar area, Ruffini-like and Golgi-like endings were distributed near the dorsal and ventral radioulnar ligament attachments on the ulnar styloid and fovea. This distribution of nerve endings near the bony attachment of ligaments has also been demonstrated in other areas of the wrist, indicating a potential link to strain-related stimulation. In conclusion, the fluorescence immunohistochemical staining technique coupled with the confocal laser scanning microscope was successful in identifying nerve endings in the dorsal, ulnar and ventral area in the peripheral TFCC area.


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