Classification of fascial planes as natural pathways for neural structures

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BACKGROUND Spinal nerves, as part of the peripheral nervous system, divide and combine to end up giving the terminal peripheral branches. The main function of peripheral nerves is to give up sensory and motor innervation to the musculoskeletal system. To reach the target structures these nerves run through several anatomical planes. Recently the interfascial course of some nerves has been studied and as a result new locoregional ultrasound-guided techniques have been proposed. However, peripheral nerves may run through other anatomical planes with different fascial relations or specializations. We aim to compare ultrasound, anatomic and histologic characteristics of terminal peripheral nerves that run through different anatomic and fascial planes and describe dye diffusion patterns when injected under ultrasound guidance.

METHODS: Different peripheral nerves (musculocutaneous nerve, median nerve, radial nerve, sciatic nerve, superficial peroneal nerve and deep peroneal nerve) of the upper and lower limbs and their surrounding fascial relations were studied by ultrasound, gross anatomy dissection and histology in human cadaver body donors. Ultrasound-guided injections were performed previous to dissection to describe dye diffusion patterns.

RESULTS: The nerves studied run through different anatomic three-dimensional planes until they reach the structures they innervate. According to ultrasound, anatomic, histologic and dye diffusion patterns we have identified the following fascial structures: intraperimysial plane (musculocutaneous nerve through the coracobrachialis muscle), interepimysial (musculocutaneous nerve in the arm), between epimysium and periosteum plane (radial nerve), between epimysium and deep fascia (musculocutaneous and common peroneal nerve), and between deep fascia and superficial fascia (radial nerve, superficial peroneal nerve).

CONCLUSION: ultrasound, gross anatomy and histologic morphologic parameters as well as dye diffusion pattern differences enable to classify the course of terminal peripheral nerves in different types. We believe that this could help to consider further locoregional anaesthesic techniques, surgical nerve reparations as well as to better understand nerve mobilization techniques when applied to different nerves and different regions.