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EDIZIONI MINERVA MEDICA

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Can we reduce the risk of adverse effects in selective neurolysis of the motor branches of musculocutaneous nerve? Evidence-based anatomy approach to the rescue of patients with muscle spasticity.

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TEXT

We have read with great interest the article entitled 'Selective peripheral neurolysis using high frequency ultrasound imaging: a novel approach in the treatment of spasticity' by Kaymak et al.[1] published in the European Journal of Physical and Rehabilitation Medicine. In their article, the Authors illustrate that high frequency ultrasound can be efficiently used for localizing the peripheral nerves and their primary branches and suggest that it can aid peripheral neurolysis for the treatment of spasticity. We would like to congratulate the Authors for their professional knowledge and skills and make some contributions to the possible implementation of their findings in clinical practice.

Muscle spasticity, despite numerous clinical efforts to reduce it, still represents a crucial problem in the rehabilitation process of patients with upper motor neuron lesions.[2] Among the pharmacological treatment options, alcohol or phenol injections are often reserved to patients with spastic involvement of large muscle groups, who would otherwise require an excessively high dose of botulinum toxin A. However, chemoneurolysis is a double-edge sword: the clinical benefits are permanent, but so are the possible adverse effects. Apart from neurolytic agent-specific side effects, the main concern is with the involvement of sensory fibres, as their damage could produce paresthesia and dysesthesia, with severe impact on patients' quality of life. Pure muscular or cutaneous nerves, such as posterior interosseous nerve or sural nerve, respectively, are rare and most nerves of the peripheral nervous system are mixed, with possible cutaneous, articular, muscular and autonomic branches. In the treatment of spasticity in patients with upper motor neuron syndrome, however, the procedure should be selective, i.e. destroy only the nerve fibers within the muscular branches, avoiding the commonest iatrogenic side effect of chemoneurolysis, that is persistent sensory symptoms in the cutaneous distribution area of the involved nerve.

The identification of motor branches originating from the main nerve trunk, however, remains problematic. Currently, the procedure often involves the use of some nerve monitoring technique. In electromyography, a series of electrical stimuli is delivered through a specific stimulator needle to locate the nerve and its target motor branch. This neurofunctional approach is difficult for operators, painful for patients and limited to specialist centres where the expensive equipment and trained staff are available. Moreover, no morphological information is available. Recent advances in ultrasound technology have permitted the development of high-frequency probes that lend themselves to nerve visualization and primary branches localization. Indeed, the Authors of the aforementioned case report used this technique to visualize the branches of the musculocutaneous nerve in the arm and suggested that it could be used prior to neurolysis in the selective treatment of focal spasticity. As the same Authors mentioned—and we would like to stress out—the course, origin and distribution of nerve branches is variable. In our opinion, nerve monitoring is not a panacea for the neurolysis complications and it does not substitute for the anatomical knowledge of the landmarks along the course of nerve or, even more importantly, knowledge of anatomical variations of muscles and nerves. Notwithstanding the improvement of safety of chemoneurolysis offered by nerve monitoring techniques, a neglect to consider anatomical variations can make patients go out of the frying pan into the fire, changing their muscle spasticity into dysesthesia.

In patients with upper motor neuron lesions, the flexor muscles in the upper limb are commonly more involved than extensors. The musculocutaneous nerve serves the muscles in the anterior arm compartment, namely coracobrachialis, biceps brachii and brachialis, which act as shoulder and/or elbow flexors. Accordingly, it is a common target for neurolysis in patients with spasticity. We have recently performed the meta-analysis of the musculocutaneous nerve variations and, based on data from 43 cadaveric studies including over 4000 brachial plexuses, their overall pooled prevalence was 20%, which means that, theoretically, one out of every five encountered plexuses could have a variation in this nerve.[3] The most common variation of the musculocutaneous nerve is the presence of an anastomotic branch with the median nerve, but other variations include an absence of the nerve and an origin of the branch for the coracobrachialis muscle from the lateral cord, or an origin of the terminal cutaneous branch of the musculocutaneous nerve (lateral cutaneous nerve of forearm) from its secondary motor branches.[4] It remains doubtful whether all these variations can be detected by the available functional or structural nerve monitoring techniques and whether the adverse consequences of their presence following the neurolysis can be avoided.

Our meta-analysis revealed that the part of the musculocutaneous nerve distal to the coracobrachialis muscle, independently of whether the nerve pierces the muscle or emerges from beneath it at its lateral border, is the region with the highest rate of variations. Coincidentally, this is also the commonest location for selective musculocutaneous nerve neurolysis. It is also extremely noteworthy that the majority of the variations present in the more proximal part of the musculocutaneous nerve were associated with another variation in the same nerve.

Based on the above discussion, we would like to merge the practical skills of Kaymak et al. with our anatomical observations and suggest one mandatory step in high-frequency ultrasound scanning of upper limb nerves. Apart from the musculocutaneous nerve and its main branches, the median nerve should be identified as well. The first branch of the median nerve, typically, originates in the cubital fossa and is destined to the pronator teres. Hence, the presence of a branch in the arm should warn the operator about the possible communication between the median nerve and musculocutaneous nerve. By the same token, the absence of a branch departing from the main trunk of the median nerve in the arm most likely excludes the presence of communications and other variations in the musculocutaneous nerve. In our opinion, this simple approach takes better into account the complex anatomical characteristics of the anterior arm region and could improve safety of the pharmacological treatment of spasticity of the anterior arm muscles in patients with upper motor neuron injury.

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NOTES

Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions.— Felice Sirico contributed to the conception of the work, drafted the letter, revised it critically for intellectual content and approved the final version. Marcello Zappia contributed to the conception of the work, drafted the letter and approved the final version; Franca Di Meglio contributed to the conception of the work, supervised the writing, revised the letter critically for intellectual content and approved the final version. Clotilde Castaldo contributed to the conception of the work, drafted the letter and approved the final version. Daria Nurzynska contributed to the conception of the work, revised the letter critically for intellectual content and approved the final version.