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LETTER TO THE EDITOR

"It is not what it seems." Ultrasound findings in a case of unusual iatrogenic ulnar nerve damage

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Dear Editor:

We have read with interest the paper by Payne et al. about the fracture-related nerve laceration. The authors presented a literature review about this topic and two very illustrative cases [4]. This work is very informative for clinical point of view, because it shows how severe may be the consequences of a bone fracture. As indicated by the authors, an accurate diagnosis is mandatory for deciding a prompt and proper medical action. The authors rightly asserted electrophysiology can provide complete information three weeks after the injury, while imaging techniques may be immediately able to characterize a nerve suffering [4]. Especially, ultrasound (US) can be applied for this purpose, because of its speedy execution, safety, precision, low cost, and capability to evaluate the nerve in dynamic condition [2].

In our experience, besides the possible nerve injuries directly due to the traumas, iatrogenic neuropathy may occur as consequence of the surgical intervention for bone fracture [3]. This condition of "late" nerve damage may happen during the surgical maneuvers or when osteosynthesis implants are in contact with the nerve. Even in these situations, US can aid in understanding the cause of neuropathy and support the therapeutic decision [3]. The contact between the implant and a nerve, in particular, represents an insidious circumstance, where the foreign body causes a continuous mechanical stress on the nerve. Consequently, when surgical treatment is decided, US allows implant localization. Usually, the implant is metallic and hence, US clearly shows a typical finding, characterized by the presence of a thin and highly hyperechoic well-defined line. This appearance is due to the properties of the metal when exposed to US beam. However, in the last years, some surgeons have preferred the use of more biocompatible non-metal implants, constituted by a complex material including calcium and carbonate (CC) composites [5]. In literature, the risks related to these implants are less documented and no information about their US assessment exists.

We describe a case of ulnar nerve damage related to a CC nail migration, in which US visualized a particular finding regarding the nerve and the surrounding structures.

A 15-year-old boy reported a traumatic left epitrochlear fracture with no symptoms of concomitant nerve injury. An osteosynthesis, using a CC nail, was performed. Henceforward, the boy progressively began to complain pain and weakness in the fourth and fifth left hand fingers. Two months after the intervention, our clinical evaluation found weakness of hand muscles, innervated by the left ulnar nerve (strength of 3/5, following the Medical Research Council scale, MRC). Dysesthesia in the last two left fingers was shown. Electrophysiological examination found reduction of sensory and motor potential amplitude in the left ulnar nerve. Needle electromyography of the first dorsal interosseous and abductor digiti minimi muscles revealed fibrillation potentials and marked voluntary recruitment reduction. Axonal damage of the left ulnar nerve was diagnosed. After that, we evaluated this nerve by US, through an 18-MHz probe. In the elbow, the nerve showed a focal cross-sectional area

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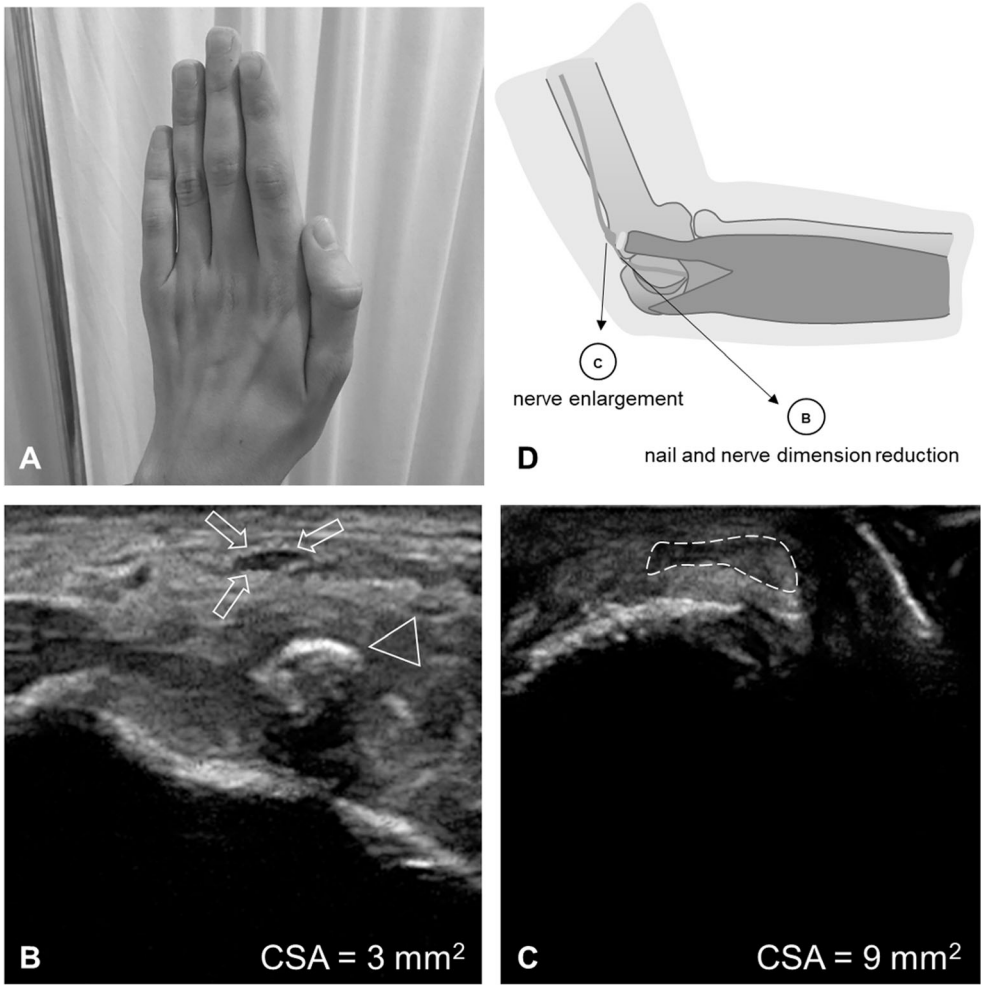

Fig. 1 **a** Patient's left hand showing hypotrophy of the intrinsic muscles. **b** US picture of the left ulnar nerve (arrows) close to the calcium carbonate nail (triangle), distal to the elbow. **c** US picture of the left ulnar nerve at elbow. **d** Schematic representation of the damage ulnar nerve. The letters indicate the position of the ultrasound findings

(CSA) reduction, with a value of 3 mm^2, and, just proximally, a CSA enlargement, up to 9 mm^2. Furthermore, US, during elbow flexion, showed the left ulnar nerve went into contact with a small hyperechoic structure, exactly where the nerve had the maximum CSA reduction (Fig. 1). The patient, during the maneuver, reported severe local pain [1]. This pointed structure was initially interpreted as bone fragment and a surgical exploration was decided, with the intention to take away the fragment. The intervention confirmed the US findings but found the hyperechoic structure, in contact with the nerve, was the CC nail, used for the previous surgical treatment, and not a bone (Fig. 2). The nail was removed with a marked amelioration of patient's clinical condition and electrophysiology (two months later, hand intrinsic muscle strength of 4/5 following MRC). A new US evaluation showed the disappearing of the pointed hyperechoic structure and nerve CSA normalization (7 mm^2) along the elbow.

In our case, the CC nail migration determined a damage to the ulnar nerve. Clinical and electrophysiological examinations are fundamental for the diagnosis, but a morphological evaluation should be always added, in order to characterize patient's condition. In our patient, this was essential to localize the damage and to plan a personalized surgical intervention, reducing the extension of the operating field and limiting the surgical complications. Furthermore, the peculiarity of our case is the US feature of the CC nail. This foreign body appeared similar to a bone fragment, probably because its constituting materials are very similar to bone composition.

As Payne et al. indicated, the nerve suffering following a trauma is a source of quality of life reduction in young patients [4]. For this reason, we underline the importance of an integrated morpho-functional evaluation (clinical, electrophysiological, and US) to study the patients, in order to guarantee the correct diagnosis, treatment, and rehabilitation of nerve impairment.

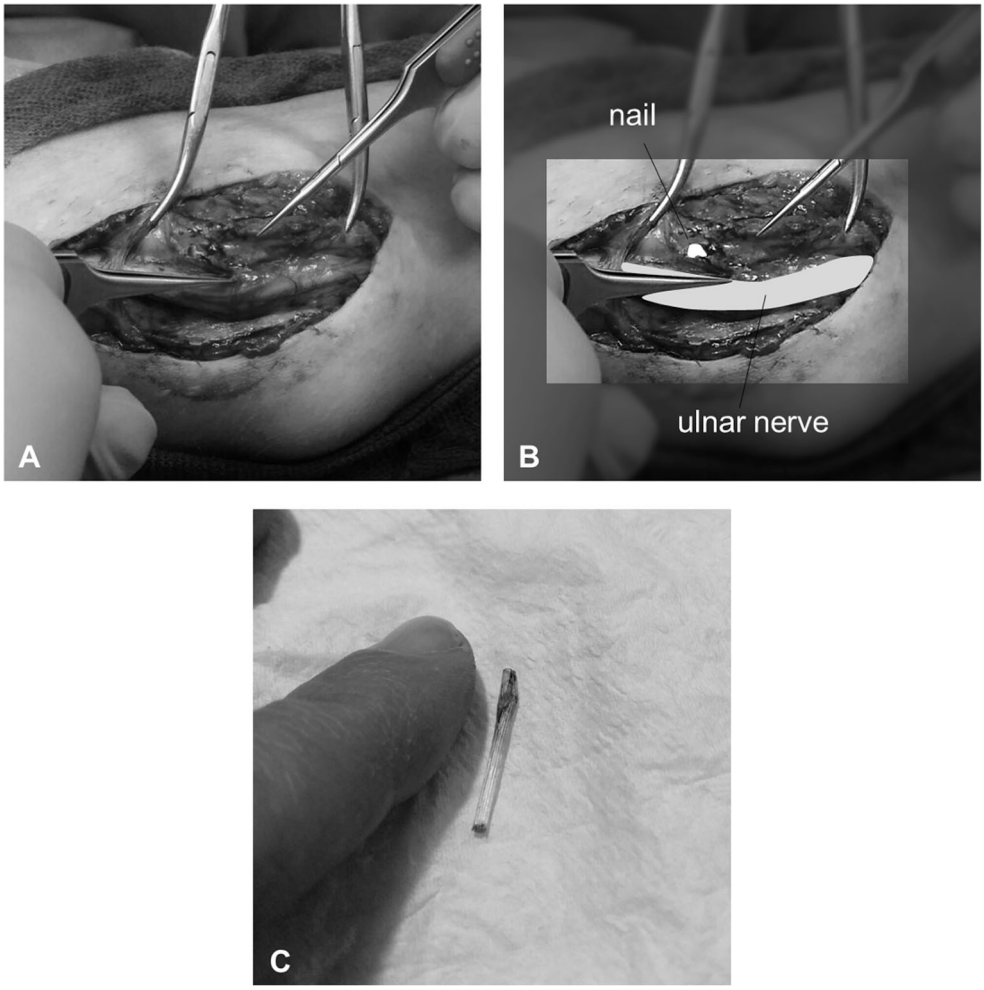

Fig. 2 **a** Surgical exploration findings. **b** Scheme of the surgical findings. The nerve was dislocated by the surgeon to display the nail. **c** The calcium carbonate nail removed after the surgery

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Compliance with ethical standards

Conflict of interest None.

Informed consent Informed consent from the parents of the participant included in the study.

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