Technical Note

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Securing the ulnar nerve in plate osteosynthesis of the coronoid process: exposure and closure

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Background

In the area of the proximal ulna, the ulnar nerve is located anatomically very close to the medial aspect of the coronoid. This is particularly relevant for osteosynthetic fracture treatment using a coronoid plate in the region of the anteromedial facet and the extra-articularly localized sublime tubercle. In such osteosynthesis, visualizing and securing the nerve is mandatory, without destabilizing its course in the cubital tunnel and preventing direct contact to the plate after successful open reduction and internal fixation (ORIF) by closing back the two heads of the flexor carpi ulnaris (FCU).

Surgical procedure

In the present technique, the ulnar nerve is left in its course in the cubital tunnel. We therefore do not split the roof of the cubital tunnel. Primarily, however, the nerve proximal to the cubital tunnel is exposed and secured (**Fig. 1a**). The ulnar nerve is relatively easy to identify proximally, as it can be palpated very well here. We merely accomplish a short exposure in order to obtain a better view of the joint later. Only after successful visualization can the flexor-pronator mass be incised safely and thus improve the view considerably, especially in muscular patients.

Then, bridging distally to the cubital tunnel, in our approach, the FCU lodge is carefully split. The nerve can usually be palpated, visualized, and protected at this point (**Fig. 1b**). The protection is important for the ensuing procedure, as the ulnar nerve lies directly medial to the coronoid.

In principle, in isolated coronoid treatment, the nerve is held away dorsally, since no anterior transposition is performed. Therefore, there is no mobilization of the nerve anteriorly, only a slinging and careful holding away in order to perform the corresponding osteosynthesis with reduction and plate application. In our procedure, the FCU interval is split. In addition, the complex and/or attachment of the flexor-pronator mass is detached over a few centimeters, leaving a small protrusion on the distal humerus for better visualization of the coronoid (**Fig. 1c**). Osteosynthesis and reduction then follow; the nerve remains in the cubital tunnel the entire time. The nerve is thus presented at two levels, proximal and distal to the cubital tunnel. This description is a novelty regarding approaches to the coronoid.

Initially, after plate osteosynthesis, the distally exposed area of the nerve runs directly along the plate (**Fig. 2a**). Therefore, it is initially of enormous importance to trace and display the nerve far enough distally into the FCU. This can cause postoperative symptoms, especially in flexion and therefore under tension. Even today, we still experience bizarre adhesions with the plate bearing in everyday clinical practice.

To prevent this, the nerve is carefully elevated and then the FCU interval is closed again (**Fig. 2b**). The closure of the muscle fascia is a crucial step to adequately cover the nerve in soft tissue and prevent direct implant contact.

At the end of the procedure, maximum flexion is performed to check whether the nerve continues to run smoothly in the cubital tunnel and does not show any anterior dislocation tendency over the medial

Video Online

The online version of this article (https://doi.org/10.1007/s11678-022-00682-z) contains the video: "Securing the ulnar nerve". You will find the video at the end of the article as "Supplementary material." Video by courtesy of F. Lanzerath, T. Leschinger, A. Harbrecht, L.P. Müller, Department of Trauma, Hand and Elbow Surgery, University Hospital of Cologne, Germany; all rights reserved 2022.

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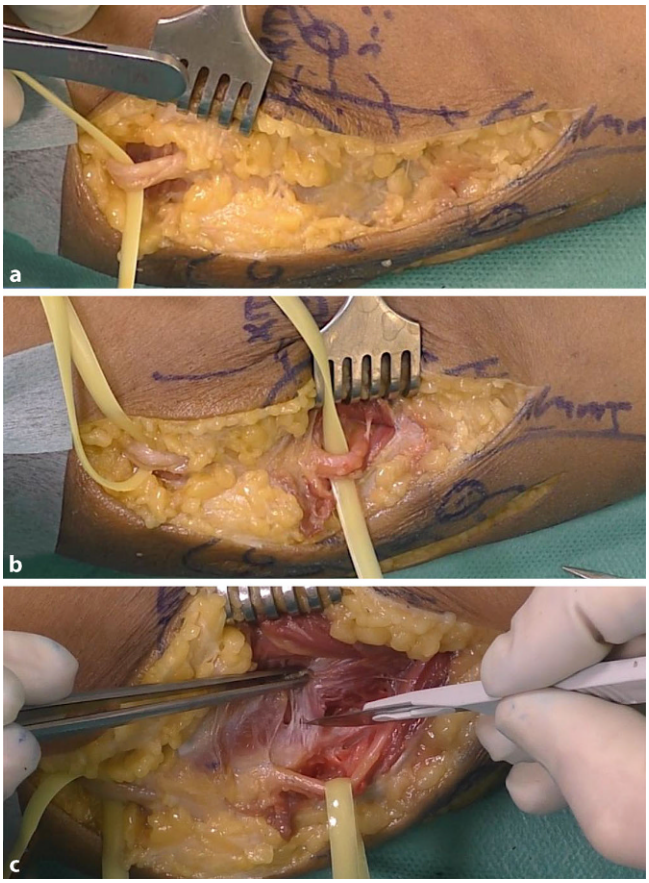

Fig. 1 ▲ Visualization of the ulnar nerve proximal and distal to the cubital tunnel. **a** Exposure of the ulnar nerve proximal to the cubital tunnel, **b** exposure of the ulnar nerve distal to the cubital tunnel, **c** detachment of the flexor-pronator mass

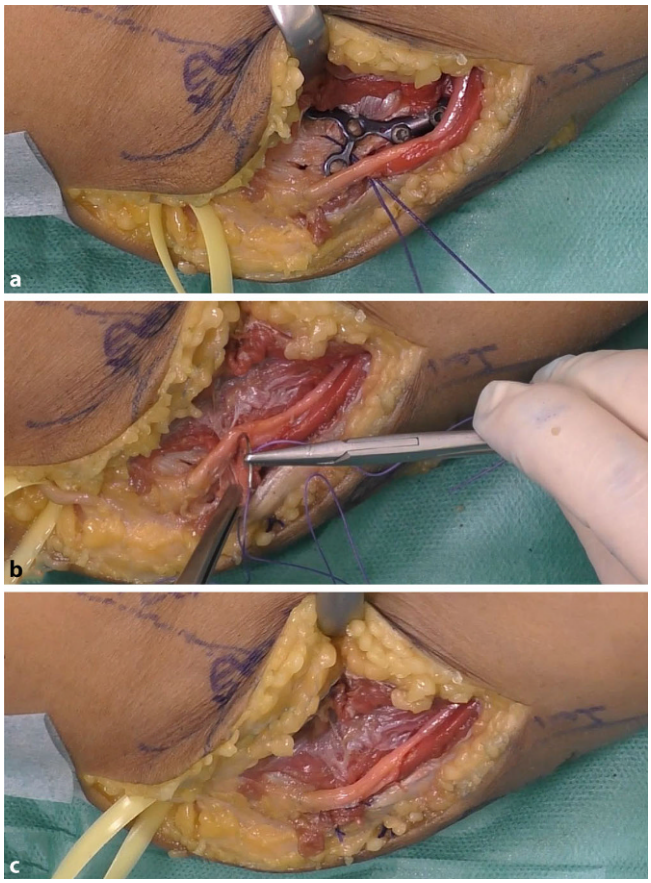

Fig. 2 ▲ Closure of the flexor carpi ulnaris interval to prevent direct plate contact of the nerve. **a** Anatomical proximity of the exposed nerve and the inlying plate bearing, **b** closure of the FCU interval, **c** maximum flexion to confirm smooth ulnar nerve running

epicondyle (◘ **Fig. 2c**). This should usually not be the case, since the roof of the cubital tunnel has been left in place.

Postoperative management

Postoperatively, radiological control in two planes (lateral and anteroposterior) is mandatory. In addition, compute tomography can be performed. To reduce swelling, we recommend an immobilizing plaster splint for 5 days in 90° flexion and neutral position with respect to pro- and supination. Varus and valgus load in particular should be avoided until fracture healing. Subsequently, mobilization of the elbow should be performed as soon as possible according to the overhead motion protocol [5]. Depending on the pain, maximum flexion is approved in an active-assist fashion. However, it should be kept in mind that the ulnar nerve flattens and stretches during flexion, resulting in increased tensile stress [1]. Care should be taken to ensure that patients perform this independently three times daily in a complete back-flat position. Attention should also be paid to guide the affected arm with the healthy arm and not to perform too many repetitions, but rather to slowly and continuously attempt to bring the arm into flexion. A mobile elbow orthosis (especially for extension restriction indicated postoperatively) can be applied after wound healing is complete. However, we do not assume that these orthoses can compensate for relevant varus and valgus loads.

Discussion

In the technique presented here, the ulnar nerve is left completely in the cubital tunnel and exposed only in two sites and thus not over its entire distance. Possibly, this could further reduce the incidence of postoperative neuropathies, since neurolysis, especially in the cubital tunnel, carries a considerable risk of destabilizing the ulnar nerve [4]. Of course, comparative studies will be necessary to prove this. Furthermore, our procedure might be faster than the standard full-thickness imaging, and thus the operation time might be reduced. It should be noted that the procedure presented here assumes that the nerve runs physiologically in the cubital tunnel and no anterior transposition is necessary. The vascular supply of the ulnar nerve is very pronounced, particularly in the elbow region, and has substantial influence on its vitality [3]. The manipulation involved in conventional neurolysis damages the vascular supply, and it takes time for the nerve to become sufficiently re-vascularized [2, 3]. Since we maintain the nerve in situ in the particularly highly remodeled region of the cubital tunnel, preservation of the vascular supply may be another advantage

of our procedure. During revision surgery, we frequently notice that the FCU interval over the applied plate has been neglected, leaving the nerve completely unprotected. Of course, this must be avoided, and sufficient time should be taken to close the fascia between the plate and the nerve.

Practical conclusion

- **The nerve is left in the cubital tunnel, the roof is not split, and therefore we do not take the risk of damage at this location.**
- **Our technique may reduce the operating time, since neurolysis of the nerve does not have to be performed over the entire distance.**
- **The vascular supply to the nerve within the cubital tunnel remains intact.**
- **The intact cubital tunnel along with the closed flexor carpi ulnaris interval protects the nerve from the osteosynthetic material.**

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Declarations

Conflict of interest. F. Lanzerath, T. Leschinger, A. Harbrecht, and L.P. Müller declare that they have no competing interests.

For this article no studies with human participants or animals were performed by any of the authors. All studies mentioned were in accordance with the ethical standards indicated in each case.

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