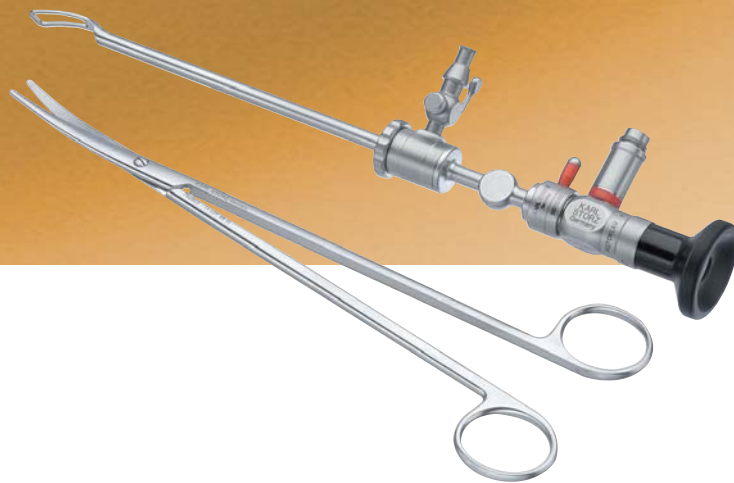


Endoscopic Treatment of Cubital Tunnel Syndrome (Sulcus Ulnaris Syndrome)

Dr. Reimer Hoffmann



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Preliminary remarks

Compression neuropathy of the ulnar nerve in the cubital tunnel is the second most frequent entrapment neuropathy of the upper extremity after carpal tunnel syndrome. Open surgical methods include in situ decompression of the nerve and subcutaneous or submuscular transposition of the nerve. The combination of in situ decompression with medial epicondylectomy is extremely popular in the USA in particular. However, a not small number of surgeons are dissatisfied with the results achieved using these surgical techniques, and many regard the extended open operations and the associated long recovery periods for patients as outdated. No reliable statistics are available to establish which of the traditional surgical techniques are preferred internationally. Unchanged, surgeons who favor in situ decompression still face those who advocate transposition.

In situ decompression: For experienced physicians in situ decompression represents a low-risk procedure. The nerve is left in its tunnel and decompression is achieved by dividing Osborne's ligament in the retrocondylar area and dividing the flexor carpi ulnaris (FCU) fascia up to a distance of 3-5 cm, measured from the midpoint of the retrocondylar groove. The fascia covering the nerve is divided along a length of 6-8 cm towards proximal. This operation can thus be characterized by the relative ease with which it can be performed and the limited length of nerve decompression of, in total, around 10-12 cm. We regard the restricted nerve decompression as the most probable cause for the relatively high failure rate of this procedure.

Subcutaneous transposition: Subcutaneous transposition of the nerve is a considerably more difficult intervention, which demands a high degree of atraumatic and indeed microsurgical operating expertise. In this intervention, the surgeon is constantly required to reach a compromise between avoiding devascularization (and to some extent denervation of small nerve branches) wherever possible and still effecting the necessary radical mobilization of the nerve. In order to achieve tension-free transposition of the nerve, the correct performance of the procedure requires considerably more extensive "long-distance" decompression than is the case with in situ decompression. The "long-distance" decompression is, in our view, the most likely reason for the good results achieved with this technique in the literature. This technique is, however, associated with major complications, which result most frequently when this – supposedly simple – operation is performed by surgeons without specialist training or who only perform this type of intervention sporadically.

Submuscular transposition: Submuscular transposition is both a radical and complex intervention in which, following decompression, the nerve is transposed below the musculature, which has been detached from the ulnar epicondylus previously. The musculature is subsequently returned to its previous position. This intervention is usually followed by an immobilization period lasting 2 to 3 weeks.

Endoscopic “long-distance” in situ decompression: This endoscopic procedure combines the advantages of in situ decompression (atraumatic approach, the nerve is left in its vascular supply system) with the advantages of the more extensive, i.e., longer, decompression associated with surgical techniques involving transposition. We therefore refer to our procedure as endoscopic “long-distance” in situ decompression.

Introduction

The use of endoscopic techniques on the upper extremity is nothing new. Arthroscopies on the shoulder, elbow and wrist have long become routine operations. Endoscopy of soft tissues, also known as “non-joint” or “non-cavity” endoscopy, is however still not performed regularly on the extremities. Soft tissue endoscopy, the term we also use to describe this technique, originated in the field of plastic surgery (facelifts, breast and abdominal interventions). The endoscope used in the technique described here – as well as for endoscopic brow lifts – also comes from this field. Techniques for the endoscopic treatment of cubital tunnel syndrome were described as early as the late 90s. In 1999, Dr. Tsai referred to a method which is similar to endoscopic carpal tunnel roof division insofar as only the forearm fascia was incised using a special scalpel. We have developed a technique for endoscopic decompression of the ulnar nerve in the cubital tunnel which allows **operations** in the upper extremity and not merely a specific structure to be divided. By tunneling in the area to be operated upon, we create a space similar to the joint or body cavities, which we visualize and illuminate using specula and endoscopes and into which we insert instruments to enable two-dimensional surgery to be performed under good visual conditions. As such, this is a fundamentally different concept to that of endoscopic interventions in which the anatomical structures cannot be seen at all times during the operation. In our endoscopic technique, the space which has been created is kept open by the endoscope and the dissector located at its tip without the need for gas or liquids. Moreover, the endoscope and the instruments required for surgery are not inserted into the nerve tunnel but, similar to the way in which a knife and fork interact, are guided above the nerve which means that the structures are not only visualized perfectly, but can also be dissected precisely and atraumatically under magnification.

Technical Description of Surgery

The operation is carried out under subaxillary plexus or general anesthesia. A tourniquet is also used on the upper arm. Draping must allow full passive mobility of the arm. The arm is positioned in 90° shoulder abduction on a hand table (Fig. 1a). The arm is flexed at the elbow joint and supinated. The surgeon is seated to directly face the retrocondylar groove.

An incision is made over a length of 15 to 20 mm along the retrocondylar groove (Fig. 1b). The wound is held open with double-prong hooks and the tunnel roof is visualized and opened. The nerve is easy to identify given its white coloring and the vasa nervorum running longitudinally (Fig. 2). In the case of obese patients, the nerve is also surrounded by adipose tissue, which may render recognizing it more difficult. Atypical musculature (epitrochleo-anconeus muscle) in the tunnel is rare (4% of our cases), but if it is present it can hinder dissection. After identifying the nerve, the cubital tunnel roof is transected along a length of approx. 1 cm toward both distal and proximal respectively.

Following this, the space required for the endoscopic intervention is created by tunneling. Therefore, tunneling forceps are introduced epifascially; under no circumstances should the forceps be inserted into the nerve tunnel! A space sufficiently large to accommodate the instruments is created by gently spreading the forceps, which are rounded at the tip in a similar way to dressing forceps (Fig. 3). The forceps must not be opened too abruptly as this may result in injury to cutaneous nerve branches, e.g., the ulnar antebrachial cutaneous nerve, which can cause temporary reduced sensation at the ulnar forearm. In the next step, an illuminated speculum is introduced into the distal tunnel (blade length 9 to 11 cm) (Fig. 4). Osborne's ligament (synonym: cubital retinaculum) is then divided under direct vision. This is a ligamental thickening of the cubital tunnel roof between the ulnar epicondylus and the olecranon (Fig. 5).

Continuing under visual control, the fascia is divided until both heads of the FCU are visible (Fig. 6). This is most likely the location of one of the major compression zones of the nerve and the majority of surgeons are satisfied once this structure has been divided. From this point onward, we favor the use of the endoscope. The relevant layers must be clearly identified (Fig. 7). The endoscope with its rounded dissector at its shaft tip is slowly advanced distally up the forearm fascia. Using the dissector, the surrounding soft tissue is displaced and retained to expose the fascia (Fig. 8a, b). Blunt-tipped dissection scissors (three lengths: 18, 21 and 26 cm) are used to gradually



Fig. 1a: Positioning of the arm for surgery



Fig. 1b: Positioning and incision



Fig. 2: Visualization of the nerve with vasa nervorum



Fig. 3: Epifascial tunneling towards the distal end

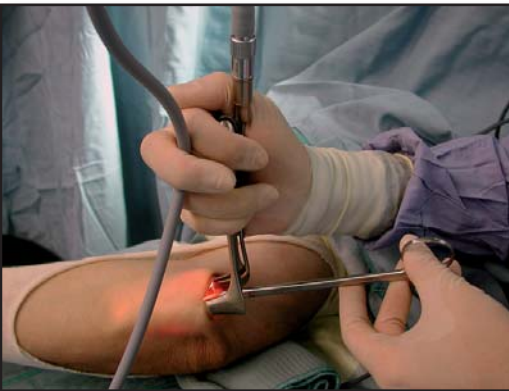


Fig. 4: Insertion of the illuminated speculum and initiation of dissection



Fig. 5: Division of Osborne's ligament



Fig. 6: Division of the sharp-edged FCU arch



Fig. 7: Identification of the relevant layers: forearm fascia; flexor carpi ulnaris muscle; submuscular membrane

tear through up to a distance of 12 cm from the midpoint of the retrocondylar groove (Fig. 8b). When doing this, special care is taken to ensure that sensitive nerve branches crossing the fascia are not damaged. If necessary, these are detached from the fascia and displaced by passing the dissector underneath (Fig. 9). Once the forearm fascia has been divided, the next step involves division of all compressive structures in the vicinity of the nerve. In terms of complete decompression, this part of the operation is of major significance. All structures which cover the nerve and which may be the cause of compression are divided using the cubital tunnel scissors. This concerns the submuscular membrane in particular; a thin but strong structure which lies between the FCU and nerve (Siemionow, Hoffmann, 2006). At a distance of between 5 and 9 cm, measured from the midpoint of the retrocondylar groove, we often found fibrous thickenings in this membrane; structures which are comparable to the ring bands of flexor tendon sheaths and capable of compressing the nerve. The proximal end of the submuscular membrane is initially located and divided. This area is extremely small and sometimes difficult to visualize, particularly if the nerve is swollen (Fig. 10). The submuscular membrane and its thickenings are transected (Fig. 11). Any muscle branches which come off from or, more rarely, cross the nerve in this area of the cubital tunnel must not be damaged (Fig. 12). Decompression is performed up to a distance of 10 to 15 cm distal from the midpoint of the retrocondylar groove (Fig. 13). The instrument set does not or barely touches the nerve during dissection (no touch). Furthermore, the nerve's natural anatomical connection to its surroundings is retained and, in particular, its own vascular supply is protected. The entire course of the motor branches to the FCU and flexor musculature can be well visualized. These can be easily protected; as well as vessels and nerve branches which cross the path of the nerve.

Long bipolar forceps or special bipolar microforceps allow this even at greater depths. Adipose tissue makes dissection and visualization difficult, particularly in combination with lax soft tissue. The endoscope then has to be cleaned more often and adipose tissue particles must be removed. The surgical procedure is carried out identically towards the proximal side. The fascia is divided up to a length of 10 to 12 cm. If the triceps has an aponeurotic edge, this is divided. The intermuscular septum does not represent a cause of compression and is left alone. A genuine Struther's arcade, a fibrous band which runs from the triceps muscle to the intermuscular septum, has been seen in only very few of the patients we operated upon (Fig. 14). At the end of the intervention, the wound is closed, a bulky compression dressing is applied and the tourniquet is let down (Fig. 15). Patients are allowed all movements which are feasible with the dressing. However, patients are instructed to avoid a fully flexed idle position for three weeks. The dressing is removed after 2-3 days. At this point, there is almost always full mobility (Fig. 16).



Fig. 8a: Endoscopic division of the forearm fascia

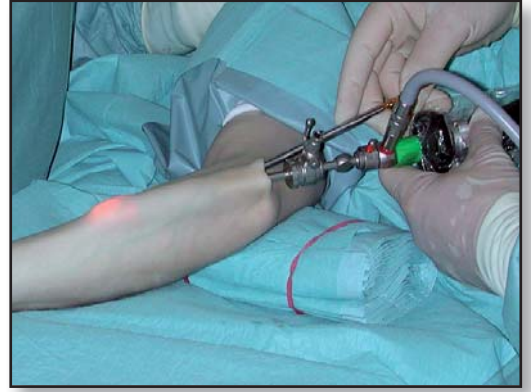


Fig. 8b: "Long-distance" decompression (15 cm) towards the distal end



Fig. 9: Dissection of nerves crossing the fascia



Fig. 10: Small area at the entrance to the cubital tunnel

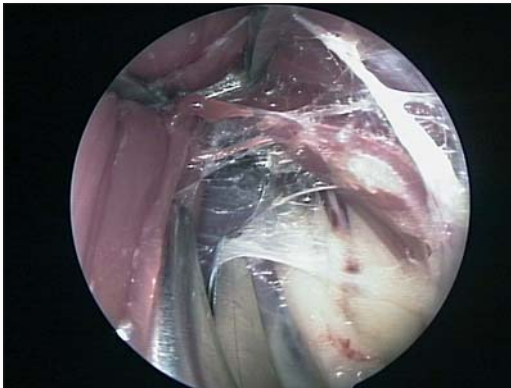


Fig. 11: Transsection of a fibrous thickening of the submuscular membrane

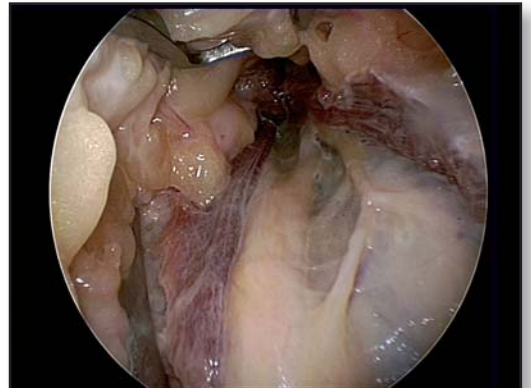


Fig. 12: Passage of a motor branch in the distal cubital tunnel



Fig. 13: Dissection findings at the end of the distal path



Fig. 14: Fibrous thickening in the triceps muscle toward proximal

Findings

In a study published by us in 2006, we reported on the findings of our endoscopic cubital tunnel operation. In 94% of the cases (n=76), the results were either good or very good. 95% of patients reported a subjective improvement in their symptoms within just a few days. In the same number of cases, full mobility of the elbow joint had returned on the second day after the operation. The average strength of the hand grip improved significantly. Approx. 80% of cases were subjected to electro-diagnostic monitoring; all showed improved values. To date, the endoscopic procedure has been performed on approx. 400 patients. The results speak for themselves. In terms of complications; in 4% of patients a superficial hemotoma was identified which did not necessitate treatment. Three patients underwent a second endoscopic procedure after a period of approx. 3 years without any symptoms. Even patients with considerable arthrosis in the area of the cubital tunnel and/or in some cases considerable post-traumatic valgus deformity of the elbow joint could be successfully treated using the endoscopic technique. Further studies from other authors (Bultmann, Ahcan, Zorman) produced comparable and, in part, even better findings.

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Fig. 15: Dressing

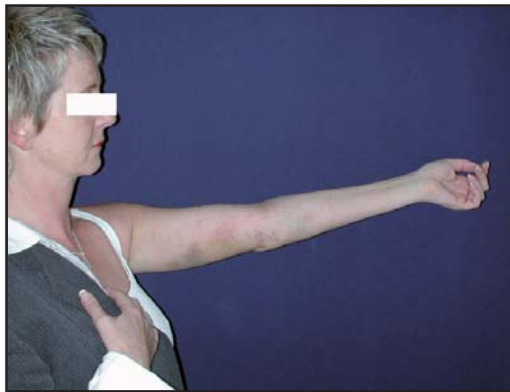


Fig. 16 a,b: Early postoperative mobility

Advantages of Endoscopic Treatment of Cubital Tunnel Syndrome

For the surgeon

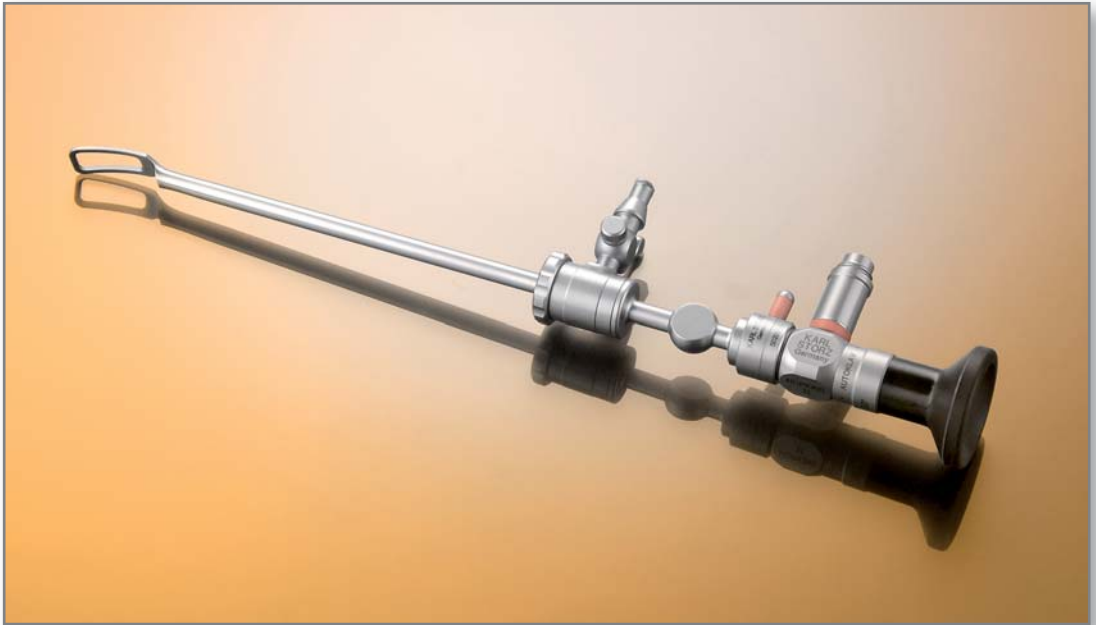
- Easy-to-learn procedure (workshop, observing operations)
- Quick learning curve
- Low operation risk thanks to perfect visualization
- Simple instruments set
- High level of patient satisfaction

For patients

- Significantly longer decompression lengths of up to 30 cm
- Considerably lower morbidity
- Rapid improvement of symptoms
- Dressing worn for only 2-3 days
- Full mobility of elbow joint within 2 to 3 days

Instrument Set for Endoscopic Treatment of Cubital Tunnel Syndrome





50230 BA **HOPKINS® Forward Oblique Telescope 30°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiberoptic light transmission incorporated, color code: red

50200 ES **Optical Dissector**, with distal spatula, fenestrated, large, sharp, for use with **HOPKINS® telescopes 30°**



404090 S **Illuminated Nasal Speculum** with fiberoptic light carrier, with set screw, length 13.5 cm, blade 90 mm

404092 S **Illuminated Nasal Speculum** with fiberoptic light carrier, with set screw, length 13.5 cm, blade 110 mm



748220 DUPLAY Dressing Forceps, curved, with ratchet, length 21 cm

748221 DUPLAY Dressing Forceps, straight, with ratchet, length 21 cm



752918 METZENBAUM Scissors, curved, length 18 cm

752923 METZENBAUM Scissors, curved, length 23 cm

752928 METZENBAUM Scissors, curved, length 28 cm



28164 BDM **Take-apart Bipolar Forceps**, width 1 mm delicate jaws, distally angled 45°, horizontal closing, outer diameter 3.4 mm, working length 20 cm, consisting of:

26284 HM	Handle
26284 AS	Outer Tube
26284 BS	Inner Tube
28164 FGM	Bipolar Insert

26184 PTS **Take-apart® Bipolar Forceps**, straight, pointed, coaxial closing, outer diameter 3.4 mm, working length 20 cm, bipolar attachment for use with handle, outer and inner sheath from 28164 BDM

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