ENDOSCOPIC TREATMENT OF CUBITAL TUNNEL SYNDROME

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Endoscopic Treatment of Cubital Tunnel Syndrome

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Online Video Content
The author has contributed a topic-related video clip which is readily identified in the text by a play button with accompanying number and title (see below). Click on the play button to view the video clip in your internet browser.

1 – The endoscopic management of cubital tunnel syndrome
Click here, or see page 5.
Endoscopic Treatment of Cubital Tunnel Syndrome

1.1 Basic Principles

Apart from the carpal tunnel syndrome, compression neuropathy of the ulnar nerve in the cubital tunnel is the second most common entrapment neuropathy in the upper extremity.\(^3\) Open surgical treatment options include in situ decompression of the nerve and subcutaneous or submuscular nerve transposition. The combination of in-situ decompression with medial epicondylectomy is particularly popular in the USA.\(^8\) More than but a few surgeons are dissatisfied with the outcomes achieved through the use of these surgical techniques and many hold the opinion that extensive open surgery, which usually entails a lengthy recovery period, is no longer an acceptable option. There is no conclusive statistical analysis available regarding the traditional surgical techniques most commonly used on a global scale. Invariably, however, the proponents of in-situ decompression still stand opposed to those who favor the use of anterior transposition.\(^7\)

1.1.1 In-situ Decompression

When conducted by an experienced surgeon, in-situ decompression is a low-risk procedure.\(^2\)\(^,\)\(^11\) The nerve is left in its tunnel and decompression is achieved by releasing both Osborne's ligament in the retroepicondylar area and the flexor carpi ulnaris (FCU) fascia up to a distance of 3–5 cm, measured from the midpoint of the retroepicondylar groove. The fascia overlying the nerve is released over a length of 6–8 cm in a proximal direction. Given its relative ease of performance and the limited overall length of nerve decompression of approximately 10–12 cm, this type of surgery is referred to as ‘simple decompression’. The limited extent of nerve decompression appears to account for the relatively high failure rate associated with the procedure.

1.1.2 Subcutaneous Anterior Transposition

Subcutaneous transposition of the nerve is quite a challenging technique, which demands a high level of atraumatic and even microsurgical skills on the part of the surgeon, who is constantly required to make a reasonable compromise between avoiding devascularization (and, to some extent, denervation of small nerve branches) on the one hand, and achieving the necessary radical mobilization of the nerve, on the other. In order to achieve a tension-free transposition of the nerve, the correct performance of the procedure requires a considerably longer nerve segment to be decompressed as compared to in-situ decompression. This ‘long-segment’ decompression, in the authors opinion, is the most likely cause for the reported favorable results yielded by the use of the technique. However, major complications associated with the technique most frequently occur when this – supposedly ‘simple’ – operative procedure is undertaken by surgeons who failed to participate in a hands-on training course or who perform this type of surgery only sporadically.

1.1.3 Submuscular Anterior Transposition

Submuscular transposition is both a radical and complex surgical procedure and, after decompression, involves that the nerve is transposed below the musculature, which, prior to this step, is detached from the ulnar epicondylus.\(^10\) Subsequently, the musculature is returned to its previous position. Follow-up care usually requires an immobilization period for approximately 2 to 3 weeks.

1.1.4 Endoscopic ‘Long-Segment’ In-situ Decompression

The endoscopic procedure combines the benefits of in-situ decompression (atraumatic approach, the nerve is left in place along with its vascular supply) with those derived from more extensive, i.e., ‘long-segment’ decompression techniques involving anterior transposition of the nerve. For this reason, this type of procedure, preferably used by the author, is referred to as endoscopic ‘long-segment’ in-situ decompression.

1.2 Historical Aspects

Using endoscopic techniques on the upper extremities is not a new concept. Arthroscopies on the shoulder, elbow and wrist have long become routine practice. However, endoscopic procedures that are geared toward the soft tissues, also known as ‘non-joint’ or ‘non-cavity’ endoscopy, are still not regularly performed on the extremities. Soft tissue endoscopy – the term we also use to describe the technique – stems from the field of plastic surgery (facelifts, breast and abdominal procedures). The endoscope used in the technique described here – as well as for endoscopic brow lift – also emerged from this field. Techniques for endoscopic treatment of cubital tunnel syndrome were described as early as the late 1990s. In 1999, Dr. Tsai reported on a method which is similar to endoscopic carpal tunnel roof division in which only the forearm fascia is incised with a special scalpel.\(^13\) Endoscopic decompression of the ulnar nerve in the cubital tunnel, as devised by the author and colleagues, can be used on the upper extremity and allows not only a specific structure to be divided.\(^16\) Similar to the technique used for
minimally invasive surgery of carpal tunnel syndrome, the area of interest is undermined first to create a space that can be illuminated and explored with specula and endoscopes. Subsequently, instruments are inserted enabling two-dimensional operative maneuvers to be performed under good visual conditions. As such, the author employs a completely different concept as compared to that of endoscopic procedures where anatomical structures are not amenable to visual control throughout the entire surgery. In our endoscopic technique, the space created in the way described above is kept open by the scope and the optical dissector’s distal spatula. For obvious reasons, these design features offer the advantage of eliminating the need for any type of distension medium, like gas or fluid.

Apart from that, both scope and surgical instruments are not inserted into the nerve tunnel, but are guided above the nerve – similarly to the way in which ‘knife and fork’ interact during a meal – which allows structures not only to be visualized perfectly but also to be dissected precisely and atraumatically under magnification.

2 Endoscopic ‘Long-Segment’ In-Situ Decompression

2.1 Operating Technique

The operation is carried out using an axillary block of the brachial plexus or general anesthesia. The author prefers the use of a tourniquet on the upper arm. Draping must permit full passive mobility of the arm, which is positioned in 90° shoulder abduction on a padded hand table (Fig. 2.1a). The arm is flexed at the elbow joint and placed in supination. The surgeon assumes a seated position to directly face the retroepicondylar groove.

The author prefers the use of a special instrument set for endoscopic decompression of the ulnar nerve (cubital tunnel syndrome), developed in collaboration with KARL STORZ Tuttlingen, Germany (Fig. 2.2, Item No. 50600).

Fig. 2.1 Positioning of the arm for surgery (a). Once the skin incision has been made, the wound is retracted with a two-pronged hook (b).

Fig. 2.2 Instrument set for endoscopic decompression of the ulnar nerve – cubital tunnel syndrome, (KARL STORZ Tuttlingen, Germany).
An incision is made over a length of 15 to 20 mm along the retroepicondylar groove (Fig. 2.1b). The wound is held open with double-pronged hooks and the roof of the tunnel is visualized and opened. The ulnar nerve is readily identified given its whitish color and the vasa nervorum running longitudinally (Fig. 2.3). In obese patients, adjacent fatty tissue may obscure visualization making it difficult to identify the nerve. In patients with an atypical musculature (epitrochleo-anconeus muscle) in the cubital tunnel (in 4% of the author’s patient group), this can complicate dissection to some degree. Once the ulnar nerve has been identified, the roof of the cubital tunnel is transsected over a length of approx. 1 cm, both in a distal and proximal direction.

Subsequently, the space needed to proceed with the endoscopic procedure, is created by tunneling. For this purpose, the tunneling forceps is introduced to follow an epifascial course. Utmost care must be paid to prevent the forceps from going astray into the nerve tunnel! A space large enough to accommodate instruments is created by gently opening the rounded jaws of the forceps, which are similar in design to those of dressing forceps (Fig. 2.4a). Opening the jaws in an overly abrupt manner may cause iatrogenic injury to cutaneous nerve branches, e.g., the ulnar antebrachial cutaneous nerve, potentially resulting in transient impairment of sensation in the area of the ulnar forearm. In the next step, an illuminated speculum is introduced into the distal tunnel (length of blade 9 to 11 cm) (Fig. 2.4b). First, Osborne’s ligament (synonym: cubital tunnel retinaculum) – a transverse fascial band that is formed by thickening of the roof of the cubital tunnel between the ulnar epicondyle and the olecranon – is divided under direct vision (Fig. 2.5a).

Continuing under visual control, the fascia is divided until both heads of the FCU become visible (Fig. 2.5b). This site most likely is one of the major zones of nerve compression and the majority of surgeons are satisfied once this structure has been divided. Hereupon, the author favors the use of the endoscope. The relevant layers must be clearly identified (Fig. 2.5c). Gentle force is applied...

**Fig. 2.3** Gross aspect of the ulnar nerve with vasa nervorum.

**Fig. 2.4** Epifascial undermining is performed in a distal direction (a). Once the illuminated speculum has been introduced into the tunnel, dissection can be initiated (b).

**Fig. 2.5** Osborne’s ligament is divided (a). The fibrous arch that bridges the heads of the flexor carpi ulnaris (FCU) muscle is split (b). The relevant surgical layers are identified (c) as follows: forearm fascia, flexor carpi ulnaris muscle and its submuscular membrane.
to advance the scope – which is mounted to a spoon-tipped optical dissector – distally up the forearm fascia.

Using the dissector, the surrounding soft tissue is detached until the fascia is fully exposed. In doing so, care is taken to preserve integrity of the soft tissue (Fig. 2.6, insert). Blunt-tipped dissection scissors (available with a length of 18 cm, 21 cm and 26 cm) are used to gradually transect the fascia up to a distance of 12 cm from the center of the retroepicondylar groove (Fig. 2.6). Special care is advised to ensure that the sensitive nerve branches traversing over the fascia are spared. If necessary, the nerve branches are detached from the fascia and lateralized by passing the dissector underneath (Fig. 2.7a). Once the forearm fascia has been released, the next step is to provide decompression from structures situated in close proximity to the nerve. In order to meet the goal of complete decompression, the latter step of the operation is of major importance.

**Fig. 2.6** Distal ‘long-segment’ decompression (15 cm). The forearm fascia is released under constant endoscopic control using the optical dissector (see insert).

**Fig. 2.7** Meticulous dissection of the nerve branches traversing over the fascia (a). Bottleneck section at the entrance to the cubital tunnel (b). Transection of a dense fibrous thickening of the submuscular membrane (c). View of a motor branch coming off the distal cubital tunnel (d). Final aspect demonstrating the end of the distal segment after completion of dissection (e). Proximal triceps muscle exhibiting fibrous thickening (f).
Any structures covering the nerve and posing a potential source of compression are dissected with the cubital tunnel scissors. This particularly holds true for the thin but sturdy submuscular membrane, located between the FCU and nerve. At a distance of 5 to 9 cm from the center of the retroepicondylar groove, fibrous thickenings are often seen in this membrane. They are comparable to the annular pulleys of flexor tendon sheaths and may compress the nerve. Initially, the proximal end of the submuscular membrane is identified and divided. The surgeon often must cope with narrow anatomical conditions in this area, which is particularly difficult to expose if the nerve is swollen (Fig. 2.7b). The submuscular membrane and its thickenings are transected (Fig. 2.7c). Any muscle branches that arise from, or more rarely, cross the nerve in this area of the cubital tunnel must be spared (Fig. 2.7d). The distal margin of decompression is no further than 10 to 15 cm from the midline of the retroepicondylar groove (Fig. 2.7e). In order to preserve anatomical continuity with neighbouring structures, particularly in terms of vascular supply, make sure that any surgical instrument used for dissection does not touch (no touch) or does barely come into contact with the nerve. The entire course of the motor branches to the FCU and the flexor musculature are well visualized endoscopically. Vital structures are protected in a straightforward manner, and this also applies to vessels and nerve branches crossing the path of the nerve. Given the use of a nerve-sparing dissection technique, electrocoagulation of small veins is only rarely needed. In cases where a greater depth of tissue penetration is required, the use of long bipolar forceps or a special micro forceps is another option worth to be considered. The presence of adipose tissue can make dissection and visualization more challenging, particularly if there is lax soft tissue. This can make it necessary to repeatedly clean the scope’s distal lens surface or to remove adherent fatty debris with a cotton pledget.

Identical surgical steps are then performed on the proximal side. The fascia is divided up to a length of 10–12 cm. If the triceps has an aponeurotic edge, this is divided. The intermuscular septum does not represent a cause of compression and is left intact. A genuine arcade of Struthers, a fibrous band traversing from the triceps muscle to the intermuscular septum, has been observed very rarely in those patients treated at the author’s institution (Fig. 2.7f).

At the end of surgery, the wound is closed, a well-adapted bulky compressive dressing is applied and the tourniquet is released (Fig. 2.8). Patients are permitted active mobilization within the range of motion afforded by the dressing, however they should also be counselled to avoid a fully flexed resting position for three weeks. The dressing is removed at day 2–3 after surgery. At this point, in most patients full mobility should nearly always be possible (Figs. 2.9a,b).
Endoscopic Treatment of Cubital Tunnel Syndrome

3 Discussion and Conclusion

3.1 Outcomes of Studies

In a study, published in 2006, the authors evaluated the outcomes of a small series of operative procedures for endoscopic cubital tunnel release. In 94% of cases (n = 76), the results were either good or very good. 95% of patients reported a subjective improvement in their symptoms occurring within just a few days. The same number of patients stated that full mobility of the elbow joint was regained on day 2 after surgery. It was shown that average grip strength improved significantly in the postoperative phase. Approximately 80% of patients were subjected to electrodiagnostic monitoring, and all of them showed improved values. To date (2017), the endoscopic procedure has been performed on a total of approximately 1,500 patients and the ensuing results are the same as in the 2006 study. In terms of complications, the rate of superficial hematoma was 4%, albeit the condition did not necessitate any treatment. Three patients presenting with recurrence of cubital tunnel syndrome after a symptom-free interval of approximately 3 years, were reoperated endoscopically. Notably, even patients who suffered from arthrosis in the cubital tunnel area and/or (in a few cases severe) posttraumatic valgus deformity of the elbow joint, were managed successfully with the endoscopic technique. Studies reported by other authors (Bultmann C, 2009; Ahcan U, Zorman P, 2007) showed comparable results, which, in part, exceeded even those of the 2006 study.

3.2 Benefits of Endoscopic Treatment of Cubital Tunnel Syndrome

Benefits for the operating surgeon

- Straightforward procedure which is easy to learn (e.g., in a workshop setting, as trainee in residence).
- Steep learning curve.
- Minimal surgery-related risks owing to perfect visualization.
- Easy-to-use instruments.
- High level of patient satisfaction.

Benefits for the patient

- Considerably extended length of decompression of up to 30 cm.
- Associated rate of morbidity is considerably lower when compared to other operative procedures.
- Rapid symptomatic relief.
- Postoperative compression dressing needed for 2–3 days only.
- Full mobility of elbow joint restored within 2–3 days after surgery.

3.3 References

Instrument Set for Endoscopic Treatment of Cubital Tunnel Syndrome

50600 HOFFMANN Cubital Tunnel Set, complete, consisting of the items shown as follows.

It is recommended to check the suitability of the product for the intended procedure prior to use.
Instrument Set for Endoscopic Treatment of Cubital Tunnel Syndrome

Components included in the Set

28731 BWA  **HOPKINS® Wide Angle Forward-Oblique Telescope**
- 30°, enlarged view, diameter 4 mm, length 18 cm,
- autoclavable, fiber optic light transmission incorporated,
- color code red

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

Alternative option:

**NEW** 50300 ES  **Optical Dissector**, with distal spatula,
- for use with HOPKINS® telescopes 30°
Instrument Set for Endoscopic Treatment of Cubital Tunnel Syndrome

Components included in the Set

404055 H  COTTLE Speculum, with fiber optic light carrier, without set screw, special matt finish, blade length 55 mm, length 13 cm

404090 S  Speculum, with fiber optic light carrier, with set screw, blade length 90 mm, length 13.5 cm

404092 S  Speculum, with fiber optic light carrier, with set screw, blade length 110 mm, length 13.5 cm

748220  DUPLAY Dressing and Sponge Holding Forceps, curved, with ratchet, length 21 cm

748221  DUPLAY Dressing and Sponge Holding Forceps, straight, with ratchet, length 21 cm
Instrument Set for Endoscopic Treatment of Cubital Tunnel Syndrome
Components included in the Set

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, with fine jaws, width 1 mm, distally angled 45°, horizontal closing, outer diameter 3.4 mm, length 20 cm consisting of:
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   Outer Sheath
   Inner Sheath
   Forceps Insert

26184 PTS  Take-apart® TAN Forceps Insert, size 3 mm, length 20 cm
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