Endoscopic Cubital Tunnel Release

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A minimally invasive endoscopic approach has been successfully applied to surgical treatment of cubital tunnel syndrome. This procedure allows for smaller incisions with faster recovery time. This article details relevant surgical anatomy, indications, contraindications, surgical technique, complications, and postoperative management. *(J Hand Surg 2010;35A: 1690–1697. Copyright © 2010 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Cubital tunnel, endoscopic cubital tunnel release, ulnar nerve.

DESPITE THE FACT that cubital tunnel syndrome is the second most common nerve entrapment in the upper extremity, there is no accepted standard for surgical treatment.

Endoscopic release, the newest of the surgical options for cubital tunnel syndrome, has been described by several authors.[1–8] It is a patient-driven procedure that is performed through a smaller incision, is less invasive, and results in faster recovery time.[6] Despite the fact that it is minimally invasive, simple, and fast to perform, it has been shown to be as effective as more invasive procedures.[7] It provides for a limited soft tissue dissection, thereby allowing more rapid recovery with minimal scarring.[6] The safety and efficacy of endoscopic cubital tunnel release has been shown by several studies.[1,3–10] A recent publication has demonstrated a significantly higher patient satisfaction ($p=.02$) and a lower complication rate ($p=.04$) for endoscopic decompression compared with open *in situ* decompression of the ulnar nerve.[10]

INDICATIONS AND CONTRAINDICATIONS

Indication for endoscopic cubital tunnel release is idiopathic cubital tunnel in patients failing conservative treatment. The authors typically use nighttime splinting, as well as nerve glide exercises and avoidance of provocative activities. In the absence of clinical progression, conservative management can be continued as long as tolerated by the patient. In the author's practice, if patients have progressive clinical findings of atrophy, elevated 2-point sensory discrimination, weakness or static changes in the ulnar nerve distribution, and positive electrical studies, conservative treatment is considered a failure and surgical treatment is offered, regardless of the length of conservative treatment. In the absence of progressive findings, 3 to 6 months of conservative treatment is typical. Steroidal and nonsteroidal anti-inflammatory drugs might or might not be of benefit.

Contraindications include masses or space-occupying lesions; severe, long-standing elbow contractures requiring release; and conditions necessitating anterior transposition, such as humeral malunions with cubitus valgus; and prior surgery or trauma with a scarred and adherent nerve.

Subluxating ulnar nerves are a relative contraindication. In the author's practice, patients with a subluxating ulnar nerve and concomitant prominent ulnar neuritis are not treated with endoscopic cubital tunnel release. However, patients with cubital tunnel in which symptoms predominate in the hand (as opposed to prominent, medial-sided elbow pain) and associated with a subluxating ulnar nerve will respond favorably to endoscopic cubital tunnel release. Patients with medial epicondylosis tend to have a more protracted course after surgery, particularly if concomitant medial epicondylectomy is performed.

A surgeon's inexperience with arthroscopy/endoscopy should be considered a relative contraindication for endoscopic release. At the authors' request, Integra LifeSciences currently does not release sets for endoscopic cubital tunnel release to surgeons who have not

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performed formal, cadaveric laboratory instruction. The author believes that hands-on experience with the equipment is mandatory before using this technique in the clinical setting.

SURGICAL ANATOMY

The ulnar nerve passes from the anterior compartment of the brachium to the posterior compartment through the arcade of Struthers. This controversial structure, composed of a band of deep brachial fascia, lies about 8 cm proximal to the medial epicondyle and has been implicated in ulnar nerve compression. The author has yet to see a case of clear manifestations of ulnar nerve compression at this level. The ulnar nerve descends the brachium under cover of the deep brachial fascia and posterior to the intermuscular septum. The intermuscular septum can cause compression of the ulnar nerve after anterior transposition but does not cause compression in primary cases.

The proximal portion of the release includes the deep brachial fascia and the arcade of Struthers, if found. The author is not convinced that this portion of the release has any clinical relevance, but it is simple and fast to perform and is included in the release for completeness.

At the level of the medial epicondyle, the ulnar nerve passes under the cubital tunnel retinaculum, or Osborne's ligament. It courses distally under the aponeurosis of the 2 heads of the flexor carpi ulnaris (FCU) muscle. The ulnar nerve then courses under the FCU muscle, deep to the deep layer of the aponeurosis of the FCU muscle. The distal release is the most important part of the procedure. It includes the cubital tunnel retinaculum, the fibrous raphe between the 2 heads of the FCU muscle, and the deep layer of the aponeurosis of the FCU muscle. The latter typically extends 4 to 7 cm distal to the medial epicondyle. The release is complete when all of the aponeurosis has been released, so that the muscle of the FCU muscle can be seen through the superior slot of the cannula.

SURGICAL TECHNIQUE

The patient is placed supine on the operating room table, with the shoulder abducted and externally rotated and the arm on the arm table. A nonsterile tourniquet is placed high on the brachium. The tourniquet is placed sufficiently high on the brachium so as not to interfere with surgical release. The arm is placed on a bath blanket to elevate it off the arm table sufficiently to facilitate instrumentation of the cubital tunnel. The procedure can be performed under general, regional, or local anesthesia with sedation.

A standard 30°, 4-mm endoscope is used. This is a dry endoscopy, and therefore, no fluid is required. The author uses the EndoRelease Endoscopic Cubital Tunnel Release System (Integra LifeSciences, Plainsboro, NJ) (Fig. 1), which includes a cannula specifically designed for cubital tunnel release. The cannula has a flat undersurface, which helps hold the nerve under the cannula, and slots on the inferior surface, which allow visualization of the ulnar nerve during the release (Fig. 2). The cannula has an attached retractor, which atraumatically holds the superficial nerves out of the way during the release. Spatulas are available to facilitate placement of instrumentation into the canal.

FIGURE 1: Photograph of EndoRelease Endoscopic Cubital Tunnel Release System full instrument tray; 2 sizes of spatulas and 2 sizes of cannula/trocar are available. The large cannula is most commonly used and is used with a 4.0-mm, 30° endoscope. The smaller cannula can be used with a 2.7-mm, 30° endoscope. Typically, the larger of the 2 spatulas is used to develop the potential space between the ulnar nerve and the roof of the canal.

After exsanguination and elevation of the tourniquet, a 2-cm incision is made over the cubital tunnel, just posterior to the medial epicondyle. The author prefers to place the incision in the skin creases for better appearance. A slightly larger incision is used in obese patients, large patients, or patients with an anconeus epitrochlearis muscle.

The author recommends slightly larger longitudinal incisions over the course of the ulnar nerve for the first few cases, until the surgeon becomes sufficiently comfortable operating through a 2-cm portal. The incision is made just through the skin (Fig. 3). Scissors are used to dissect directly down to the medial epicondyle. Superficial nerves are not intentionally dissected out, but they

FIGURE 2: Photograph of the EndoRelease cannula and blade. The cannula has an attached retractor, which atraumatically holds the superficial nerves out of harm's way while the release is being performed. A superior slot allows for division of the roof of the canal. The undersurface of the cannula is flat, which helps hold the nerve under the cannula during the procedure. The inferior surface of the cannula has slots, which allow for visualization and confirmation of the location of the ulnar nerve during the release.

FIGURE 3: The incision is placed directly over the cubital tunnel and immediately posterior to the medial epicondyle.

are protected as they are encountered. After the medial epicondyle is identified, blunt scissors are used to dissect the adipose tissue and superficial nerves off the deep fascia, both proximally and distally over the course of the ulnar nerve (Fig. 4). The surgeon should not violate the deep fascia during the initial exposure. The surgeon should also avoid dissecting through the adipose tissue, but rather dissect directly down to the

FIGURE 4: Blunt-tip scissors are used to dissect adipose tissue and superficial nerves off the deep fascia, both proximally and distally, over the course of the ulnar nerve.

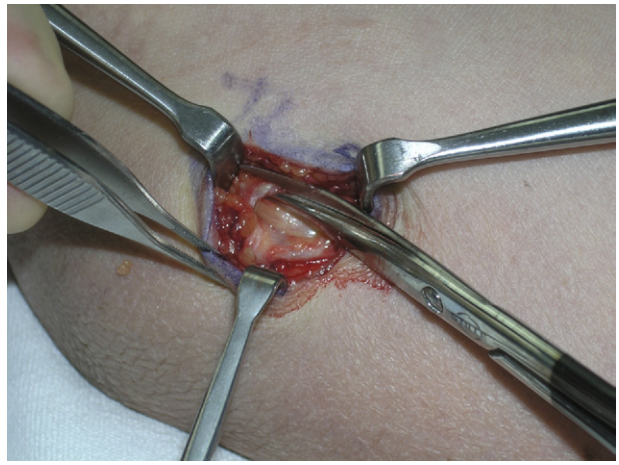

FIGURE 5: The cubital tunnel is opened sufficiently to allow for instrumentation to be placed without binding.

deep fascia, and then develop the potential space between the adipose tissue and deep fascia.

Developing multiple layers through the adipose tissue or exposing the ulnar nerve during this portion of the exposure should also be avoided.

The ulnar nerve is then palpated, directly posterior to the medial epicondyle. After the location of the ulnar nerve is clearly identified, an incision is made through the roof of the canal, and the ulnar nerve is identified. The opening in the cubital tunnel should be opened sufficiently to allow instrumentation to be placed without binding (Fig. 5). If an anconeus epitrochlearis muscle is encountered, it is incised directly over the cubital tunnel, and the procedure continues as otherwise described.

The spatula is moistened with saline and inserted

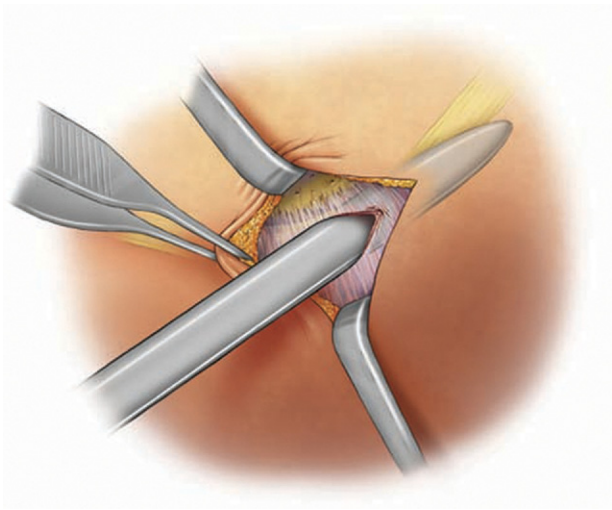

FIGURE 6: The spatula is used to open the potential space between the ulnar nerve and the roof of the canal. This is done both proximally and distally.

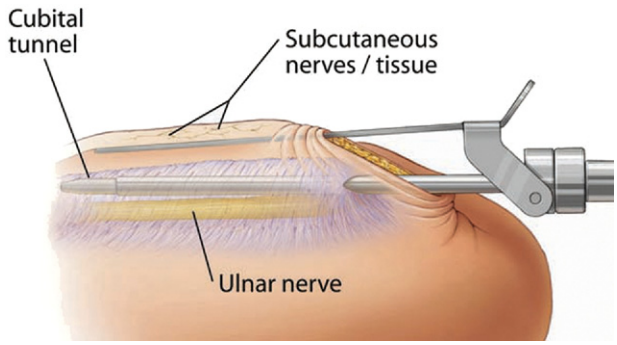

FIGURE 7: The trocar/cannula is placed within the canal, immediately superficial to the ulnar nerve and deep to the fascia, and advanced. The attached retractor is allowed to slide on the external surface of the fascia, thereby atraumatically elevating the superficial nerves out of harm's way.

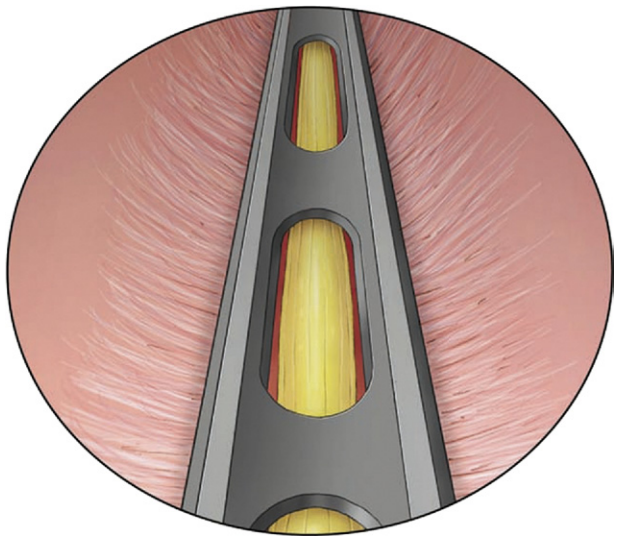

FIGURE 8: The ulnar nerve should be clearly identified through the inferior slots of the cannula before release of the roof of the canal.

into the potential space between the ulnar nerve and the roof of the canal (Fig. 6). The spatula should advance without resistance. The spatula is placed both proximally and distally. With the spatula in place, the surgeon can confirm the course of the ulnar nerve and confirm that the adipose tissue and superficial nerves have been sufficiently elevated off the deep fascia throughout the course of the ulnar nerve, both proximally and distally.

The cannula/trocar is then placed in the canal and advanced proximally between the ulnar nerve and the roof of the canal. The cannula/trocar is moistened with saline before placement. The attached retractor is allowed to slide on the external surface of the fascia and thereby atraumatically elevates the superficial nerves out of the way as it is advanced. The trocar/cannula is advanced within the canal and immediately superficial to the ulnar nerve (Fig. 7). The trocar/cannula should not be placed against resistance. If resistance is encountered, the surgeon should remove the instrumentation and confirm that the superficial tissue is sufficiently elevated off the fascia, so as not to cause binding of the retractor.

Furthermore, the spatula should be placed between the ulnar nerve and the roof of the canal, again confirming that the potential space between the ulnar nerve and the roof of the canal has been developed and also that the trocar is being placed in the same orientation. The canal might need to be opened slightly with scissors if the instrumentation appears to be binding. Extending the elbow might help if the cannula is binding as the canal bends around the medial epicondyle. The surgeon should realize that placing the trocar against resistance could potentially result in violating the canal or injuring the ulnar nerve. Once the cannula/trocar has been placed into the canal, the trocar is removed, and the scope is placed initially between the cannula and the retractor to confirm that there are no superficial nerves in the way. The scope is then placed into the cannula and turned to view the inferior slots so the ulnar nerve can be identified. The ulnar nerve should be identified throughout the entire course of the cannula (Fig. 8). Rotation of the cannula might help to identify the nerve as it pops under the flat surface of the cannula.

After the nerve is clearly identified, the fascia (roof of the canal) is divided with the blade, along the supe-

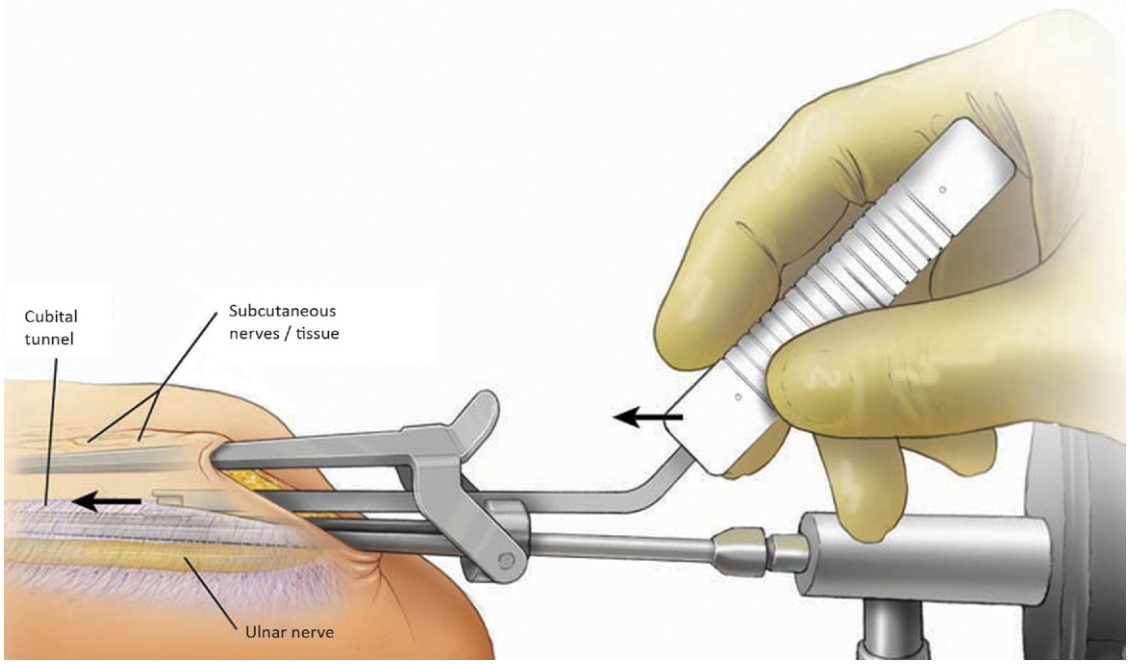

FIGURE 9: After the nerve has been clearly identified, the fascia (roof of the canal) is divided with the blade, along the superior slot of the cannula.

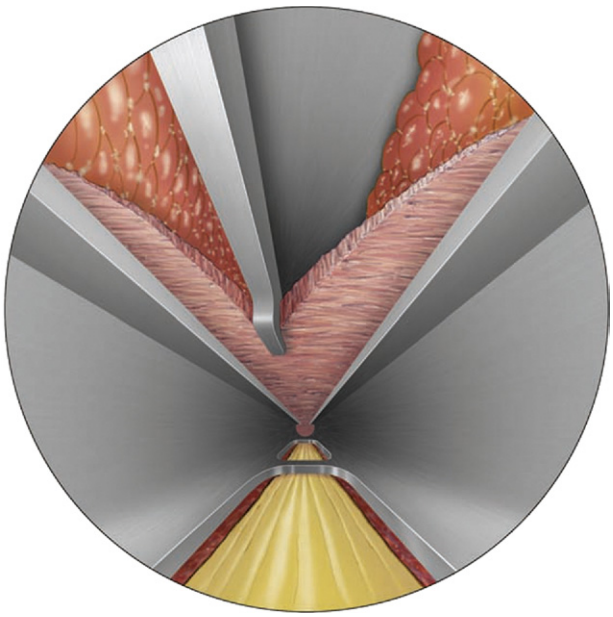

FIGURE 10: Arthroscopic view of the ulnar nerve, seen through the inferior slots of cannula. The fascia is being divided along the superior slot of the cannula.

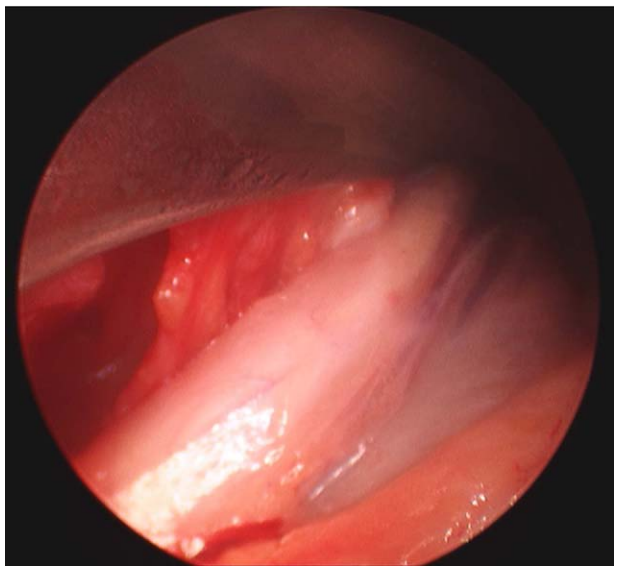

FIGURE 11: After release and removal of cannula, the ulnar nerve should be inspected to confirm complete release.

rior slot of the cannula (Figs. 9, 10). The fascia should be divided only if the nerve is clearly identified throughout the entire length of the intended release.

Following release of the fascia, the completeness of release should be checked. This can be performed by pulling the cannula back on the scope and out of the canal. The scope is then slowly withdrawn, confirming complete release. If visualization of the release cannot be confirmed in this fashion, a narrow retractor is placed, exposing the nerve, which is then visualized with the endoscope, which is held under the retractor (Fig. 11).

The cannula/trocar is then placed into the canal and advanced distally. The procedure is performed using the

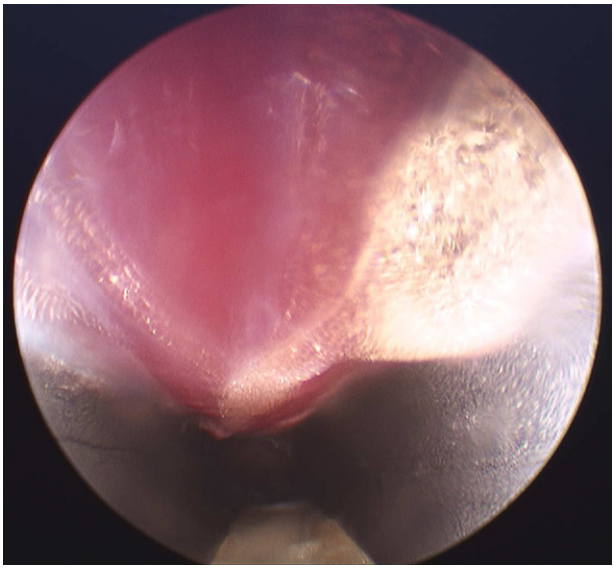

FIGURE 12: The distal release is complete when the FCU muscle can be viewed through the superior cannula slot.

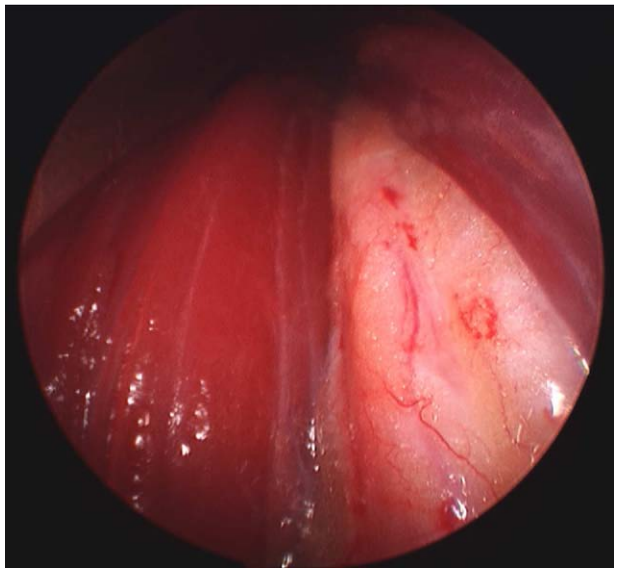

FIGURE 13: Hemostasis should be confirmed under direct endoscopic visualization.

same technique as described earlier. Following the distal release, the muscle of the flexor pronator mass will be seen through the superior slot of the cannula (Fig. 12). This tissue can be released. However, in the authors' opinion, release of this tissue is not necessary and results in unnecessary bleeding.

The tourniquet is then deflated, and pressure is applied. The retractor is placed into the incision, and the endoscope is used to visualize the surgical field, both proximally and distally, confirming that complete release and hemostasis has been obtained (Fig. 13). Generalized punctate bleeding is typically handled with direct pressure and a compressive dressing. If excessive bleeding is noted, bipolar cautery can be used under direct visualization with the endoscope. The ulnar nerve is identified and protected if bipolar cautery is used.

A 20-gauge Angiocath (Becton-Dickinson, Franklin Lakes, NJ) is placed through the skin and into the wound (Fig. 14). The needle is withdrawn after placement. Placement of the Angiocath is in line with the incision, so the Angiocath does not interfere with placement of Steri-Strips (3M, St. Paul, MN) after closure. The wound is tightly closed with subcuticular absorbable sutures such as 3-0 Monocryl (Ethicon [Johnson & Johnson], Somerville, NJ). The closure is supplemented with Steri-Strips. Following closure, 15 to 20 cm^3 0.5% bupivacaine with epinephrine (if not contraindicated) is infiltrated through the Angiocath and directly into the wound. The Angiocath is then removed, and a compressive dressing is applied. Marcaine with epinephrine provides postoperative pain relief and further aids in hemostasis.

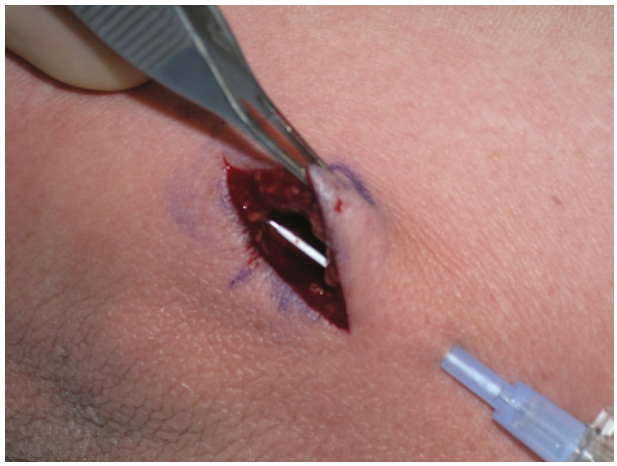

FIGURE 14: A 20-gauge Angiocath is placed through the skin and into the wound. The needle is withdrawn after placement. The Angiocath is used for infiltration of 15 to 20 cm^3 0.5% Marcaine with epinephrine.

POSTOPERATIVE CARE

Patients are instructed to work on gentle range of motion of the elbow, with the expectation of having a full range of motion by the first postoperative visit (5-7 d) (Fig. 15). They are instructed to debulk the dressing as necessary to facilitate full range of motion. Patients can expect to go back to sedentary/office activity on the first postoperative day. Manual laborers are typically restricted for 1 week and then advanced to full duty. Defining expectations before surgery will greatly facilitate meeting postoperative goals.

FIGURE 15: Typical appearance of first postoperative visit, with a small, well-healed incision and full range of motion.

COMPLICATIONS

The most common complication reported after endoscopic cubital tunnel release is hematoma formation. For this reason, the authors recommend deflating the tourniquet and obtaining hemostasis before closure. The author had a number of cases of wound dehiscence early on in the series due to too much emphasis being placed on the Steri-Strips for closure. Tight wound closure is mandatory to allow for early range of motion of the elbow after surgery.

PEARLS AND PITFALLS

Positioning

The arm is placed on a bath blanket to elevate it off the arm table sufficiently to facilitate instrumentation of the cubital tunnel.

Incision

The incision can be placed into the skin crease to improve appearance. For the first few cases, it is recommended to use a longitudinal incision larger than 2 cm until the surgeon is comfortable with the dissection and exposure.

Initial exposure

Do not violate the deep fascia during the initial exposure (Fig. 4). Do not dissect through, but rather under the adipose tissue, developing the potential plane between the adipose tissue/superficial nerves and the deep fascia. Avoid developing multiple layers through the adipose tissue. If an anconeus epitrochlearis muscle is encountered, it is incised directly over the cubital tunnel, and the procedure continues as otherwise described.

Instruments

Do not force instruments into the canal. This can result in injury to the ulnar nerve or cause the instruments to rupture through the wall of the fascia, which will result in an incomplete release. If resistance is encountered, it is usually one of several things:

(1) Friction because the instruments were not wet with saline before placement.
(2) Adipose tissue is not elevated off the fascia and is binding the attached retractor.
(3) The canal is not opened sufficiently, and the instruments are binding.
(4) The elbow is flexed too much, causing the instrumentation to bind in the canal.
(5) The trocar is not being placed in the correct orientation and is hitting either the ulnar nerve or the wall of the canal. Orientation should be confirmed when the spatula is placed, and the trocar should be placed in the exact same orientation.

Do not release the fascia with a knife if the ulnar nerve is not clearly visualized below the cannula. The ulnar nerve can and will rotate superiorly into the way. Therefore, it must be identified visually throughout the course of the intended release.

Always visually inspect the nerve with the endoscope after the release to ensure complete release. This technique can result in an incomplete release only if the surgeon chooses not to complete the release.

Hemostasis

Most bleeding can be controlled with direct pressure. Bipolar cautery is required in a small percentage of cases. Hematoma formation is one of the most common complications following endoscopic cubital tunnel release. Therefore, hemostasis should always be obtained before closure. Wound dehiscence can and will occur during the postoperative range of motion if tight closure is not obtained.

Postoperative care

Defining expectations for range of motion and return to work with the patient before surgery will greatly facilitate meeting postoperative goals.

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