Initial experience with endoscopic carpal tunnel release surgery

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A retrospective analysis of patients who underwent endoscopic carpal tunnel release (ECTR) surgery at the authors' institution during the past 18 months was performed. Twenty-six ECTR surgeries were performed in 24 patients. Eighty-seven percent of patients experienced significant improvement or resolution of their symptoms following ECTR. Of the patients in whom surgery failed, those who have undergone postoperative assessment of nerve conduction velocities have experienced improvement or normalization. Three patients (12.5 %) underwent ECTR after a previous open procedure in the contralateral hand; all three patients preferred the ECTR procedure. One significant complication, a lacerated ulnar artery, was noted. It is concluded that ECTR is a promising technique that appears to have similar efficacy to open CTR and has the potential to be a superior technique.

Key Words * endoscopy * carpal tunnel syndrome * carpal tunnel release surgery

In recent years there has been a proliferation of fiberoptically assisted surgical techniques, with the expectation that reducing incision size would improve outcome and reduce patient recovery time. Within the field of neurological surgery, these developments have created the capability of performing endoscopic surgery in the ventricular system and the pituitary gland, as well as allowing for intraspinal and transthoracic approaches to spinal pathology. The full potential of neuroendoscopy has yet to be realized, however, because the potential advantages of these techniques must be balanced, at least in part, by steep learning curves and the fact that their application has been directed toward entities for which good results have already been achieved by conventional methodology.

Carpal tunnel release (CTR) is just such a procedure. Excellent results have been almost universally reported. Variations of the open CTR (OCTR) have related primarily to the size and configuration of incisions and whether the incision is made on the palm, wrist, or both. The proposed advantages of endoscopic CTR (ECTR) surgery include a smaller incision, which is thought to decrease the patient's postoperative pain and recovery time, and avoidance of cutting the superficial palmar fascia and skin, which has been reported to lead to improvement in postoperative grip strength when compared with open procedures.[5] In this report, we will discuss our initial experience with the 3M Agee Endoscopic Carpal Tunnel Release System (3M Orthopaedic Products Division, St. Paul, MN).
CLINICAL MATERIAL AND METHODS

Patient Demographics

During the period from January 1996 to May 1997, a consecutive series of 24 patients (23 men and one woman, with an average age of 52 years) at the Portland Veterans' Administration Medical Center underwent ECTR surgery by means of the 3M Agee system. A total of 26 ECTRs were performed, with two patients undergoing bilateral release.

Each patient was given the option of choosing between traditional OCTR and ECTR surgery; the procedures, risks involved, and alternative treatment were described in detail to allow them to make an informed choice. The possibility that the surgeon might have to convert an ECTR to an OCTR procedure because of technical complications was also discussed with each patient. Conservative treatment had failed in all patients and patients were selected to undergo surgery based on clear clinical and electromyographic (EMG) evidence of carpal tunnel syndrome. Patient and procedural statistics and outcome were collected retrospectively. Each patient's chart was also reviewed before the final analysis of the data.

Operative Technique

Patients received a local anesthetic and a tourniquet was applied to ensure clear visualization, which might otherwise have been obscured by blood. A 1.5-cm incision was placed in the proximal wrist crease, positioned between the flexor carpi ulnaris and palmaris longus tendons, beginning approximately 5 mm radial to the flexor carpi ulnaris tendon.

Once the incision was made, the underlying loose tissue was dissected by longitudinal spreading to identify and preserve any palmar cutaneous nerves. The antebrachial fascial layer was identified, and a trap door-type flap was fashioned, which was hinged distally. This exposed the underlying synovial membranes and the median nerve, which was positioned radially. The synovial separator was passed distally, which brought it deep to the undersurface of the transverse carpal ligament (TCL). The instrument was then used to sweep the synovial membranes from the undersurface of the ligament. The hamate finders were passed sequentially under the TCL; the finders functioned as dilators and as a method of locating the hook of the hamate.

The blade/endoscope assembly was then passed under the TCL (Fig. 1A, click here to view video; Fig 1B, click here to view video). Once the assembly was in place, the undersurface of the ligament was visualized. The ligament was distinguished by its striated bands of collagen. Once the desired alignment was achieved, the blade was raised, and the assembly was withdrawn, cutting the ligament (Fig. 2A, click here to view video; Fig 2B, click here to view video). The blade assembly was then reinserted to inspect the adequacy of the division. Any remaining bands were carefully sectioned. The assembly was again reinserted; the tourniquet was deflated and the amount of bleeding was observed as the assembly was slowly withdrawn. The final step before closing the wound was for the surgeon to divide the antebrachial fascia proximally, to prevent an abrupt transition of the nerve into the decompressed area, which obviated any potential for compression at that site. Postoperative splints were not used.

RESULTS

Of 26 procedures, 11 (42.3%) were performed in left hands and 15 (57.7%) were performed in right
Morbidity and Mortality Rates

For the 26 ECTR surgeries performed there was only one procedural complication, a laceration of the superficial ulnar artery. Arterial bleeding was noted following release of the tourniquet, which required the surgeon to convert to an open procedure to allow primary repair of the artery with 6-0 prolene sutures. This case (3.8 %) was the only one in the series that required conversion to an OCTR procedure. There were no wound infections, dehiscence of incisions, or operative mortality in this series. No neurological complications occurred. The overall morbidity rate was 3.8%.

Surgical Outcome

Follow-up data were obtained in 23 of 24 patients. One patient died of a myocardial infarction 3 months after surgery and had been lost to follow-up study in the interim. Patients were assessed at 1 week and 1 month postoperatively to evaluate surgical results. If the patients' symptoms had resolved, no further follow up was scheduled. If the patient was still symptomatic, additional EMG and nerve conduction studies were performed.

Twenty (86.9%) of the 23 patients experienced significant improvement or resolution of their symptoms following ECTR. Three patients did not improve after ECTR surgery, two of whom were subsequently noted to show improvement or normalization of their nerve conduction studies compared with preoperative studies; this included the patient who sustained the lacerated ulnar artery. Of the three patients who did not experience improvement or resolution of symptoms, one patient has not yet undergone postoperative EMG and nerve conduction studies to evaluate the ECTR procedure.

Three patients in the series (12.5 %) underwent ECTR following a previous OCTR surgery in the contralateral hand. It is noteworthy that all three patients preferred the ECTR over the OCTR technique; they cited a variety of reasons, including decreased postoperative pain at the incision site, faster incision healing, faster return to activity/work, improved cosmesis, and better subjective postoperative grip strength.

DISCUSSION

Proving the superiority of minimally invasive techniques is a difficult matter that first requires documenting efficacy that is comparable to that of conventional surgery in alleviating symptoms. There is evidence in the literature to suggest that results obtained with ECTR are similar to those found in OCTR surgery.[1,5] Although our series is small, it appears that the efficacy of ECTR is similar to that of the OCTR technique. The learning curve must be taken into account when interpreting the data derived from a small series such as this one, especially because learning curves for most minimally invasive procedures tend to be fairly steep.

One advantage of the ECTR procedure is patient recovery time. It has been proposed that by not transecting the superficial palmar fascia, which occurs in OCTR, the origin of the thenar muscles is preserved. Preservation of the thenar muscles has been demonstrated to result in improved postoperative grip strength.[5] The smaller incision made in ECTR surgery has been shown to diminish the patient's postoperative pain and to facilitate an earlier return to work and activities of daily living, compared with OCTR.[1,2,5] All three patients in our series who underwent both procedures preferred the ECTR.
A number of technical issues pose possible disadvantages to this technique. The distal margin of the TCL may be difficult to distinguish visually; however, it is generally at a depth of 4 cm. The surgeon's failure to keep the surgical apparatus proximal to this landmark can result in injury to the common digital nerve or the superficial palmar arterial arch. In the one case of arterial injury in our series, the actual laceration was found to be more proximal to this area and was likely related to an anomalous, more radial, position of the ulnar artery in relation to the hook of the hamate. Generally speaking, this structure remains ulnar to the hook of the hamate, but some anatomical variation may exist in rare instances. Improper placement of the endoscope assembly into Guyon's canal has also been reported in conjunction with ulnar nerve injury. Although the incidence of neurovascular complications reported in the literature is low, the actual incidence is likely higher; thus, these results should be interpreted with caution.

There have been reports of difficulty in introducing the endoscope into the carpal tunnel, resulting in conversion to an open procedure. We did not encounter this problem, although introduction of the assembly into the carpal tunnel often requires flexing the patient's wrist with the surgeon's free hand. As previously discussed, the distal margin of the TCL is not infrequently difficult to distinguish by visual inspection. This, in association with the potential for injury to the superficial palmar arch, may lead to incomplete sectioning of the ligament. Accordingly, a cadaveric model was used to compare complete sectioning of the TCL with incomplete sectioning, sparing the distal 4 mm of the ligament. No significant difference in the degree of widening of the carpal arch was noted. The clinical significance of this has not yet been determined.

In our experience, superior wound healing is a substantial advantage in the use of the ECTR procedure. Despite making only a 2- to 3-cm incision in our OCTR procedures, we have been dissatisfied with the rate with which the palmar incisions heal and the incidence of superficial, mild dehiscences involving the palmar skin. Although the eventual cosmetic results are usually acceptable, the extended healing period and attendant appearance of the healing wound can be distressing to the patient. This somewhat lengthy healing time may also contribute to delay in the patient's returning to work and activities of daily living.

On balance, ECTR surgery has several potential advantages; however, there is a very steep learning curve and a narrow margin for error. At present, fewer ECTR procedures have been performed compared with OCTR surgeries, and superiority will be difficult to prove without commensurate numbers of cases for adequate comparison. Because ECTR has only been in use for a few years, long-term studies describing the incidence of complications and confirming the durability of symptom relief are not available.

Regardless of whether one plans to perform this type of CTR, it is imperative that neurosurgeons performing CTR surgery familiarize themselves with the advantages and disadvantages of the endoscopic methodology. Our initial experience has led us to conclude that this procedure produces good relief of symptoms. Wound healing from ECTR appears to superior and there has been a tendency for patients to experience decreased postoperative pain compared with those undergoing OCTR surgery. The potential for complications will likely diminish with increasing experience.

INVESTMENT DISCLOSURE

The authors hold no financial interest in the 3M Agee Carpal Tunnel Release System.
References


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Figure 1a

Figure 1b