

Transillumination in minimally invasive surgery for carpal tunnel release

Technical note

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✓ An alternative technique for performing minimally invasive release of carpal tunnel syndrome is described. The suggested methodology is based on transillumination of the carpal tunnel during surgery. The advantages of the technique are discussed and compared with other available surgical procedures including endoscopy. The authors also describe preliminary operative results in 50 consecutive patients.

KEY WORDS • carpal tunnel syndrome • minimally invasive surgery • transillumination

IN the last decade, minimally invasive surgery for carpal tunnel syndrome has gained increasing popularity among neurosurgeons and orthopedic surgeons.^{1,3,5,12–15,17} The aim of the various procedures is the early use of the operated hand and the decrease of side effects caused by palmar incision and scar.⁹ Nevertheless, some problems and controversies still surround the available minimally invasive procedures.^{3,6} Incomplete section of the ligament may occur distally when blind procedures are performed. Endoscopic procedures may cause a certain rate of discomfort and complications mainly due to the considerable size of endoscopic devices inserted into a narrow tunnel.³ In addition, the transverse incision selected in most endoscopic techniques lies on the wrist flexion crease, which can lead to potential damage of the superficial palmar branch of the median nerve. Side effects may also occur as a result of nerve ischemia when the tourniquet (required to perform endoscopic carpal tunnel surgery) is maintained too long.

The goal of this report is to describe an alternative minimally invasive surgical technique that is based on intraoperative transillumination and performed using the modified Paine retinaculotome.^{14,15}

Operative Technique

During surgery the hand is maintained slightly extended to give the carpal tunnel a linear shape. Two milliliters of 0.5% lidocaine is subcutaneously injected into the wrist

of the patient.⁷ A small longitudinal incision is made 1 cm proximal to the wrist flexion crease, which lies between the palmaris longus and flexor carpi radialis tendons. The median nerve is exposed by blunt dissection of the anti-brachial fascia. Inspection of the nerve may be conducted using loupes or under microscope magnification to rule out the existence of a patent median artery^{4,10,11} or other anatomical variations at the entry of the tunnel.² The origin of the superficial palmar branch of the nerve may be detected at this site where it leaves the main trunk before it enters the tunnel.^{9,16}

The proximal edge of the transverse carpal ligament is sectioned by scissors for approximately 0.5 cm to facilitate the insertion of the grooved guide. The guide must be directed toward the fourth finger and maintained over the nerve (Fig. 1). The rationale for this is that no branches originate from the median nerve at its ulnar side.^{4,8,16}

A fiber optic light probe (1.5 mm in diameter) is inserted with the guide and connected to the light source (white light, 60 W, 3100°K). While the guide and probe are under the ligament, a pale spotlight becomes visible through the palmar skin (approximately one lumen/square centimeter if eight lumens are delivered at the tip of the probe). The guide and probe are then gently pushed along the trajectory until the spotlight on the palmar surface shows a clear-cut sudden increase in intensity (approximately six lumens/square centimeter). This marks the distal edge of the ligament as the light is not absorbed by the tight collagen fibers of the ligament (Fig. 1).

Transillumination in carpal tunnel surgery

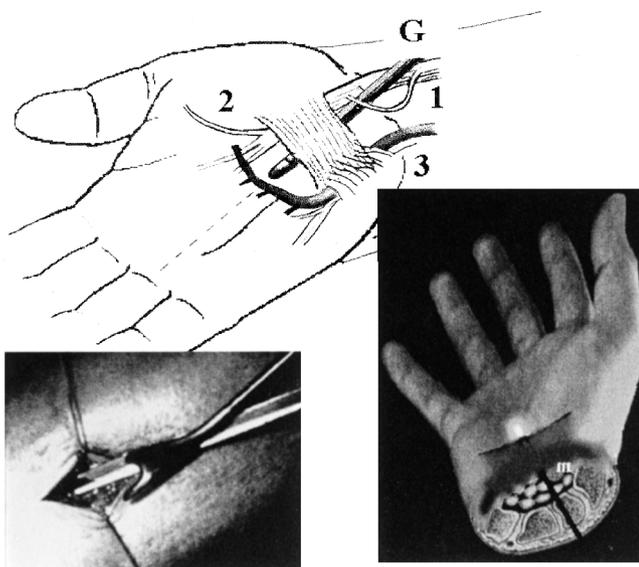


FIG. 1. *Upper:* Schematic representation of the guidelines for insertion of the grooved guide (G). The superficial palmar branch of the median nerve originates proximal to the wrist flexion crease and lies subcutaneous to the thenar palmar skin (1). The dotted line shows a safe trajectory to insert the instruments toward the base of the fourth finger avoiding the motor branch of the abductor pollicis brevis (2) and the ulnar nerve in Guion's canal, which lies more medially (3). Note that the arterial palmar arch is protected by the smooth tip notch of the guide. *Lower Left:* Intraoperative photograph showing the grooved guide inserted at the wrist and the modified Paine retinaculotomy. *Lower Right:* Artist's drawing showing the distal edge of the transverse carpal ligament as it is detected by fiber optic transillumination.

The guide is left in this position while the fiber optic probe is retracted. The modified Paine retinaculotomy is pushed forward along the groove of the guide to cut the ligament until it is stopped by the guide tip notch. A characteristic grating sound¹⁴ is produced by the cutting of the ligament. At the end of the procedure the fiber optic probe may be reinserted through the tunnel; a bright spotlight will now be detected along the whole section line. No tourniquet is needed and hemostasis is easily obtained by compression applied on the hand palmar surface. Finally, the small wound is sutured by skin stitches.

Summary of Cases

Since January 1994, 50 consecutive patients have undergone this surgical procedure for carpal tunnel release. Thirty-nine patients were women. Patient's ages ranged from 32 to 60 years (mean age 52 years). None of the patients was affected by systemic diseases that could possibly be related to carpal tunnel syndrome.¹⁶ All patients had at least a 1-year history of numbness and pain in the first three fingers occurring at night.

Splinting the wrist and administration of antiinflammatory drugs proved ineffective. Electromyography showed diminution of nerve conduction velocity at the wrist in all patients and minor denervation signs were detected in the thenar muscles in 17 patients.

At surgery, the average estimated length of the ligament along the suggested trajectory was 3.9 cm in women and 4.3 cm in men.

Pain and numbness disappeared within a few days after surgery and all patients could use the operated hand on the 1st postoperative day. Full dexterity of the hand recovered in approximately 1 week and only 20% of patients used analgesic medications in the early postoperative days. The only side effect consisted of subcutaneous blood diffusion at the wrist, which lasted a few days in seven patients.

At 1-year follow-up evaluation, all patients showed complete recovery from the disease.

Discussion

In this report we describe a simple and reliable method of carpal tunnel release. The use of transillumination to assess the length of the transverse carpal ligament during surgery is the major improvement made to the original Paine technique, in which no information is provided about the extent of the ligament.^{14,15}

The main advantages of the new technique compared to endoscopic procedures include the considerably smaller size of the instruments inserted into the tunnel and the avoidance of tourniquet-induced ischemia. We question the need to inspect the ligament during surgery because the trajectory must be chosen preoperatively following topographical anatomical landmarks, which allow the surgeon to avoid functional areas as shown in Fig. 1. Previous experience with open carpal tunnel surgery or direct knowledge of hand anatomy obtained from cadaveric dissection may be more fruitful than looking around within the carpal tunnel. The longitudinal incision made proximal to the wrist flexion crease and centered over the median nerve reduces the risks of damaging the superficial palmar branch and allows the safe trajectory shown in Fig. 1. Wound healing is also improved because fewer mechanical stresses are exerted in this area than would occur in palmar incisions. The risks of damaging the arterial palmar arch are lowered because the guide that pushes the artery distally and protects it from the blade has a smooth tip with a stopping notch.

In conclusion, the technique described may be considered an improvement in minimally invasive procedures for carpal tunnel release and an alternative method to endoscopic surgery.

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