HAND (2014) 9:48–51
DOI 10.1007/s11552-013-9566-x

MULTIMEDIA ARTICLES

Carpal tunnel release using the Paine retinaculotome inserted through a palmar incision

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Published online: 16 October 2013

The online version of this article (doi:10.1007/s11552-013-9566-x) contains a video, which is available to authorized users

Abstract
Background Carpal tunnel syndrome (CTS) is the most commonly diagnosed and treated entrapment neuropathy. There is no consensus regarding the optimal technique for carpal tunnel release. The objective of this study is to demonstrate the surgical treatment of CTS by a small palmar incision and utilization of Paine retinaculotome to divide the transverse carpal ligament.
Methods In this technical note, we describe the use of a retinaculotome described by Paine in 1955, through a palmar approach.
Discussion Open, minimally invasive and endoscopic surgical techniques have all been described as treatment options for CTS, and short-term success with these methods is well established. During the last decade, less invasive techniques have been developed in order to reduce the incidence of pillar pain and tender scars. We have used a mini-palmar incision and the Paine retinaculotome for carpal tunnel release since 1994. The goals of surgery are to create a small incision that permits a patient to have early motion and return to activity.
Conclusion After many years, no permanent nerve or vascular damage has been reported. This method has demonstrated itself to be efficient and safe in the treatment of the carpal tunnel syndrome.

Keywords Carpal tunnel syndrome · Median neuropathy · Paine retinaculotome · Palmar approach

Introduction

Despite the fact that Sir James Paget described the compression of the median nerve in patients with a distal radius fracture in 1894, carpal tunnel syndrome (CTS) was not well understood until the 1950s. Nowadays, compression of the median nerve at the wrist is the most common compression neuropathy of the upper extremity, and surgery for CTS is the most common surgery performed on the hand.

Palmer and Hanrahan [13), in 1995, estimated that in the United States of America, 400,000 to 500,000 surgeries were performed at a cost of US$2 billion per year. Brown et al. [5] reported that if the same surgeries were performed by endoscopy, the cost would increase by US$497 due to equipment costs, more time spent in the operating room, and use of special blades.

Smaller incisions and new surgical approaches using two incisions or special retractors are becoming common practice. These modifications will likely improve the surgical care of patients with CTS.

Use of the Paine retinaculotome by palmar incision was first reported by Carneiro and James [6]. Bensimon and Murphy [2] also reported the use of palmar incision. Plancher and Perekh [16] and Iwase et al. [9] reported modified tomes.

We have used a mini-palmar incision and the Paine retinaculotome for carpal tunnel release since 1994. Pignataro et al. [15] studied in cadavers, the technique described by Carneiro and James [6]. They obtained the tunnel decompression on all hands with no vascular or nerve injury.

Electronic supplementary material The online version of this article (doi:10.1007/s11552-013-9566-x) contains supplementary material, which is available to authorized users.

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The indication for use of carpal tunnel release with the Paine retinaculotome by palmar incision is patients who have not improved after nonsurgical treatment. Diagnosis of CTS is made based on clinical history, physical exam, and electrophysiological testing. In non-obvious cases, injection of a steroid preparation is useful in diagnosis and prognosis.

The goals of surgery are to create a small incision that permits a patient to have early motion and return to activity, avoiding adherence of the median nerve and scarring at the pressure-bearing area. We also use this technique in severe cases where there is thenar atrophy. We do not perform surgery of opponensplasty associated.

Relative contraindications are clinical history of wrist trauma including distal radius fracture and carpal fracture dislocation in which the normal anatomy of the carpal tunnel will be altered. Sometimes, the presence of expansive masses inside the tunnel (ganglia, anomalous muscles, or arteries) requires major exposure.

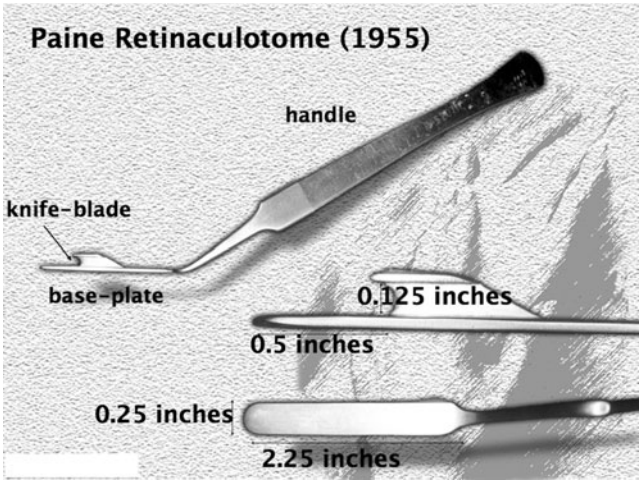

Fig. 1 Paine retinaculotome with its measurements

Methods

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study.

Surgical Technique (See Movie).

The patient is positioned on the operating table in the supine position and anesthetized with general or regional anesthesia. We do not use local anesthesia because the normal anatomy of the carpal tunnel can be altered, making the surgery difficult. The procedure is performed using an arm nonsterile pneumatic tourniquet that is inflated to 250 mmHg. We do not use pre- or postoperative antibiotics. The arm is abducted over a hand board, and the upper extremity is positioned in a sterile manner.

All surgeries are performed using a surgical instrument developed by Paine [12]. This tool is made of stainless steel with a flat shaft in the frontal plane and a base plate in the horizontal plane, together forming an angle of 135°. The base has rounded edges and measures 2.25 by 0.25 in. The 0.5 in of base before its end has a cutting blade 0.125 in in the same plane of the rod (Fig. 1).

For orientation as to where the incision will be made, the topographic position of the palmaris longus tendon, pisiform bone, hook of hamate, Kaplan's cardinal line, middle palmar crease, and radial border of the ring finger are identified (Fig. 2). A longitudinal straight incision of 1.5 to 2.0 cm is performed lengthwise, approximately 0.5 cm proximally from the medial palmar crease along the radial border of the ring finger. The subcutaneous tissue is divided, two small Senn-Mueller retractors are placed in each side of the skin border, and the palmar aponeurosis is visualized. A small incision is made on the palmar aponeurosis with a number 15 scalpel blade. The tip of a Kelly clamp is inserted into this opening and carried out the maneuver to open the clip in order to open the rest of the palmar aponeurosis, observing the direction of its fibers. The retractors are placed deep to ward off the edges of the aponeurosis and to allow identification of the palmar fat pad and three structures that form the "safe zone of Agee" [1] as follows: the distal edge of the transverse carpal ligament (black arrows), the superficial palmar arch(white arrows), and the second digital common branch (Fig. 3)

The distal end of the transverse carpal ligament must be positively identified. Through this security zone, blunt scissors, curved and closed for the identification of the carpal tunnel, are introduced as carefully as possible. The tip of the scissors is always directed upwards to sense the end of the TCL. The introduction is made from the distal border through the carpal tunnel proximally, until the tip of the scissors on the topographic place of the flexion crease of the wrist is visualized and felt with the pulp of an index finger of another hand or with a forceps. This maneuver has the objective of feeling the consistency of the transverse fibers of the carpal ligament, releasing adhesions of the TCL, and creating a path for the retinaculotome.

The scissors should never be opened inside the carpal tunnel due to the risk of causing nerve or tendon injury. Although it is possible, and sometimes occurs during first surgeries, care should be taken to not enter Guyon's canal because it is superficial to the ulnar side of the carpal tunnel.

The scissors are removed from the tunnel. The Paine retinaculotome is placed with the tip inside the carpal tunnel, with its base protecting the median nerve and the blade in contact with the distal border of the transverse carpal ligament (Fig. 4).

To divide the ligament, the tome is pushed with continued strength and control in a proximal direction to the resistance

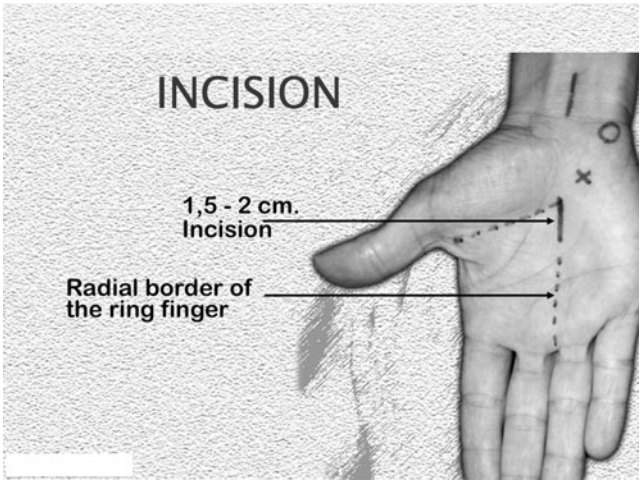

Fig. 2 Topographic position of anatomical structures for orientation as to where the incision must be made

caused by the consistency of the TCL. When this resistance occurs, the tip of the instrument base is touching 1.0 cm distance proximal to the wrist flexion crease.

The retinaculotome is withdrawn, and a Senn-Mueller retractor is placed in the proximal border of the incision. Complete release is indicated by observation of the lateral retraction of the cut edges of the ligament (white arrows), opening of the channel, and the integrity of the median nerve (Fig. 5).

Fig. 3 Identification of the palmar fat pad, the distal edge of the transverse carpal ligament (*black arrows*), and superficial palmar arch (*white arrows*)

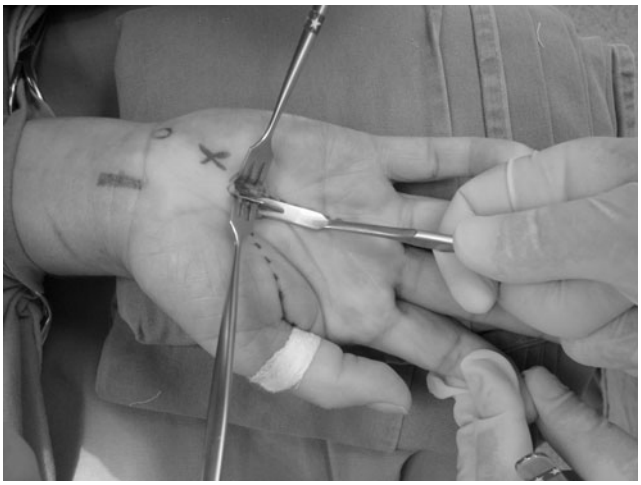

Fig. 4 The Paine retinaculotome is placed with the tip inside the carpal tunnel, with its base protecting the median nerve, and the blade in contact with the distal border of the transverse carpal ligament

If some structures remain that compress the nerve, a second passage of the instrument is performed. The skin is closed, and a bulky dressing placed. All patients are instructed to keep their hands up while supine or sleeping during the first 24 h, and the motion of flexion–extension of the fingers is encouraged immediately to control swelling. After 7 to 10 days, the stitches are removed, and patients are followed-up via supervised exercise program.

Results

We have treated more than 500 hands with this surgical technique. We have had a few minor complications, including transient paresthesias of the ulnar border of the long finger, superficial infections, sympathetic dystrophies, and pillar pain. We have never had major complications with permanent

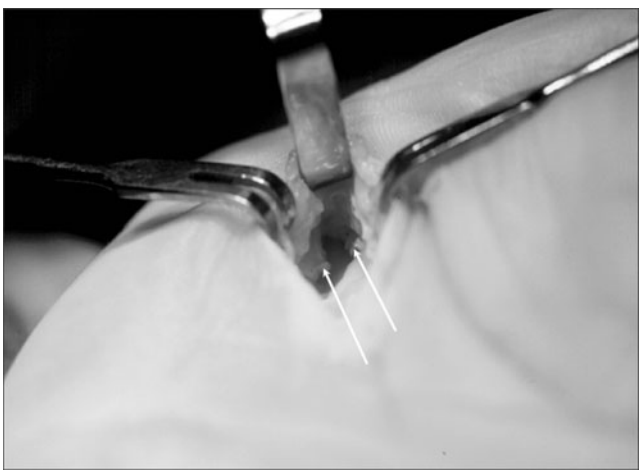

Fig. 5 Inspection of the lateral retraction of the cut edges of the ligament (*white arrows*) and opening of the carpal tunnel

nerve or vascular damage. Physical therapy is usually continued until satisfactory pinch and grip strengths are achieved.

Discussion

Most patients have a good result with open carpal tunnel decompression, but there is a small incidence of unsatisfactory outcomes, usually relating to tenderness of the scar or pillar pain [11]. The mechanism of pillar pain is not clear but may result from small neuromas in the subcutaneous tissue caused by the incision in the intertenar space. Open, minimally invasive, and endoscopic surgical techniques have all been described to have been recommended in an attempt to decrease the incidence of such complication. Long-term studies are scarce and usually evaluate only clinical signs and symptoms.

We observed short- and long-term outcomes with the Paine retinaculotome [7, 8, 10, 14, 17], and observed that the symptoms and signals were relieved in more than 95 % of patients. Sensitivity improved with time, and grip and tip strength remained unchanged. There was a decrease in the incidence of pillar pain and scar tenderness with less need of pain control.

The main advantage of the Paine retinaculotome is the low cost of the instrument, as it is a multiple use device.

Independent of which surgical technique is used, there are many possible complications after carpal tunnel surgery [4]. The literature review shows that major nerve injuries do occur with different techniques [3].

This method has been demonstrated to be efficient and safe for the treatment of CTS, and this is why we used this technique for the past 17 years.

Acknowledgements The Main author (C.H.F.) would like to acknowledge to Ronaldo dos Santos Carneiro, MD, for first lessons to use Paine retinaculotome.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

Informed consent was obtained from all patients for being included in the study.

Conflict of interest The authors declare that they have no conflict of interest.

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