

Carpal Tunnel Syndrome: Endoscopic Carpal Tunnel Release

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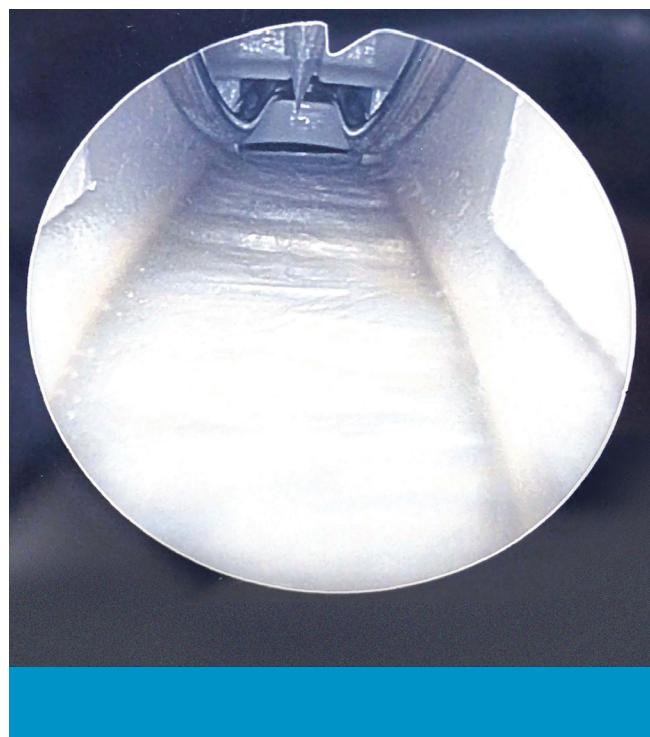
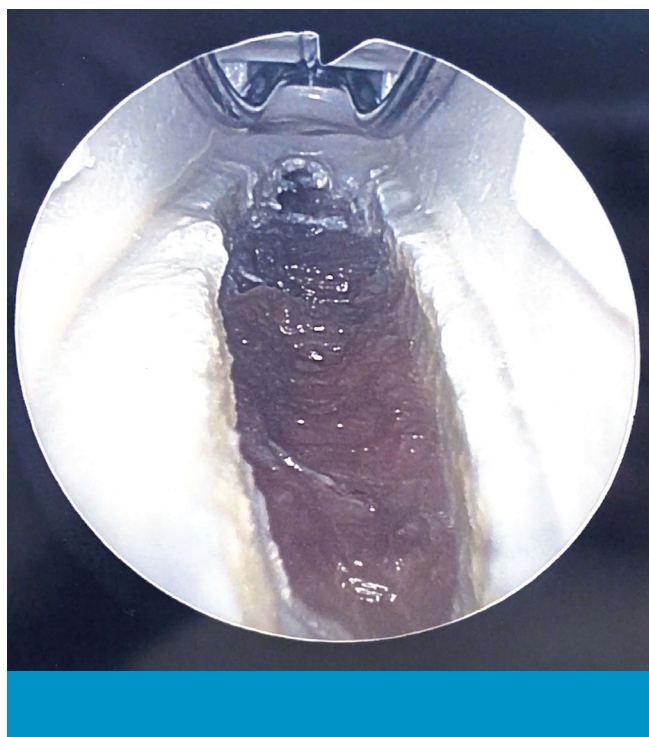
Carpal tunnel syndrome (CTS) is the most common peripheral nerve entrapment encountered by hand and upper extremity surgeons, accounting for over 600,000 surgeries in the United States annually.² The diagnosis was introduced in 1854 when Dr. James Paget first described a case of median nerve compression at the wrist in a distal radius fracture.¹ It was not until 1933 when Dr. Paget performed the first open release of the transverse carpal ligament.¹ Endoscopic surgery was not performed until 1987 when Dr. Ichiro Okutsu, a Japanese orthopedic surgeon, first reported division of the transverse carpal ligament in a patient with CTS using an endoscope.²

INTRODUCTION

Carpal tunnel syndrome occurs when the median nerve, which runs from the forearm into the palm of the hand, becomes pressed or squeezed at the wrist. It is a narrow, rigid passageway of ligament and bones at the base of the hand. Its contents include the median nerve and the flexor tendons that bend the fingers and thumb. The median nerve provides sensation to the palm side of the thumb and to the index, middle, and part of the ring fingers. Symptoms usually start gradually, with frequent numbness or tingling in those fingers. With CTS, sleep disturbance is a common complaint. Patients consistently report nighttime symptoms include multiple awakenings due to hand pain and numbness.² A person with CTS may wake up feeling the need to “shake out” the hand or wrist.³ With chronic median nerve compression, symptoms

LEARNING OBJECTIVES

- ▲ Review the anatomy of the hand and wrist
- ▲ List the six diagnostic criteria for CTS
- ▲ Explain the various treatment options used for this condition
- ▲ Study the surgical steps taken for an endoscopic carpal tunnel release
- ▲ Compare the Agee Technique and the Chow Technique



include a gritty or numb sensation in the fingers, grip and pinch weakness, and diminished finger dexterity with a history of dropping objects.⁴

CTS usually occurs only in adults. Women are three times more likely than men to develop carpal tunnel syndrome.³ Symptoms often are experienced during pregnancy and typically relieved post-delivery. Workplace factors may contribute to existing pressure on or damage to the median nerve. The risk of developing CTS is not confined to people in a single industry or job but may be more reported in those performing assembly line work—such as manufacturing, sewing, finishing, cleaning, and meatpacking.³

DIAGNOSING CARPAL TUNNEL SYNDROME

The hand consists of 27 bones. Eight carpal bones: scaphoid, capitate, trapezoid, trapezium, lunate, hamate, triquetrum, and pisiform; five metacarpal bones; and 14 finger bones. Each finger has a proximal, middle, and distal phalanx. Except for the thumb, it does not have a middle phalanx. The carpal tunnel is bordered dorsally by the concave arch of the carpus and volarly by the transverse carpal ligament (TCL). The carpal tunnel houses the median nerve and nine flexor tendons. The flexor pollicis longus tendon, four flexor digitorum profundus tendon slips, and four flexor digitorum superficialis tendon slips.⁴ The following are the six diagnostic criteria for CTS: nocturnal numbness, numbness and

tingling in the median nerve distribution, weakness and/or atrophy of the thenar muscles, Tinel's sign, Phalen's sign, and loss of two-point discrimination.¹ Tinel's sign is elicited by gently tapping on the median nerve at the carpal tunnel. A positive response is noted if the patient describes an electrical shock sensation in the median nerve distribution.⁴ Phalen's test is performed by placing the patient's elbow on an examination table and allowing the wrist to flex for 60 seconds. If the patient reports paresthesia in the median nerve distribution, this test is considered positive.⁴ Durkan's median nerve compression test involves direct compression of the median nerve at the carpal tunnel for 30 seconds. This test is considered positive if the patient reports numbness

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and/or tingling in one or more of the radial digits.⁴ Sensory testing alternatives for CTS include innervation density measurements using static or moving 2-point discrimination and threshold sensory measurements using Semmes-Weinstein monofilaments or vibrometer.⁴ An electrodiagnostic study includes measurements of nerve conduction alone or in combination with electromyography (EMG). Nerve conduction measurements are obtained by electrically stimulating a nerve at one point with data collection at a separate point along the course of the nerve.⁴ No blood tests specifically support the diagnosis of CTS.⁴ Surgery is indicated when conservative treatments have failed.² Conservative measures include splint immobilization and possibly corticosteroid injections for symptomatic relief.

TREATMENTS

Non-surgical treatments include splinting. Immobilization of the wrist at night and intermittently during the day has been shown to diminish reports of CTS.⁴ Oral medication has been advocated in the treatment of CTS, including diuretics, nonsteroidal anti-inflammatory drugs (NSAIDs), oral corticosteroids, and vitamin B₆ (pyridoxine). Diuretics, NSAIDs, and oral corticosteroids are thought to decrease interstitial fluid pressure within the carpal canal. A corticosteroid injection can be useful not only in nonsurgical management but also in confirming the diagnosis of CTS as well as in predicting the results of surgery.⁴ A single corticosteroid injection improved CTS symptoms in 76% of patients after six weeks. However, only 22% remained symptom-free at one year. An injection was determined to be most effective in patients with mild CTS symptoms [4].

SURGICAL TREATMENT

Open carpal tunnel release incised longitudinally just distal to the Kaplan Cardinal line and extended 3.0 to 4.0 cm proximally toward the distal wrist crease. The superficial palmar fascia, transverse carpal ligament and antebrachial fascia are divided.⁴

Endoscopic carpal tunnel release can be performed through a single incision, known as The Agee Technique, or through two, known as The Chow Technique.² The goal of the single incision endoscopic technique is to avoid an incision on the palmar surface of the hand as compared with open release.⁵ This article will explore the Agee Technique.

BACK TABLE:

Table cover

Four towels

Three-quarter drape

Hand drape

Basin

2- 20mL syringes

NaCl

Antifog solution

Esmarch bandage

Light handles

Gown and gloves

#3 knife handle

#15 blade

Joseph double skin hook

Ragnell retractor

Littler Dissecting scissor

Adson tissue forceps with teeth

Needle holder

Disposable system blade

Needlebook

3-0 Prolene suture

Towel clips

Bandage scissor

Straight Strabismus suture scissor

Camera

Light source

Carpal tunnel release system

– Hand piece

– Eye piece Endoscope

– Synovial elevator

– Hook of the Hamate dilators



Agee Technique

In 1990, a new technique was developed at the Hand Biomechanics Laboratory in Sacramento, California by Dr. John Agee, and Francis King. It was among the first to introduce endoscopy technology in carpal tunnel surgery using a video endoscope and light source. Dividing the transverse carpal ligament from the deep side using a disposable elongated blade. In the Agee single-portal endoscopic technique, a small transverse skin incision is made at the ulnar border of the palmaris longus tendon, that is, midway between the flexor carpi radialis and flexor carpi ulnaris tendons, proximal to the wrist flexion creases. A distally based flap of forearm fascia is elevated to expose the proximal end of the carpal canal. With the wrist held in slight extension, the endoscopic blade assembly is inserted into the canal, making sure that the blade is aligned with the axis of the ring finger. The distal edge of the transverse carpal ligament is identified, and the ligament is sectioned distally to proximally.⁴

POSITIONING PREPPING DRAPING

After the patient is brought into the operating room, the surgical team is introduced to the patient. Once the patient moves onto the table, the anesthesiologist or CRNA begin placing the patient under anesthesia. Endoscopic carpal tun-

nel release may be performed under a local anesthesia. However, more often patients are sedated with monitored anesthesia care. As the surgical technologist prepares the back table, the circulator and anesthesia work together by sedating and positioning the patient. An arm table is attached on the OR table next to the shoulder region allowing for full extension of the arm. A stockinette or cast padding is applied around the upper arm to provide protection from the tourniquet. A single bladder tourniquet is used with an additional steri-drape 1010 to aid against nonresident bacteria. Sterile prep technique begins at the fingers scrubbing between the interdigital spaces circumferentially proximal extending above the elbow onto the 1010 drape. The surgical technologist uses a three-quarter sheet or Mayo stand cover to drape the arm table. After prepping is complete the circulator gently places the patient's arm in supination on the arm table. One towel is placed under the upper arm distal to the tourniquet and another over top. Both ends are clipped together using Backhaus towel clips. A sterile fenestrated hand drape exposes the operative site to begin the procedure.

SURGICAL PROCEDURE

After performing a time out, the surgeon exsanguinates the arm distal to proximal using a Esmarch bandage. The tourniquet is inflated to 250mmHg. Using a #15 scalpel, a transverse incision is made at the wrist flexor crease. Subcutaneous tissue is dissected with Littler scissors. The palmaris longus is retracted by the CST radially to protect the palmar cutaneous branch of the median nerve. Scissors are used to make a distally based flap in the flexor retinaculum.⁴ The volar antebrachial fascia is elevated using a Joseph double skin hook exposing the medial nerve. Carefully staying in line with the ring finger, the surgeon inserts the synovial stripper into the carpal canal. Next, the hook of the Hamate dilators is passed through the canal, preparing for insertion of the endoscope.⁸ Attached to the endoscope is a small, elongated blade. The distal margin of the transverse carpal ligament is identified and the median nerve is noted to be out of the plane dissection.⁸ Deploying of the blade, dividing the transverse carpal ligament distal to proximal. The surgical site is irrigated with normal saline. Using Littler dissection scissors, the distal fibers of the volar antebrachial fascia are released, and the site is irrigated again.⁸ Using 3-0 Prolene, the subcutaneous tissue is reapproximated by a single running suture. Tourniquet is deflated and a soft sterile dressing is applied with xeroform, sterile 4x4 gauze, two-inch rolled conform gauze, and a two-inch ace bandage. On average, tourniquet time for an endoscopic carpal tunnel is usually between five to seven minutes.

POST-OPERATIVE

With the endoscopic carpal tunnel release, patients can use their operative hand almost immediately. No splinting is used. Having a light, soft dressing allows for slight range of motion of the wrist and full range of movement of the fingers. At approximately two weeks post-op, the patient will go in for a bandage and suture removal. With the open carpal tunnel release, a bulky soft dressing covers the wrist and hand. This dressing acts as a splint limiting range of motion.⁴ Several studies of carpal tunnel syndrome either endoscopic (ECTR) or open (OCTR) have shown less postoperative pain and improvement in grip and pinch strength with the endoscopic technique.⁶ Endoscopic surgery has been found to shorten recovery time compared with open carpal tunnel decompression, with a two- to three-week earlier return to work.⁴ Scar

In the Agee single-portal endoscopic technique, a small transverse skin incision is made at the ulnar border of the palmaris longus tendon, that is, midway between the flexor carpi radialis and flexor carpi ulnaris tendons, proximal to the wrist flexion creases.

sensitivity with the endoscopic technique remains significantly less than those having an open carpal tunnel release.⁷ One of the most important functional outcomes is the patient's resumption of activities of daily living and work.⁷



ABOUT THE AUTHOR

Alissa Boone has been a Certified Surgical Technologist (CST) since 2017. She started her medical career in orthopedics at the young age of 20 as a file clerk preparing patient charts. She quickly started training into the medical assistant role. After many years working with orthopedic surgical patients, she desired to know the “how” and “why” of surgery. In 2016, Alissa was accepted into the surgical technology program at Owensboro KCTCS. Since graduation Alissa has remained working at the Advanced Center for Orthopedics and Sports Medicine as a CST for Dr. David Boles, the practice's only board-certified hand surgeon. Together they operate in two states and four counties. She is also a BLS instructor for the American Heart Association and Notary Public for the Commonwealth of Kentucky. In October 2021, Alissa will celebrate her 20th anniversary in orthopedic medicine as well as at Advanced Center for Orthopedics and Sports Medicine. Alissa has one son, Cayden, and a golden retriever, JaxAlan. She was born, raised, and still resides in Kentucky.

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- Carpal tunnel syndrome (CTS) is the most common peripheral nerve entrapment encountered by hand and upper extremity surgeons, accounting for over _____ surgeries annually.**
 - 400,000
 - 500,000
 - 600,000
 - 700,000
- The carpal tunnel houses the median nerve and _____ flexor tendons.**
 - Six
 - Seven
 - Eight
 - Nine
- Phalen's test is performed by placing the patient's _____ on an examination table and allowing the _____ to flex for 60 seconds.**
 - Elbow, fingers
 - Elbow, wrist
 - Wrist, fingers
 - Fingers, wrist
- True or false:** Women are five times more likely than men to develop carpal tunnel syndrome.
- In the Agee single-portal endoscopic technique, a small transverse skin incision is made at the ulnar border of the _____.**
 - Flexor carpi ulnaris tendons
 - Palmaris longus tendon
 - Flexor carpi radialis tendon
 - All of the above
- With CTS, which is a common complaint by patients?**
 - Sleep disturbance
 - Numbness
 - Tingling
 - Pain
- Once the distal edge of the transverse carpal ligament is identified, the ligament is sectioned:**
 - Superior to inferior
 - Medial to lateral
 - Distal to proximal
 - Anterior to posterior
- The Agee Technique uses how many incisions in the endoscopic carpal tunnel release?**
 - One
 - Two
 - Three
 - Four
- With the wrist held in slight extension, the endoscopic blade assembly is inserted into the canal, making sure that the blade is aligned with the axis of the _____.**
 - Thumb
 - Pointer finger
 - Middle finger
 - Ring finger
- Carpal tunnel syndrome occurs when the _____ becomes pressed or squeezed at the wrist.**
 - Median nerve
 - Flexor tendon
 - Transverse carpal ligament
 - Ulnar nerve

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