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COMPARATIVE STUDIES BETWEEN OPEN AND ENDOSCOPIC CARPAL TUNNEL RELEASE: REVIEW OF ARTICLES

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Abstract

Squeezing the median nerve in the carpal tunnel as it passes through the wrist causes carpal tunnel syndrome (CTS). It strikes more women than men and usually manifests itself in adulthood. Even after a year of treatment without focused therapy, a third of patients may notice an improvement. Though it happens often and has enormous social and health costs, a complete description of CTS did not arrive until after WWII, and the term itself did not emerge until 1953. Our objectives are to determine whether endoscopic surgery, as opposed to open surgery, could be a more effective method for relieving chronic fatigue syndrome. Despite its prevalence and the serious social and health effects it can have, the term "chronic fatigue syndrome" didn't appear until 1953, and our present knowledge of the condition is very recent, having been correctly described after WWII [6-8].

Patients and Methods:A comprehensive literature search was performed in the electronic online medical databases such as: PubMed, ScienceDirect, Medline, Cochrane, and Google Scholar databases to find relevant articles on surgical approaches of CTS management. Moreover, keywords such as: “carpal tunnel syndrome”, “carpal tunnel syndrome management”, “carpal tunnel syndrome surgical management”, “carpal tunnel syndrome conservative management”, “carpal tunnel syndrome nonsurgical treatment”, “carpal tunnel syndrome non-surgical treatment”, “carpal tunnel syndrome open release”, and “carpal tunnel endoscopic release”, were used for searching in the databases. The inclusion criteria were set and they included English articles during 2010 to 2018 as follows: (1) systematic reviews and meta-analysis; (2) randomized clinical trials;

(3) case-control studies; (4) cohort studies; and (5) cross-sectional studies on the open and endoscopic managements of CTS. All other study types like: (1) case series; (2) case reports; (3) letter to editors; and (4) studies on animals and cadavers, were excluded from the present review.After searching, 31 articles were found and the articles were filtered according to the inclusion and exclusion criteria. Thence, only five systematic reviews and/or meta-analysis were remained. ResultsThree of the five articles were systematic review and/or meta-analysis of RCT and the other two articles were only systematic reviews. Moreover, all the articles were found no strong evidence on the superiority of endoscopic CTS release over open CTS release or vice versa except for one systematic review. One of the articles was published in 2010, one in 2014, one in 2015, and the other one in 2017. Conclusions:No strong evidences were found to support endoscopic CTS release over open CTS release or vice versa; therefore, the decision of choosing the approach is based on surgeon's and patient's preference.

Keywords: Carpal tunnel syndrome (CTS), compression, median nerve.

INTRODUCTION

Connecting the forearm to the hand, the carpal tunnel or canal is a small, stiff channel of bones near the base of the hand, or wrist, on the palmar side [1]. The transverse carpal ligament and the flexor retinaculum, in addition to the wrist bones, form the tunnel's boundary. In a normal configuration, the median nerve and nine tendons from the flexor group of the forearm muscles go through the tunnel to enable finger movement. The median nerve supplies feeling to the thumb, index finger, long finger, and half of the ring finger as it travels from the hand to the rest of the hand via the carpal tunnel. Also, while working the tendons, they glide past each other thanks to the tenosynovium, a slippery layer that covers the tendons. The median nerve can get trapped or compressed in carpal tunnel syndrome, which occurs when the canal narrows due to swelling or degeneration of any of the nine long flexor tendons that travel through it [1, 2]. The compression of the median nerve as it passes through the wrist at the carpal tunnel causes carpal tunnel syndrome (CTS) [3]. The prevalence of carpal tunnel syndrome in the US is estimated at 5% [4]. More women than men experience it, and it typically starts in adulthood [5]. Furthermore, after about a year, up to 33% of patients may show improvement even without targeted treatment [3]. Despite its prevalence and significant societal and health consequences, our current understanding of CTS is very new; the name itself did not arise until 1953, and a detailed description did not come out until after WWII [6-8].

1.2. Contextual Historical

Among peripheral compression-induced neuropathies, carpal tunnel syndrome (CTS) affects between 1.14 and 14.4 percent of the population on a statistical basis [1]. Number of working days lost due to CTS is estimated to be on the average. Paget documented two instances of median nerve compression in the carpal tunnel in 1854; one case was due to trauma, and the other was idiopathic. [7-9].In the first four decades of the twentieth century, the removal of the cervical rib was the most prevalent therapy for cervical stenosis [7-8]. This practice peaked in 1895.

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The procedure that Learmonth outlined in 1933 is still relevant today [7-8]. Published in 1946 by Brain et al., the first description of surgery for idiopathic CTS was later defined by Phalen et al., who provided a clinical, anatomical, and pathological perspective on the condition [7-8].The tourniquet test, which is used to diagnose CTS, was described in a 1953 publication.

Chow initially detailed endoscopic release of the carpal tunnel in 1989 [7].

Patients with carpal tunnel syndrome often reported their symptoms first thing in the morning, which makes sense given that the average intracranial pressure (ICP) of CTS patients is 13 mmHg higher than that of healthy subjects. What's more, the ICP of CTS patients continues to rise, especially during the night, and never drops below 30 mmHg, the critical threshold for nerve compression. The therapeutic efficacy of splints is likely due to the fact that internal pressure can be adjusted based on the postures of the fingers or elbow. When the intracranial pressure (ICP) rises from 20 to 30 mmHg, it causes changes in the nervous system, including epineural, perineural, and intraneural vascularization. When the ICP rises above 80 mmHg, the nerve is completely ischemiad [7].

Section 1.3. How CTS Works

In the palmar wrist, you'll find the osteofibrous carpal tunnel. Its ceiling is the transverse carpal ligament, which is also known as the flexor retinaculum, and its floor is the set of carpal bones. The proximal carpal tunnel is formed when the retinaculum, which is three to four centimeters wide, inserts into the scaphoid tuberosity and pisiform. The distal carpal tunnel is formed when it inserts into the trapezium and hook of hamate. Additionally, in order to fit the tendon of the flexor carpi radials, it divides into superficial and deep layers on the radial side [10].

The median nerve and nine tendons—including the flexor pollicis longus, four flexor digitorum superficialis, and four flexor digitorum profundus—are located in the tunnel. There is a shared synovial sheath between the profundus and superficialis flexors of the digits, while the flexor pollicis longus has its own [10]. The palmaris longus tendon, flexor carpi ulnaris tendon, and flexor carpi radialis tendon all pass near to the tunnel, however they do not travel through it. After passing through the channel formed by the splitting of the flexor retinaculum, the flexor carpi radialis tendon enters into the scaphoid and the base of the second metacarpal bone. Palmaris longus tendon either enters into the flexor retinaculum or continues with the palmar fascia; in 10% of the population, it is absent [10]. In contrast, the flexor carpi ulnaris tendon attaches into the pisiform. The carpal tunnel or canal is a narrow, rigid passageway of bones at the base of the hand i.e. wrist, on the palmar side that connects the forearm to the hand [1]. The tunnel is bounded by the bones of the wrist and the transverse carpal ligament or flexor retinaculum. Normally, nine tendons from the flexor group of forearm muscles and the median nerve pass through the tunnel to allow movement of the fingers. The median nerve passes through the carpal tunnel to hand and gives sensation to the thumb, index finger, long finger, and half of the ring finger. Moreover, the tendons are covered by tenosynovium, which is a slippery covering that allows the tendons to glide next to each other as they are worked. The canal is narrow, and when any of the nine long flexor tendons passing through it swells or degenerates, the narrowing of the canal may result in the entrapment or compression of the median nerve which is called carpal tunnel syndrome [1, 2].

Carpal tunnel syndrome (CTS) is a medical condition due to compression of the median nerve as it travels through the wrist at the carpal tunnel [3]. About 5% of people in the United States have carpal tunnel syndrome [4]. It is usually beginning in adulthood, and women are more commonly affected than men [5]. In addition, up to 33% of people may improve without specific treatment over approximately a year [3]. In spite of its great frequency and very high social and health costs, our proper understanding of CTS is quite recent and was first fully described after World War II and the term itself only appeared for the first time in 1953 [6-8].

2. Historical Background

The most prevalent peripheral compression-induced neuropathy is carpal tunnel syndrome (CTS), which affects 1.14–14.4% of the population [1]. CTS typically results in the loss of more than one workday. Aget recorded two cases of median nerve compression in the carpal tunnel in 1854 [7-9], one of which was idiopathic, and the other was caused by trauma. The standard treatment for cervical stenosis (CTS) in the early 1900s, starting in 1895, was surgical removal of a cervical rib [7-8]. The method described by Learmonth is applicable even in 1933 [7-8]. Phalen et al. described idiopathic CTS from a pathological, anatomical, and clinical point of view, but Brain et al. were the first to report surgery for idiopathic CTS in 1946 [7-8]. 1953 saw the publication of an article that detailed the tourniquet test, a diagnostic tool for CTS. In 1989, Chow first described endoscopic carpal tunnel release [7]. Patients with carpal tunnel syndrome typically reported their symptoms first thing in the morning since their internal tunnel pressure was 13 mmHg lower than that of healthy subjects. However, for CTS patients, this pressure increased even further, primarily during the night, and regularly exceeded 30 mmHg—a key number for nerve compression. The therapeutic effectiveness of splints was likely due to the fact that finger and elbow postures can change internal pressure. Changes in intracranial pressure impact the pathogenesis of chronic transient ischaemicstroke (CTS). At 20 to 30 mmHg, perineural pressure changes occur, and at 50 to 80 mmHg, intraneural vascularization takes place. Complete nerve ischaemiahappens at pressures above 80 mmHg [7]. 3. The Organization of CTS The carpal tunnel, a canal of osteofibrous material, is located in the palmar wrist. The carpal bones constitute the base, and the flexor retinaculum, a component of the transverse carpal ligament, serves as the roof. The boundaries of the carpal tunnel are as follows: By penetrating the scaphoid tuberosity and pisiform, the retinaculum—which is about three or four centimetres wide—forms the proximal carpal tunnel. Thereafter, it enters the trapezium and hook of hamate to create the distal carpal tunnel. It also splits into deep and superficial layers on the radial side to accommodate the flexor carpi radialistendon [10]. The tube houses the median nerve, the four flexor digitorum profundus, and the four flexor digitorum superficialis. The profundus and superficialis flexors of the digitorum share the synovial sheath, while the flexor pollicis longus is a separate muscle [10]. The tendons of the flexor carpi radialis, palmaris longus, and flexor carpi ulnaris all pass outside the tunnel, even though they are very close to it. After the flexor retinaculum splits, the flexor carpi radialis tendon makes a canal that it uses to get to the scaphoid and the base of the second metacarpal bone. The flexor carpi ulnaris tendon goes into the pisiform, and the palmaris longus tendon either connects to the flexor retinaculum or continues with the palmar fascia. In 10% of people, neither of these things happens [10].

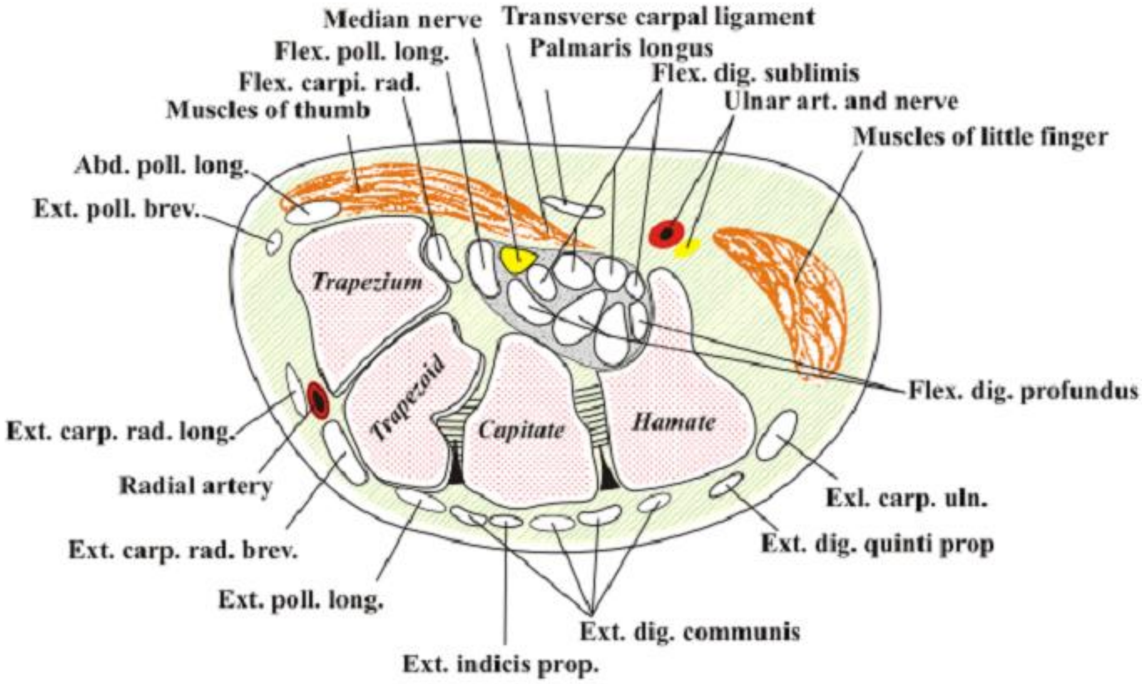

Figure (1): cross-sectional diagram of wrist at carpal tunnel region [11]

1.4. Signs and symptoms of CTS

Section 1.4. Characteristics of CTS

Thumb, index, middle, and lateral side of ring finger discomfort, numbness, and tingling are the primary symptoms [3, 9]. The pain may radiate to the arm and usually begins slowly during the night [5, 9]. Eventually, the muscles of the thenar eminence may atrophy, leading to weak grip strength and other symptoms [5, 9]. More than half of the time, both parties are impacted [3]. Children may experience disorienting symptoms such as widespread discomfort and impaired dexterity. In addition, the tourniquet test, nerve percussion, and wrist flexion were all evaluated for their clinical utility; nevertheless, the wrist flexion test was determined to be the most sensitive. Phalen test, whereas nerve percussion, i.e. The least sensitive and most specific was the Tinel sign [9]. At the time of presentation, the ailment is likely severe, as evidenced by findings including weakening and atrophy of the posterior deltoids. After a lengthy period of nerve compression, the Tinel sign and Phalen test might not be noticeable [9]. The Durkan test, a type of carpal compression, was discovered to be more sensitive (87%) and specific (90%) than the Tinel or Phalen tests [9]. This test involves applying direct pressure on the median nerve for 30 seconds using either the thumbs or an atomizer bulb connected to a manometer.

Section 1.5. Potential causes of CTS

Getting regular exercise lowers the likelihood of chronic traumatic stress disorder (CTS) [12]. Additionally, women are two to three times more likely to have it than males, and patients between the ages of 30 and 60 account for the majority of cases. Factors that increase the likelihood of carpal tunnel syndrome include being overweight, not getting enough exercise, smoking cigarettes, being pregnant, and having rheumatoid arthritis or other autoimmune diseases.

Diabetes mellitus is poorly linked with CTS, and there is little evidence that hypothyroidism enhances the risk [9, 12, 14–15]. Furthermore, the risk is unaffected by the use of oral contraceptives [12]. When a person sleeps with their wrists acutely flexed, it can lead to carpal tunnel syndrome symptoms [9].

Section 1.6. Final verdict

Section 1.6.1. Assessing Reliability

Electrodiagnostic investigations and symptoms of nerve compression were found to correspond accurately with threshold sensibility tests in peripheral nerve compression syndromes. When it came to identifying early nerve compression, the most accurate method was Semmes-Weinstein monofilament pressure testing. An 82% sensitivity and 86% specificity result was obtained for a "quantitative provocational" diagnostic test that combined the Semmes-Weinstein monofilament test with the wrist flexion test [9].

Section 1.6.2. Evaluations using electrodiagnostic devices

The presence of electrodiagnostic markers, such as a loss of muscle mass at the base of the thumb, can provide strong evidence of CTS [5, 12].

Nerve conduction velocities, electromyography, and other electrodiagnostic studies are valid confirmatory tests that can reveal the severity of CTS; that is, they can categorize CTS as mild, moderate, or severe. It is deemed abnormal when the distal motor delay exceeds 4.5 ms and the sensory latency surpasses 3.5 ms. Electromyography can reveal signs of nerve injury such as increased insertional activity, positive sharp waves, resting fibrillations, reduced motor recruitment, and complicated repeating discharges. On rare occasions, these tests come back normal; yet, they are nonetheless present in people who exhibit the characteristic symptoms of carpal tunnel syndrome. Electrodiagnostic testing can sometimes be off in people who aren't showing any symptoms. According to reports, nerve conduction investigations can detect carpal tunnel syndrome with a sensitivity of 90% and a specificity of 60%. Additionally, they facilitate the examination of the cervical spine, elbow, and axilla for signs of nerve compression and to reveal alterations in peripheral neuropathy. However, research has demonstrated that electrodiagnostic testing does not enhance the diagnostic value of the four most popular tests—the drawing test, abnormal Semmes-Weinstein testing, positive Durkan compression, and night pain—and does not offer substantial data for predicting functional recovery or reemployment following carpal tunnel release. These results, along with the 10% false-negative rates that have been recorded, make this form of testing useless for deciding on a course of therapy. In order to evaluate recurrent symptoms, electrodiagnostic testing performed after surgery can be useful [9].

1.7. Methods for treating CTS

Chapter 1.7.1. Restricted management of chronic traumatic stress

Wrist splints and corticosteroid injections alleviate symptoms, although nonsteroidal anti-inflammatory drugs (NSAIDs) and gabapentin do not seem to help [12]. While night splints and cortisone injections into the carpal tunnel may alleviate mild symptoms without thenar muscle

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atrophy, only approximately 10% of patients who undergo this treatment actually see improvements in their condition over the long term [9].
Compared to non-surgical alternatives that do not require splinting following surgery, cutting the transverse carpal ligament is a successful surgical procedure with improved results at one year [12, 16].
Indicators of a less-than-ideal result from nonoperative treatment include the following five points [9]:
1. People who are fifty years old and up.
2. Time frame exceeding ten months.
3. Persistent tingling.
4. Tenosynovitis of the flexor muscles that has not yet healed.
5. In just 30 seconds, you can get a positive response from a Phalen test.

Section 1.7.2. Management of chronic traumatic stress by surgical procedures

The results of early carpal tunnel release are more favorable for patients with severe and moderate CTSs [9, 17–18]. The gold standard for treating CTS is surgical decompression [12, 16–18]. One successful method of releasing pressure on the median nerve is the carpal tunnel release, also known as a retinaculotomy [17].
Surgery usually has positive outcomes, and the majority of patients report that the effects linger for quite some time. The initial six months following carpal tunnel release typically exhibit the most significant improvement. Thermarestrophy may go away, but it's not going anywhere soon. Patients over the age of 70 or those with severe nerve compression may not get full symptom relief after surgical release. Surgical intervention is typically necessary when posture adjustment fails to alleviate symptoms of a distal radial fracture that have persisted [9].
Surgeon skill is the determining factor in the best surgical approach for median nerve decompression. There seems to be no difference in outcomes at six months, even though minimally invasive procedures allow for an earlier return to work and less postoperative pain. Endoscopic carpal tunnel release may benefit patients who need to go back to their lives quickly, but surgeons should be mindful that it has a higher rate of temporary nerve damage and is just as effective as open carpal tunnel release overall [9].
The conventional method involves slicing the skin longitudinally across the transverse carpal ligament, from the palm to the wrist [17]. Using a skin pen to mark the planned surgical incision is the first step in the traditional approach. The incision should start just distal to the distal wrist flexion crease and slightly ulnar to the midline of the wrist. It should extend distally approximately 2-3 cm in line with the third web space. Occasionally, it has to extend into the distal forearm, but this is not always necessary (Figure 2) [9].
Some of the issues with the conventional method are as follows:
1. Aching wounds.
2. Soreness around scars.
3. There is a high rate of non-recoverable flexor tendon entrapment and thenar and hypothenar (pillar) pain.
4. Postpone getting back to your regular routine.

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Various endoscopic procedures and mini-incision approaches were developed in an effort to accomplish retinaculotomy without additional problems [9, 17].

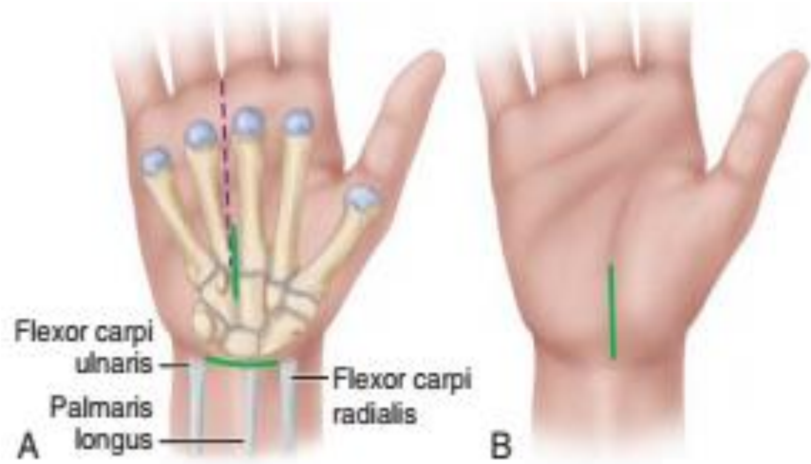

Figure (2): two approaches for open carpal tunnel release. **A,** transverse incision proximal to anterior wrist crease between flexor carpi ulnaris and flexor carpi radialis tendons. Distal longitudinal incision made between proximal palmar crease and 1 cm distal to hamate hook in line with radial border of ring finger. **B,** incision used for minimal-incision approach [9]

1.7.2.1. The mini-incision approach

7.2.1. The method of mini-incision

There is less scar pain and a lower grade of pillar discomfort with the mini-incision method, and the scar is smaller. There were still some drawbacks to the various approaches that were suggested [9, 17]. A twofold mini-incision approach, which can offer superior visualization but is limited by the significant risk of iatrogenic injury to the cutaneous branch of the median nerve, and one small incision were both offered by the researchers as methods of mini-incision approaches (Figure 3). Incomplete release occurred in several cases for various reasons, even though retinaculotomy can be safely achieved by them [17].

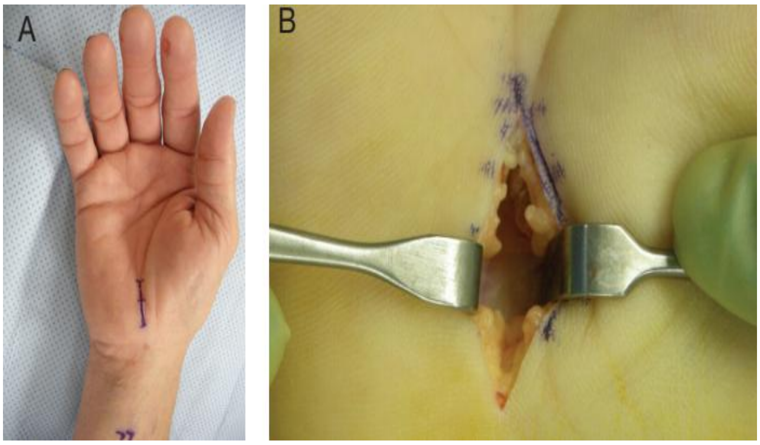

Figure (3): open release method for carpal tunnel A, preoperative markings. B, intraoperative view. **[**19]

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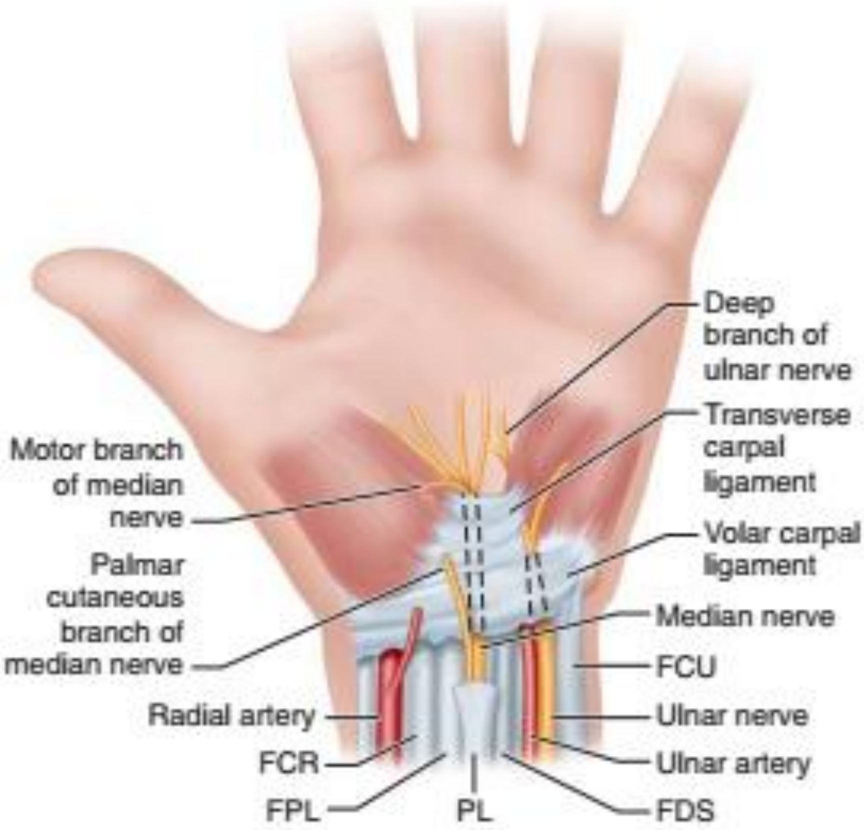

Figure (4): palmar cutaneous branch of median nerve; FCR, flexor carpi radialis; FCU, flexor carpi ulnaris; FDS, flexor digitorum superficialis; FPL, flexor pollicis longus; PL, palmaris longus [9]

Incidences of thenar branch course of median nerve are extraligamentous 46%, subligamentous 31%, and transligamentous 23% (Figure 5) [9].

Figure (5): thenar branch course of median nerve [9]

1.7.2.2. Endoscopic releases of CTS

Section 1.7.2. The release of CTS through endoscopy

The procedure to release the transverse carpal ligament endoscopically, which typically involves making one or two tiny incisions, was initially documented in 1989 [9, 17]. Although this method

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lessens post-operative incisional pain, it is associated with an increased risk of blood vessel injury and incomplete release. However, its widespread use is limited by the need for costly equipment and specialized knowledge.

Compared to open release, endoscopic carpal tunnel release has fewer side effects, including reduced scarring and ulnar "pillar" discomfort, quicker and more complete strength recovery, and the ability to resume normal activities at least two weeks earlier. Endoscopic carpal tunnel release and open methods were not significantly different in terms of function, according to some research. Those patients who do not have compensable injuries appear to benefit from the endoscopic procedure, as its benefits in grip strength and pain reduction become apparent within the first 12 weeks. The importance of being extremely careful and cautious during the endoscopic surgery is highlighted by retrospective reports of intraoperative injury to flexor tendons, median, ulnar, and digital nerves, as well as the superficial palmar arterial arch. The two approaches can be categorized as single-portal (Agee) and two-portal (Chow) methodologies, however there are numerous equipment manufacturers [9].

The following issues may arise as a result of endoscopic carpal tunnel release:

1. Quite a complex process.
2. A restricted field of view that makes it impossible to examine nearby buildings.
3. The superficial palmar arterial arch, flexor tendons, and median nerve are also susceptible.
4. Having trouble keeping bleeding under control.
5. Mechanical failure imposes certain constraints.

Endoscopic carpal tunnel release is not appropriate in the following cases [9]:

1. The patient has to have the Guyon canal decompressed, the transverse carpal ligament Z-plastied, tenosynovectomyed, or neurolysised.
2. The surgeon has reason to believe that there is a serious abnormality involving the carpal tunnel's muscles, tendons, or arteries, such as a space occupying lesion.
3. A severe case of hand edema or localized infection may be present, or the patient may have precarious vascular status in their upper extremities.
4. Repair surgery for carpal tunnel syndrome that has not healed or has returned after first treatment.
5. Discrepancy in the median nerve's anatomy, as indicated by clinical observations of weakening of the abductor pollicis brevis without noticeable alterations to median sensation.
6. Scarring from previous tendon surgeries or flexor injuries in the carpal tunnel would make endoscopic carpal tunnel release devices unsafe to employ.
7. Due to the endoscopic instruments' inability to enter the carpal tunnel and their subsequent positioning adjacent to the dorsal surface of the transverse carpal ligament, a restriction in wrist extension is another reason why endoscopic procedures are not appropriate.

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Figure (6): endoscopic release method for carpal tunnel A. preoperative markings. B. intraoperative view [19]

1.8. Aim of the study

The purpose of this study was to compare the outcomes of both open and endoscopic surgical release of CTS

Patients and Methods

A systematic review of CTS was performed with comprehensive literature search in the electronic databases including PubMed, ScienceDirect, Medline, Cochrane, and Google Scholar databases. The databases were searched with the following Keywords: “carpal tunnel syndrome”, “carpal tunnel syndrome management”, “carpal tunnel syndrome surgical management”, “carpal tunnel syndrome conservative management”, “carpal tunnel syndrome nonsurgical treatment”, “carpal tunnel syndrome non-surgical treatment”, “carpal tunnel syndrome open release”, and “carpal tunnel endoscopic release”. In addition, publications in English language were included but publications written in other languages have been excluded.

Full text articles concerned with CTS were downloaded and the count was 31 articles. We then selected the articles that have been published during 2010 to 2019. Therefore, 20 articles remained. We then filtered the articles furthermore according to the inclusion and exclusion criteria. The inclusion criteria included: (1) systematic reviews and meta-analysis; (2) randomized clinical trials; (3) case-control studies; (4) cohort studies; and (5) cross-sectional studies on the open and endoscopic managements of CTS. All other study types like: (1) case series; (2) case reports; (3) letter to editors; and (4) studies on animals and cadavers, were excluded from the present review. Finally, only five articles were fulfilled the inclusion criteria and therefore, they were planned to be analyzed by using Microsoft Excel Spreadsheets (2010).

3. Results

The five articles included in the present study were systematic review and/or meta-analysis or review of literature.

Four out of the five studies found no difference between open CTS release and endoscopic CTS release (Table 1).

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Table (1): study designs, methods of interventions to CTS and results of previous articles

Article	Design of study	Method of intervention	Their conclusion
Zamborsky et al., 2017 [18]	Systematic review (review of literature)	Surgical treatment (all approaches) of CTS	There is no strong evidence supporting the need for replacement of standard open carpal tunnel release by existing alternative surgical procedures
Ghasemi-Rad et al., 2014 [20]	Systematic review (review of literature)	Surgical treatment (all approaches) of CTS	Endoscopic CTS release had better outcome as compared to open and mini-open CTS releases
Huisstede et al., 2010 [21]	Systematic review of RCT	Comparison between surgical approaches	There is no unequivocal evidence that suggests one surgical treatment is more effective than the other.
Vasiliadis et al., 2015 [22]	Systematic review and meta-analysis of RCT or quasi-randomized controlled trials	Comparison of endoscopic with any open surgical technique.	No significant difference was found between the effectiveness of endoscope over open release
Zuo et al., 2015 [23]	Meta-analysis of RCT	Comparison of open and endoscopic release of CTS	No statistical difference in the overall complication rate, subjective satisfaction, the time to return to work, postoperative grip and pinch strength, and operative time was observed between the two groups of patients.

The outcomes of the selected articles are summarized in (Table 2).

Table (2): outcomes of selected previous articles

Outcome		Zamborsky et al., 2017 [18]	Ghasemi-Rad et al., 2014 [20]	Huisstede et al., 2010 [21]	Vasiliadis et al., 2015 [22]	Zuo et al., 2015 [23]
Overall complications	Endoscopic CTS release	Higher nerve and vascular injuries	—	—	Less safer	Higher nerve injury
	Open CTS release	Lower nerve and vascular injuries	—	—	More safer	Lower nerve injury
Operative time	Endoscopic CTS release	Longer time	Longer time	Longer time	Longer time	Longer time
	Open CTS release	Shorter time	Shorter time	Shorter time	Shorter time	Shorter time
Patient subjective satisfaction	Endoscopic CTS release	—	—	—	—	No significant difference
	Open CTS release	—	—	—	—	
Hand grip	Endoscopic CTS release	—	—	No significant difference	—	No significant difference
	Open CTS release	—	—		—	

Pinch strength	Endoscopic CTS release	—	—	—	—	No significant difference
	Open CTS release	—	—	—	—	
Pain (complex regional pain syndrome)	Endoscopic CTS release	Significantly lower	—	—	Significantly lower	Significantly lower
	Open CTS release	Significantly higher	—	—	Significantly higher	Significantly higher
Time to return to work	Endoscopic CTS release	Significantly lower	—	—	10 days earlier	No significant difference
	Open CTS release	Significantly higher	—	—	Needs more time	
Skin	Endoscopic CTS release	Better outcome	Better outcome	—	—	—
	Open CTS release	Acceptable outcome	Acceptable outcome	—	—	—
Muscle strength	Endoscopic CTS release	Better outcome	Better outcome	—	—	—
	Open CTS release	Acceptable outcome	Acceptable outcome	—	—	—
Epineurotomy	Endoscopic CTS release	—	No significant difference	—	—	—
	Open CTS release	—		—	—	—
Broken knife intraoperatively	Endoscopic CTS release	—	—	—	Yes	—
	Open CTS release	—	—	—	No	—
Recurrence and reoperation	Endoscopic CTS release	—	—	—	No significant difference	—
	Open CTS release	—	—	—		—

Discussion

The new innovation of the endoscope makes the decision between the methods of surgical care for CTS more complicated. Furthermore, not every novel idea has a positive outcome. Thus, additional data is needed to support their clinical practice opinions, and novel techniques and procedures for treating any condition should not be adopted hastily. Regarding this, we looked through the literature over the past nine years and discovered five studies that met the criteria for inclusion. Table 1 shows that the publications were published between 2010 and 2017, making them recent evidence. In addition, three of the five publications were meta-analyses of randomized controlled trials (RCTs), while the other two were merely systematic reviews; hence, all five articles had high quality and a grade of Ia for medical evidence. Hence, it is important to take their results into account. In terms of surgical interventions, four out of five papers failed to produce convincing evidence that one method was better than the others (Table 1). Zamborsky et al. [18] investigated every facet of CTS from a medical perspective by means of a systematic review, or more accurately, a literature review. The study's authors concluded that conservative treatments, such as splinting and steroid injection, are helpful but should be used with caution because of the risks associated with them. There was insufficient evidence to warrant the replacement of conventional open carpal tunnel release with the current alternative surgical techniques, even though surgery was more effective [18]. A systematic review, which involves looking at all the prior research on CTS from a medical perspective, was also employed in the study by Ghasemi-Rad et al. [20]. After 12 weeks, one year, and up to five years after surgery, there was no statistically significant difference in outcomes between open and endoscopic carpal tunnel releases, according to their study. Furthermore, there is no discernible difference between mini-open and regular open carpal tunnel releases throughout the first four to six months following surgery. Nevertheless, in the early phases following surgery, mini-open carpal tunnel releases have demonstrated superior results. There is a higher risk of nerve or artery injury due to the restrictions in visualization with endoscopic CTS release, but it is occasionally preferred over open CTS release since separating the skin from below protects the muscle and overlying skin, allowing for a more rapid return to work. Within 12 weeks following surgery, endoscopic CTS release outperformed regular open and mini-open releases in terms of muscle strength, and within 4 weeks after surgery, it outperformed all three methods. Consequently, endoscopic CTS release was superior to open and mini-open CTS releases in terms of outcome [20]. In their systematic assessment of surgical methods for treating CTS, Huisstede et al. [21] incorporated 25 RCT papers and two reviews. In both the short and long term, they discovered that surgical treatment for CTS was superior to splinting or anti-inflammatory medication plus hand rehabilitation. Despite this, there is no solid evidence that one type of surgery—including open, min-open, and endoscopic CTS release—is better than the others [21]. Vasiliadis et al. [22] conducted a meta-analysis and comprehensive review of research on CTS. The following databases were combed through: MEDLINE (from 1966 to 2013), EMBASE (from 1980 to 2013), the Cochrane Neuromuscular Disease Group Specialized Register (from 2013 to 2014), and CENTRAL (from 2013 to 2014, issue 11 in The Cochrane Library). Furthermore, they included all randomized or quasi-randomized controlled trials that compared endoscopic and open CTS release methods. Endoscopic CTS release caused fewer problems with the skin and helped patients get back to work and daily life faster, but it also had more problems, like nerve damage and recurrence [22]. Finally, Zuo et al. [23] used a meta-analysis of the literature to look at the safety and effectiveness of endoscopic versus open CTS release for idiopathic CTS. Many searches were done in the Cochrane Controlled Trial Register, MEDLINE, EMBASE, Google Scholar, and other online databases to find randomized studies that showed these two surgical methods worked to treat CTS. Endoscopic CTS release decreased postoperative hand discomfort but raised postoperative nerve damage risk in patients with idiopathic CTS, despite its excellent pain-relieving effects. Overall, there was no statistically significant difference between the two groups in terms of complication rate, subjective satisfaction, time to return to work, postoperative grip and pinch strength, or operative duration [23]. Although endoscopic CTS is preferable to open CTS in terms of scar size and recovery time, it is nevertheless associated with a higher risk of complications such as vascular and neuronal damage and incomplete release [24]. Table 2 included the rates of complications and various outcomes. Endoscopic carpal tunnel release lets patients go back to work or daily activities faster, on average about a week after the procedure. However, there isn't strong evidence that other

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surgeries should be used instead of standard open carpal tunnel release to treat carpal tunnel syndrome (Table 2). It appears that the surgeon's and patient's choices dictate the choice to use specialized, minimally invasive procedures rather than the conventional open carpal tunnel release [24].

Conclusions

At six months or later are similar with either open or endoscopic release, with the exception that endoscopic patients have a higher risk of nerve injury and a lower risk of scar tenderness, while open release patients can go back to work sooner and have better strength in the early postoperative period. Conclusions drawn from the literature and discussion indicate that neither endoscopic nor open CTS release is strongly supported by data; so, the choice between the two approaches is ultimately at the discretion of the surgeon and the patient.

Limitations

The endoscopic release approach is still relatively new, particularly in our region, there are few references on CTS that has been treated with it. This is the main drawback of the study.

Recommendations

1-Researching the same topic with more well-designed trials is necessary to support or refute endoscopic CTS release, since it is novel. 2-Reviewing more literature from longer-term, well-designed RCTs. 3-Endoscopic CTS release recurrences and reoperations may be lessened by training courses, which may be due to the influence of a learning curve.

References

[1] Schmidt HM, Lanz U. *Surgical anatomy of the hand*. New York:Thieme;2003, p. 29.
[2] Schuenke M, Schulte E, Schumacher U. *Thieme Atlas of Anatomy: General Anatomy and Musculoskeletal System*. New York:Thieme; 2006. p. 248–249.
[3] Burton C, Chesterton LS, Davenport G. Diagnosing and managing carpal tunnel syndrome in primary care. Br J Gen Pract. 2014;64(622):262–3.
[4] Bickel KD. Carpal tunnel syndrome. J Hand Surg Am. 2010;35(1):147-52.
[5] National Institute of Neurological Disorders and Stroke. Carpal Tunnel Syndrome Fact Sheet. Available from: https://web.archive.org/web/20160303181005/http://www.ninds.nih.gov/disorders/carpal_tunnel/detail_carpal_tunnel.htm#227043049. [Accessed 1st May 2019].
[6] Amadio PC. History of carpal tunnel syndrome. In Luchetti R, Amadio PC (eds.). *Carpal Tunnel Syndrome*. Berlin: Springer;2007, pp. 3–9.
[7] Stecco C, Aldegheri R. Historical review of carpal tunnel syndrome. Chir Organi Mov. 2008;92(1):7-10.
[8] Luchetti R, Amadio P. (Eds.). Carpal Tunnel Syndrome. Germany: Springer; 2007.
[9] Azar FM, Beaty JH, Canale ST. CAMPBELL'S OPERATIVE ORTHOPAEDICS. 13 ed. Canada: Elsevier; 2017.

[10] Presazzi A, Bortolotto C, Zacchino M, Madonia L, Draghi F. Carpal tunnel: Normal anatomy, anatomical variants and ultrasound technique. J Ultrasound. 2011;14(1):40–6. doi:10.1016/j.jus.2011.01.006

[11] Wikipedia. Carpal tunnel syndrome. Available from: https://en.wikipedia.org/wiki/Carpal_tunnel_syndrome#/media/File:Carpal-Tunnel.svg. (Accessed 1st May 2019).

[12] American Academy of Orthopaedic Surgeons. Management of Carpal Tunnel Syndrome Evidence-Based Clinical Practice Guideline. www.aaos.org/ctsguideline. Published February 29, 2016.

[13] Osterman M, Ilyas AM, Matzon JL. Carpal tunnel syndrome in pregnancy. Orthop Clin North Am. 2012;43(4):515-20.

[14] Padua L, Coraci D, Erra C, Pazzaglia C, Paolasso I, Loreti C, et al. Carpal tunnel syndrome: clinical features, diagnosis, and management. Lancet Neurol. 2016;15(12):1273-84.

[15] Shiri R. Hypothyroidism and carpal tunnel syndrome: a meta-analysis. Muscle Nerve. 2014;50(6):879-83.

[16] Carlson H, Colbert A, Frydl J, Arnall E, Elliot M, Carlson N. Current options for nonsurgical management of carpal tunnel syndrome. Int J Clin Rheumtol. 2010;5(1):129–42.

[17] Bai J, Kong L, Zhao H, Yu K, Zhang B, Zhang J, et al. Carpal tunnel release with a new mini-incision approach versus a conventional approach, a retrospective cohort study. Int J Surg. 2018;52:105-9.

[18] Zamborsky R, Kokavec M, Simko L, Bohac M. Carpal Tunnel Syndrome: Symptoms, Causes and Treatment Options. Literature Reviev. Ortop Traumatol Rehabil. 2017;19(1):1-8.

[19] Coady-Fariborzian L, McGreane A. Comparison of Carpal Tunnel Release Methods and Complications. Available from: https://www.mdedge.com/fedprac/article/100423/orthopedics/comparison-carpal-tunnel-release-methods-and-complications. (Accessed 17th July 2019).

[20] Ghasemi-Rad M, Nosair E, Vegh A, Mohammadi A, Akkad A, Lesha E, et al. A handy review of carpal tunnel syndrome: From anatomy to diagnosis and treatment. World J Radiol. 2014;6(6):284-300.

[21] Huisstede BM, Randsdorp MS, Coert JH, Glerum S, van Middelkoop M, Koes BW. Carpal tunnel syndrome. Part II: effectiveness of surgical treatments--a systematic review. Arch Phys Med Rehabil. 2010;91(7):1005-24.

[22] Vasiliadis HS, Nikolakopoulou A, Shrier I, Lunn MP, Brassington R, Scholten RJ, et al. Endoscopic and Open Release Similarly Safe for the Treatment of Carpal Tunnel Syndrome. A Systematic Review and Meta-Analysis. PLoS One. 2015;10(12):e0143683.

[23] Zuo D, Zhou Z, Wang H, Liao Y, Zheng L, Hua Y, et al. Endoscopic versus open carpal tunnel release for idiopathic carpal tunnel syndrome: a meta-analysis of randomized controlled trials. J Orthop Surg Res. 2015;10:12.

[24] Scholten RJ, Gerritsen AA, Uitdehaag BM, van Geldere D, de Vet HC, Bouter LM. Surgical treatment options for carpal tunnel syndrome. Cochrane Database Syst Rev. 2004;(4):CD003905.