



International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2022; 8(2): 13-16
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www.orthopaper.com
Received: 09-01-2022
Accepted: 14-02-2022

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Surgical management of carpal tunnel syndrome with an open carpal tunnel release-our experience

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DOI: <https://doi.org/10.22271/ortho.2022.v8.i2a.3110>

Abstract

Introduction: CTS (Carpal tunnel syndrome) is characterised by compression of the median nerve at the wrist joint and is quite common in orthopaedic practice. Surgical management with the release of the transverse carpal ligament is the most commonly performed modality of treatment and this study was performed to assess the functional outcome after the open release of the carpal tunnel.

Methods: This study included 30 patients with CTS managed by open carpal tunnel release done between January 2014 to January 2017. The patients were evaluated for functional outcomes using the DASH (Disabilities of arm, shoulder and hand) and GSS (Global symptom score) scores.

Results: There were 14 males and 16 females with the left wrist involvement seen more as compared to the right side. The patients age was a mean of 42.4 years (33-54 years). The average duration of the surgical procedure was 36 minutes (22-48 minutes) and the mean blood loss was 20.2 ml (18-28 ml). There was a good improvement in the DASH and the GSS scores postoperatively which were statistically significant. We were able to provide good functional outcomes to the patients with minimal complications.

Conclusion: Open surgical carpal tunnel release facilitates release of the carpal ligament under direct visualization and hence complications such as iatrogenic median nerve injury which can be associated with minimally invasive methods can be avoided. It offers a good resolution of symptoms to the patients and provides a good functional outcome enabling a faster return to work-related activity and day-to-day living.

Keywords: CTS, median nerve, entrapment neuropathy, DASH score

Introduction

CTS (Carpal tunnel syndrome) is characterised by compression of the median nerve at the wrist joint and is quite commonly seen in orthopaedic practice. It is more commonly seen in females as compared to males and can often be bilateral affecting both wrist joints^[1, 2]. The most commonly associated risk factors for carpal tunnel syndrome are hypothyroidism, female gender, rheumatoid arthritis, diabetes mellitus, obesity, advanced age, amyloidosis, smoking and alcoholism with pregnancy being a physiologically reversible cause for the syndrome. (Figure 2) It can be precipitated by constant exposure to vibrations and repetitive motions and certain athletic activities such as throwing, tennis and cycling^[3]. The presenting symptoms usually are tingling and numbness in the fingers supplied by the median nerve, an increase in symptoms on wrist flexion, pain more at night, which can wake up the patient from sleep, weakness of grip and clumsiness. The physical examination can show thenar muscle atrophy which is supplied by the median nerve and a positive Phalen's and Durkan's test. The Phalen's test is performed by keeping the wrist in acute flexion for a minute and reproducing the symptoms would represent a positive test. For the Durkan's test, thumb pressure is given on the carpal tunnel for about 30 seconds and it would produce tingling, pain or paraesthesia representing a test which is taken as positive. A positive Tinnels sign would be seen where tapping on the surface region of the median nerve in the wrist would reproduce symptoms^[4, 5, 6]. This syndrome is diagnosed mainly by clinical features and tests, while investigations such as nerve conduction studies and electromyograms are used to assess outcomes following carpal tunnel surgery. Various modalities of management are available in the treatment of this syndrome such as NSAIDs, splints, steroid injections and release of the carpal tunnel which can be through a traditional incision or a minimally invasive technique which includes an

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endoscopic assisted release as well [7, 8, 9]. This purpose of this study was to assess the functional outcome after the open release of the carpal tunnel.

Materials and Methods

This was a study of 30 patients with established carpal tunnel syndrome who were assessed from January 2014 to January 2017 and managed with open surgical release of the carpal tunnel with a follow up period of one year. Review board approval was taken prior to undertaking the study. All skeletally mature patients who had symptomatic wrists and were willing for the surgical procedure and also for regular prescribed follow ups were included in our study. In contrast, skeletally immature patients, patients who could not report for regular follow and patients with a history of prior carpal tunnel release were excluded. All patients were subjected to a clinical evaluation following admission and the Phalens test, Durkams test and the tinnels sign were performed for establishing a clinical diagnosis. The patients were assessed for decreased sensation in the fingers supplied by the radial nerve, atrophy of the thenar muscles, grip strength and loss of two point discrimination. Nerve conduction studies were done and a sensory latency greater than 3.5ms, motor latency more than 4.5ms and a conduction velocity of <52m/sec were taken as parameters for the diagnosis of the syndrome. MRI was not done in any of the cases in our series. The patients were assessed for the surgical procedure. All procedures were performed under regional anesthesia under antibiotic cover. A 2.5cm skin incision was made at the junction of two lines which was a horizontal line drawn from the medial side of the thumb and a vertical line which was started from the medial part of the fourth metacarpal extending proximally. The subcutaneous tissues and fat was mobilized and the transverse ligament was visualized. A curved scissor was used to release the ligament taking care to avoid injuring the median nerve. The V which is at the junction of the thenar and hypothenar muscles marked the distal aspect of the release. The wrist was put through its range of motion to ensure smooth gliding of the nerve and the tendons. Skin closure was done with interrupted sutures and a sterile dressing was done. Antibiotics were given for three days in the postoperative period and regular wound inspections were performed. The wrist was placed in a splint which was removed intermittently and tendon gliding exercises were started. Sutures were removed on day 12. The patients were followed up at regular intervals where the functional assessment was performed with the DASH and GSS scores. The data was collected and analyzed with IBM SPSS software. A comparison of categorical variables was done with the Chi square test. A P value of < 0.05 was taken to be of statistical significance.

Results

The average age of the patients in our series was 42.4 years (33-54 years) and the left wrist was more affected more as seen in 18 patients. (Figure 1) There was a female preponderance in our study and the duration of symptoms ranged from 3 to 18 months. The associated factors seen were hypothyroidism in 12 patients, rheumatoid arthritis in 7, diabetes mellitus in 6 and obesity in 5 patients. The mean duration of surgery was 36 minutes (22-48 minutes) and the average blood loss was 20.2ml(18-28ml). The preoperative DASH score was 47.8±4.72 which improved to 10.8±2.64 which was statistically significant with P=0.015. The pre-operative GSS score was 8±2.3, which improved to 1.2±0.26 in the postoperative period, which was statistically significant

with $P < 0.001$. (Table 1) Two patients had decreased grip strength which improved with strengthening exercises w,hile three patients had mild pain in the postoperative period ,which resolved with a course of analgesics. No wound related complications were seen in this study and we had no cases of iatrogenic injury to the median nerve or to the flexor tendons. None of the patients required a second procedure and none of the patients lost to follow up.

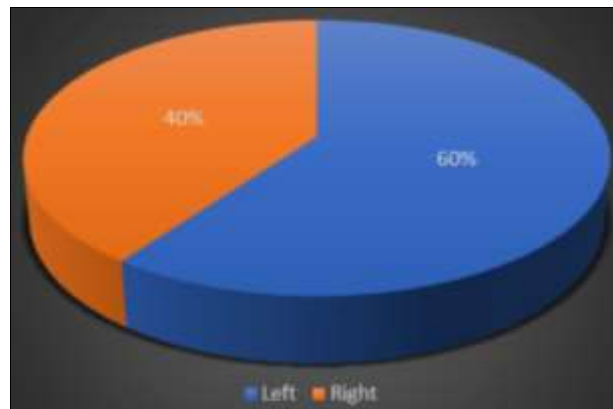


Fig 1: Side dominance

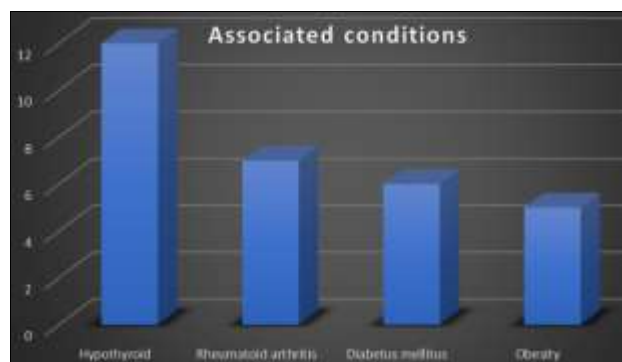


Fig 2: Associated conditions

Table 1: Functional scoring

S. No	Scoring system	Score		P value
		Pre-op	Post-op	
1	GSS	8±2.3	1.2±0.26	<0.001
2	DASH	47.8±4.72	10.8±2.64	0.015

GSS-Global system score. DASH-Disabilities of arm, shoulder and hand

Discussion

CTS (Carpal tunnel syndrome) is characterised by compression of the median nerve at the wrist joint and is quite commonly seen in orthopaedic practice. It is more commonly seen in females than males and can often be bilateral, affecting both wrist joints. The patients present with tingling and numbness in the radial fingers supplied by the median nerve, an increase in symptoms on wrist flexion, pain more at night, which can wake up the patient from sleep, weakness of grip and clumsiness. Treatment would aim to provide symptomatic relief and restore the hand's normal function and should also be cost-effective for the patient. It should provide an aesthetic hand with a good cosmetic appearance. The procedure should be coupled with active physiotherapy to ensure a rapid rehabilitation [10]. Conservative management can be done in the early stages of the disease when the symptoms are minimal with no neurological deficits. An extension brace can be applied along with physiotherapy and

exercises but can prove to be ineffective in patients with long standing symptoms and established carpal tunnel syndrome. Corticosteroids can provide short term symptomatic relief, but patients with neurological deficits and muscle atrophy with a decreased grip strength would not benefit from it [11, 12]. The gold standard procedure in the treatment of established carpal tunnel syndrome would be a carpal tunnel release with the division of the transverse carpal ligament. The carpal release could be an endoscopic or an open release with a regular or a mini incision. Endoscopic release of the carpal tunnel results in a smaller scar with decreased postoperative pain with decreased incidence of wound related complications facilitating an early return to work related activities and daily living but its associated with a steep learning curve and a higher incidence of iatrogenic median nerve injury [13]. Open release performed with mini incisions can also be associated with similar complications. Open carpal release with a conventional incision would facilitate decompression of the median nerve under direct operative vision so that a complete release is performed without injuring the median nerve. It increases the size of the tunnel while decreasing the pressure within it [14, 15]. In our series of patients, we used a standard 2.5cm incision and sectioning of the transverse carpal ligament was done under direct vision in order to avoid injury to the carpal tunnel contents. Adequate decompression was also confirmed under direct vision after ensuring free gliding of the median nerve and the flexor tendons within the tunnel. In Mardanpour K, *et al.* study of 188 patients the average age of the patients was 40±29.5 years with a follow up of 18.6±9.3 months. They had 2% of patients who complained of residual pain while 1an % had iatrogenic injury to the median nerve. Grip strength was reduced in 5 patients. The pre operative GSS was observed to be 7±2.5 while it was 1.3±0.34 in the postoperative period which was statistically significant with $P < 0.002$. [16] Khan *et al.* studied 100 patients with an average age of 39.29±3.99 years and reported a mean duration of symptoms as 5 to 24 months. In the postoperative period, 12 patients had mild residual pain at 1 month but became pain free at the third month follow up. Three of the patients experienced prolonged residual symptoms and were considered for reintervention. The patients had a 97% functional satisfaction at 6 months with no wound related complications were reported [17]. Badger *et al* studied 47 patients with an average age of 59 years and a 17 month follow up. The preoperative symptom severity score was 3.41±0.72 while it was 1.85±0.81 statistically significant with $P < 0.001$. Two patients complained of residual pain but did not require a second intervention and no wound related complications were reported [18]. In our series following release, there was a good symptomatic relief with resolution of tingling and numbness in all patients. The nocturnal pain was only mild or had reduced completely in the first week followed by complete resolution of pain. There was a good increase in grip strength in most of the patients and they were started on thenar muscle strengthening exercises. The preoperative DASH score was 47.8±4.72 which improved to 10.8±2.64 whstatistically significant with $P=0.015$. The pre surgery GSS score was 8±2.3 which improved to 1.2±0.26 in the postoperative ,, which was statistically significant with $P < 0.001$. Three patients complained of residual pain, which settled down after a few weeks and two patients had decreased grip strength which improved with strengthening exercises. No wound related complications were seen in our study. All wounds healed well with no scar contractures. No cases of incomplete

release or iatrogenic median nerve injury or flexor tendon injury were encountered. The patients were quite happy with the final functional outcome achieved and were able to return to work related activities and daily living to the best possible extent. The possible drawbacksof of our study would be a relatively small study sample and a short follow-up period p. A longer follow up would be ideal to assess the changes in functional outcometheover a long term with regards to activities of work and daily living.

Conclusion

Open surgical release of the carpal tunnel facithe the release of the transverse carpal ligament under direct visualization. Hence, complications such as iatrogenic median nerve, injury, which can be avoided with minimally invasive methods avoided. It offers good resolution of symptoms to the patients and provides a good functional outcome , enabling a quick return to work and daily living activities

Declaration

Funding: No funding was received

Conflict of interest: There are no potential conflicts of interest.

Ethical approval: This study was performed following ethical committee approval.

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