Original Article

Effectiveness of mini-open incision surgical release for carpal tunnel syndrome

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Objective: To assess the effectiveness of the single-mini incision technique in the management of carpal tunnel syndrome using visual analog scale (VAS) for pain assessment and Boston CTS Questionnaire (BCTSQ) in terms of clinical outcome.

Methodology: This prospective observational study was conducted at the Rajput General and Medicare hospital from January 2018 to January 2020. Patients ≥20 years with CTS were included after informed consent for single mini-incision procedures. Those with rheumatoid arthritis, mass lesion, cervical myelopathies, myopathies and other associated entrapment neuropathies were excluded. VAS was used to assess patient pain after one-month and three-month post-procedure. The outcome in terms of severity and functionality was evaluated by the BCTSQ and patients were graded.

Results: Out of 105 patients, 14 were (13.3%) males and 91 (86.9%) females with a mean age of 47±12.9 years. The mean VAS was 8.06±0.73 before the procedure which improved to 3.43±1.1 four weeks and <3 three-months after the procedure. Three months after the procedure, none of the patients had severe symptoms or severe difficulty in performing their activities, showing good recovery.

Conclusion: Single mini-incision technique is effective in the surgical management of carpal tunnel syndrome. It promises early return of functionality and little to no post-procedure pain. (Rawal Med J 202;45:652-655).

Keywords: Carpal tunnel syndrome, compression neuropathy, mini incision release.

INTRODUCTION

Carpal Tunnel Syndrome (CTS) is a fairly common peripheral neuropathy, caused by median nerve compression at the wrist level. Its prevalence is 4% in the overall population with a slightly higher prevalence in women (3-5.6% vs. 0.6-2.8%).[1] In as many as half of the cases, the pathophysiology remains unclear and the origin may be poorly defined. In other cases, it is associated with medical comorbidities such as diabetes mellitus, rheumatoid arthritis, hypothyroidism, obesity, trauma, and pregnancy.[2,3] As thenar muscle atrophy ensues, loss of sensation and weakness is seen. Pain is a common symptom.

CTS may be managed conservatively at first with local corticosteroid injections, splints, and other techniques.[3] Surgical management consists of two major types of procedures endoscopic and non-endoscopic.[4] Non-endoscopic procedures include standard open release (with a 5cm incision) and mini-incision release (1-3cm). As compared to the standard open approach, minimally invasive procedures have demonstrated better outcomes in terms of complications, patient satisfaction, symptom improvement, grasp strength, results of Tinel's and Phalen's, and time to regain full functionality of the hand.[5,7] This study aimed to assess the effectiveness of the single-mini incision technique in the management of CTS.

METHODOLOGY

This prospective observational study was conducted at the Rajput General Hospital and Medicare hospital, Karachi, Pakistan from January 2018 to January 2020. The study was approved by the institutional review board. The sample size was calculated using the World Health Organization (WHO) software taking 22.4%, effectiveness of the procedure at confidence interval 95%, and margin of error 8%.[8] Patients aged 20 years and above with CTS, admitted after informed consent for single mini-incision procedures were included. Patients

with rheumatoid arthritis, thenar wasting, mass lesion, cervical myelopathies, myopathies, and other associated entrapment neuropathies were excluded.

The standard diagnostic criteria of CTS included sensory loss in the median nerve distribution, nocturnal numbness, weakness or atrophy of thenar muscles, Tinel's sign and Phalen's maneuver, presence of exacerbating (like driving and strenuous hand use) and relieving factors (splinting or steroid injections), and coexisting disorders (pregnancy, diabetes, hypothyroidism).[3,9] CTS was diagnosed clinically based on these signs and symptoms correlated with nerve conduction studies.

All procedures were performed as per standard practice after providing local anesthesia under tourniquet. A plane was made superficial to the transverse carpal ligament followed by cutting of that ligament. Complete decompression was ensured, hemostasis secured and local anesthetic (0.5% Bupivacaine) was then injected before skin closure.

VAS was used to assess the pain before the procedure which assesses pain on a ten-point scale (0-10).[10] The outcome in terms of severity and functionality was evaluated by the Boston Carpal Tunnel Syndrome Questionnaire. It comprises two subscales, a symptom severity scale, and a functional status scale. The symptom severity scale has 11 components scored from 1 (mildest) to 5 points (most severe). Based on these scores, symptom severity was categorized into: No symptoms (total of 11), mild (total: 12-22), moderate (23-33), severe (total 34-44), and very severe (45-55). Similarly, the functional status scale has eight questions scored from 1 point (no difficulty with activity) to 5 points (cannot perform the activity at all). Combined scores were then grouped as no difficulty (total of 8), mild difficulty (total: 9-16), moderate difficulty (17-24), severe difficulty (total 25-32), and very severe difficulty (33-40).[11]

Statistical Analysis: SPSS version 22 was used to analyze data. Mean and standard deviation (SD) were calculated for numerical data including age, and pre and post-procedure VAS scores. A Chi-square test was used to assess the changes in outcome after the procedure. $p<0.05$ was considered significant.

RESULTS

Out of 114 patients, 14 (13.3%) were males and 91 (86.9%) females. The mean age was 47±12.9 years while 69 (65.7%) were age 40 years or above. Patient characteristics are shown in Table 1. Mean duration of the procedure was 16.4±3.8 minutes. Mean VAS was 8.06±0.73 before the procedure which improved to 3.43±1.1 four weeks after the procedure. At a three-month follow-up, VAS scores were <3 (2.4±0.3) for all patients except for 2 (1.9%).

Table 1. Patient characteristics (n=105).

Characteristic	Number(%)
Male : Female	14 : 91 → 1 : 6.5
Mean age in years	47 ± 12.9
Medical comorbidities	
Diabetes mellitus	19 (18.1%)
Hypothyroidism	7 (6.7%)
Obesity	7 (6.7%)
Trauma	2 (1.9%)
No associated condition (idiopathic)	70 (66.7%)
CTS	
Right	79 (75.2%)
Left	21 (20.0%)
Bilateral	5 (4.7%)
Positive Tinnel Sign	98 (93.3%)
Positive Phalen Sign	103 (98.1%)
Signs and symptoms	
Night pain	95 (90.5%)
Daytime pain	54 (51.4%)
Hand stiffness	32 (30.5%)
Wrist pain	88 (83.8%)
Numbness	5 (4.7%)
Tingling	12 (11.4%)
Muscle weakness	7 (6.7%)

Table 2. Symptom severity and functional status before and three months after the procedure (n=105).

	No symptoms/ difficulty	Mild	Moderate	Severe	P-value
BCTSQ symptoms severity					
Preoperative	10 (9.5%)	76 (72.4%)	16 (15.2%)	3 (2.8%)	0.000031
Postoperative	30 (28.5%)	75 (71.4%)	0 (%)	0 (%)	
BCTSQ functional status					
Preoperative	30 (28.5%)	75 (71.4%)	0 (%)	0 (%)	0.061
Postoperative	51 (48.6%)	44 (41.9%)	9 (8.6%)	1 (0.9%)	

Three months after the procedure, none of the patients had severe symptoms, while only one had severe difficulty in performing their activities, showing good recovery. Statistically, the results of symptoms severity were significant ($p<0.001$) (Table 2).

DISCUSSION

Limited incision techniques were first described in the 1990s.[4] These procedures have shown comparable postoperative pain, earlier recovery and return to work, improved grip strength, and reduced complication rate.[12,13] These are easier to perform and safer procedures as compared to endoscopic ones and do not require any special equipment.[14] The technique requires limited dissection and little interruption of tissue planes as compared to the open method and doesn't divide the subcutaneous tissue or the palmar fascia as much as the open method does.[15]

Limited visualization and trans-ligamentous variation may increase the risk of nerve damage in limited incision techniques. However, they are skill-dependent and with good instrument handling and background knowledge of anatomy, they may be prevented.[4] In a retrospective cohort, patient-rated symptom severity and functional outcomes were not significantly different in open versus mini-incision technique.[16] Job type, psychological factors, anxious response to pain, and catastrophic thinking have been determined to impact functionality after limited incision techniques.[17]

Limited incisions have shown an earlier return to work (17 days as compared to 22 days with the open procedure), hence, the technique may be preferred in people who wish an early return to work.[18] In the 1950s, Phalen first described CTS.[19] Since then, most of the literature has documented female preponderance and a higher rate of incidence at 55 to 60 years of age.[20] Our results showed a higher ratio of females (6.5:1) and more patients ≥40 years of age (65.7%). It has a varied incidence with 1–3.5 cases per 100000 person-years cases reported from the West.[21] In the United Kingdom, 43–74 per 100,000 per year require surgical decompression for CTS.[22]

In the local literature, there have been reports of two mini-incision technique for CTS.[23] In one retrospective study, the mean operating time was 12-12.5 minutes which was comparable to ours.[24] Superficial infection was a common post-procedure complication. To further evaluate its effectiveness, comparative studies must be conducted with other surgical techniques and patients should be followed for a longer duration to assess the risk of long term complications.

CONCLUSION

The single mini-incision technique is effective in the surgical management of carpal tunnel syndrome. It can be utilized as a resource-efficient procedure for these patients. It promises early return functionality and little to no post-procedure pain.

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REFERENCES

1. Geere J, Chester R, Kale S, Jerosch-Herold C. Power grip, pinch grip, manual muscle testing - which should be assessed as a motor outcome after carpal tunnel decompression. A systematic review. BMC Musculoskelet Disord. 2007;8:11-4.
2. Awan AS, Khan A, Afridi SA, Khan IU, Bhatti SN, Ahmed E, et al. Early response of local steroid injection versus mini incision technique in treatment of carpal tunnel syndrome. J Ayub Med Coll Abbottabad. 2015;27:192-6.
3. 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;15:1273-4.
4. Gaba S, Bhogesha S, Singh O. Limited incision carpal tunnel release. Indian J Orthop. 2017;51:192-8.
5. Aslani HR, Alizadeh K, Eajazi A, Karimi A, Karimi MH, Zaferani Z, et al. Comparison of carpal tunnel release with three different techniques. Clin Neurol Neurosurg. 2012;114:965-8.
6. Elsharif M, Papanna M, Helm R. Long-term follow up outcome results of Knife light carpal tunnel release and conventional open release following a departmental randomized controlled trial. A prospective study. Polish Orthop Traumatol. 2014;79:67-7.
7. Tarallo M, Fino P, Sorvillo V, Parisi P, Scuderi N. Comparative analysis between minimal access versus traditional accesses in carpal tunnel syndrome: a perspective randomized study. J Plast Reconstr Aesthet Surg. 2014;67:237-3.
8. Padua L, Padua R, Aprile, Tonali P. Italian multicenter study of carpal tunnel syndrome. Differences in the clinical and neurophysiological features between male and female patients. J Hand Surg Br. 1999;24:579-2.
9. Graham B, Regehr G, Naglie G, Wright JG. Development and validation of diagnostic criteria for carpal tunnel syndrome. J Hand Surg Am. 2006;31:919-4.
10. Okamura A, Meirelles LM, Fernandes CH, Raduan Neto J, Dos Santos JBG, Faloppa F. Evaluation of patients with carpal tunnel syndrome treated by endoscopic technique. Acta Ortop Bras. 2014;22:29-3.
11. Levine DW, Simmons BP, Koris MJ, Daltroy LH, Hohl GG, Fossel AH, et al. A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. J Bone Joint Surg Am. 1993;75:1585-2.
12. Cellocco P, Rossi C, Bizzarri F, Patrizio L, Costanzo G. Mini-open blind procedure versus limited open technique for carpal tunnel release: a 30-month follow-up study. J Hand Surg Am. 2005;30:493-9.
13. Wong KC, Hung LK, Ho PC, Wong JMW. Carpal tunnel release. A prospective, randomized study of endoscopic versus limited-open methods. J Bone Joint Surg Br. 2003;85:863-8.
14. Lee WP, Strickland JW. Safe carpal tunnel release via a limited palmar incision. Plast Reconstr Surg. 1998;101:418-6.
15. Abdel-Moneim H, Said A-B. Double mini incision in the treatment of carpal tunnel syndrome. Egypt Orthop J. 2016;51:90-3.
16. Murthy PG, Goljan P, Mendez G, Jacoby SM, Shin EK, Osterman AL. Mini-open versus extended open release for severe carpal tunnel syndrome. Hand (NY). 2015;10:34-9.
17. Cowan J, Makanji H, Mudgal C, Jupiter J, Ring D. Determinants of return to work after carpal tunnel release. J Hand Surg Am. 2012;37:18-7.
18. Gülşen I, Ak H, Evcılı G, Balbaloglu O, Sösüncü E. A Retrospective Comparison of Conventional versus Transverse Mini-Incision Technique for Carpal Tunnel Release. ISRN Neurol. 2013;2013:721-8.
19. Phalen GS. The carpal-tunnel syndrome. Seventeen years' experience in diagnosis and treatment of six hundred fifty-four hands. J Bone Joint Surg Am. 1966;48:211-8.
20. Mondelli M, Giannini F, Giacchi M. Carpal tunnel syndrome incidence in a general population. Neurology. 2002;58:289-4.
21. Cranford CS, Ho JY, Kalainov DM, Hartigan BJ. Carpal tunnel syndrome. J Am Acad Orthop Surg. 2007;15:537-8.
22. Burke FD, Ellis J, McKenna H, Bradley MJ. Primary care management of carpal tunnel syndrome. Postgrad Med J. 2003;79:433-7.
23. Hamed S, Harfoushi F. Carpal tunnel release via mini-open wrist crease incision: procedure and results of four years clinical experience. Pak J Med Sci. 2006;22:367-2.
24. Hashmi PM, Rashid RH, Ali M, Mohib Y, Baloch N. Two incision mini open carpal tunnel release- a minimally invasive alternative to endoscopic release. J Pak Med Assoc. 2016;66:93-5.