The Comparison between Limited Open Carpal Tunnel Release Using Direct Vision and Tunneling Technique and Standard Open Carpal Tunnel Release: A Randomized Controlled Trial Study

Sorasak Suppaphol MD*, Patarawan Worathanarat MD*,
Viroj Kawinwongkovit MD*, Preecha Pittayawutwinit MD**

** Department of Orthopedics, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*
*** Department of Orthopedics, Burapha University Hospital, Burapha University, Chonburi, Thailand*

Objective: *To compare the operative outcome of carpal tunnel release between limited open carpal tunnel release using direct vision and tunneling technique (group A) with standard open carpal tunnel release (group B).*
Material and Method: *Twenty-eight patients were enrolled in the present study. A single blind randomized control trial study was conducted to compare the postoperative results between group A and B. The study parameters were Levine's symptom severity and functional score, grip and pinch strength, and average two-point discrimination.*
Results: *The postoperative results between two groups were comparable with no statistical significance. Only grip strength at three months follow up was significantly greater in group A than in group B.*
Conclusion: *The limited open carpal tunnel release in the present study is effective comparable to the standard open carpal tunnel release. The others advantage of this technique are better cosmesis and improvement in grip strength at the three months postoperative period.*

Keywords: *Limited open carpal tunnel release, Standard open carpal tunnel release, Randomized controlled trial study*

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Standard open carpal tunnel release is the accepted technique for decompression of the median nerve in carpal tunnel syndrome[1]. The carpal tunnel can be safely explored especially in cases with aberrant motor branch of median nerve[2]. However, there are some problems with this technique, such as postoperative scar pain, prolonged time to return to work and poor skin cosmetic. The limited open carpal tunnel release technique has been reported to be safe, reliable, and effective to decompress the carpal tunnel with less postoperative scar pain and good skin cosmetic[3,4]. There were many techniques of limited open carpal tunnel release. Most of the techniques use the specialized dilator and cutting instrument[5-7]. The authors developed the modified technique using direct vision and tunneling technique to decompress the carpal tunnel. This technique requires no special instruments and is safe to perform. The objective of the present study was to compare the results between this technique and standard open carpal tunnel release technique.

Correspondence to:
Suppaphol S, Department of Orthopedics, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand.
Phone: 0-2201-1589, Fax: 0-2201-1599
E-mail: suppaphol@gmail.com

Material and Method

A single-blinded randomized controlled trial study was conducted at the Orthopedic clinic, Department of Orthopedics, Faculty of Medicine, Ramathibodi Hospital. Two groups were compared. The first group was limited open carpal tunnel release, and the other was standard open carpal tunnel release. The eligible participants were 1) clinically diagnosed as carpal tunnel syndrome and was confirmed by electrodiagnosis, and 2) had moderate to severe degree that required operative treatment. The exclusion criteria were 1) patients who refused to participate in the present study 2) patients who had secondary carpal tunnel syndrome from any causes. The present study was approved by the institutional reviewed board of Ramathibodi Hospital, Mahidol University.

The blocked randomization was performed by using computer software generation. Patients were randomized into two groups. Group A was limited open carpal tunnel release, and group B was standard open carpal tunnel release. The concealed envelops were opened at the operating room, and the operative technique was determined at that time.

Method of evaluation

The enrolled patient's data were collected at the time of first visit including age, sex, handedness, duration of symptom, Levine's symptom severity score (LvS score), Levine's functional score (LvF score), average two point discrimination, grip and pinch strength.

The Thai version of Levine's symptom severity score (LvS score) and Levine's functional score (LvF) were used[8,9]. The average two point discrimination measured at tip of thumb, index, middle and radial half of the ring finger were averaged by using arithmetic means. The grip and pinch strength were recorded by the using the Jamar dynamometer. The value was calculated from the means of three repeated measurements. The patients filled the questionnaire by themselves. The objective evaluation such as grip strength, average two point discrimination, etc. were collected by one of the authors who did not know which group the patient was belonged to. This blinding technique was done by concealing the wound with an elastic bandage.

Statistical analysis

The following observed parameters were used in the statistical analysis of differences between the groups: average two point discrimination, Levine's symptom severity score, Levine's functional score, duration of symptom, grip strength, pinch strength, wound's length, and operative time were collected. The comparison of categorical data between groups was using Chi-square or Fisher's exact test. The comparison of continuous data between groups was analyzed by using unpaired-t-test. All statistical analysis was done by using R-statistical software. The significant difference was defined if p-value < 0.05.

Surgical technique

Limited open carpal tunnel release, using direct vision and tunneling technique

After infiltration of local anesthetic agent, the estimated 1.5 cm incision is made over the distal edge of transverse carpal ligament. The distal edge can be easily palpated by using downward pressure. The junction between the soft and hard consistency is the distal edge of the ligament. The authors used the

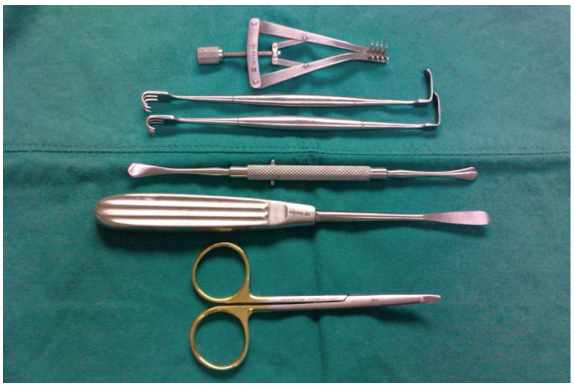

Fig. 1 Demonstrate instruments used in limited open carpal tunnel release (LOCTR)

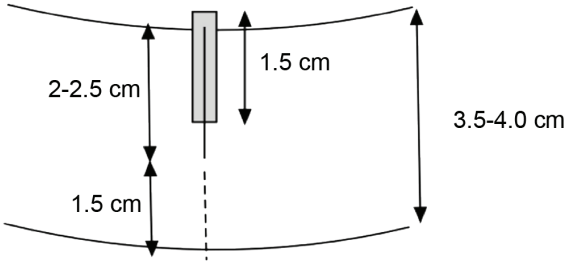

Fig. 2 Demonstrate cutting diagram: the 1.5 cm wound incision is located at distal edge of transverse carpal ligament

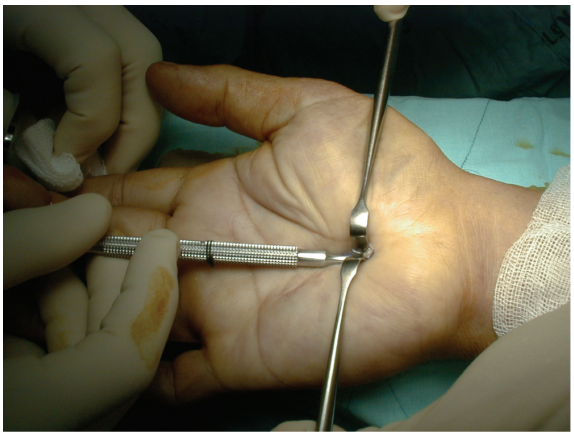

Fig. 3 Demonstrate the surgical wound and the use of blunt tip tissue separator to create the cutting tunnel

landmark of third web space for placing the incision. The subcutaneous fat and palmar aponeurosis are separated and retracted. The distal edge is identified. The ligament is cut using no.15 blade in longitudinal fashion, about 1.5 cm in length. After cutting the distal edge, the blunt tip tissue separator is inserted into the carpal tunnel. It is advanced directly into the tunnel until its tip is rested at about 1.5 cm proximal to wrist crease. The separator was left in the tunnel for a while, and the plane between the transverse carpal ligament and palmar aponeurosis is developed in the same position. The blunt tip metzenbaum is used to cut the transverse carpal ligament. By using the retractor to elevate the proximal skin, the transverse carpal ligament can be seen directly for about its entire distal two-third. The ligament is cut under direct vision until the proximal one-third of ligament is reached. After that, the cutting is done in blinded but controlled fashion. The distance between the tips of metzenbaum was kept as minimal as possible, and the cutting was performed in oblique fashion. There must be no obstruction in the tunnels, otherwise the procedure is aborted and converted to open carpal tunnel release.

Results

Twenty-eight patients were allocated into group A (Limited open carpal tunnel release) and group B (Standard open carpal tunnel release). Two patients had bilateral carpal tunnel syndrome. One patient was allocated to group A and B, the other patient was allocated to group B on both hands. The patients' demographic and preoperative data are shown in Table 1. The demographic data of both groups were comparable. The severity of disease that indicated by Levine's symptom severity score (LvS) and Levine's functional score (LvF) were not significantly different between both groups. The average LvS of group A was 3.2 and LvS of group B was 2.87 (p-value = 0.3186). The average LvF of group A was 2.946 and LvF of group B was 2.956 (p-value = 0.9693). Concerning the chronicity of disease, duration of symptom was recorded in both groups. The average duration of symptoms in group A and B were 15 months and 14.4 months, respectively. (p-value = 0.7121).

None of the parameters was significantly different between the two groups at one-month follow up. At three-months follow up, only grip strength was significantly greater in the LOCTR group. (Table 2,3) The patients in group A had significantly shorter wound length than group B ($p < 0.05$). The operative time between both groups was comparable ($p = 0.691$) (Table 4).

Discussion

Concerning the surgical treatment of carpal tunnel syndrome, the standard open carpal tunnel release is still the gold standard of treatment with

Table 1. Preopeative parameters between two groups

	Group A (15)	Group B (15)	p-value
Age	53.33	53.13	0.9476
Sex (M/F)	1/14	2/13	1
Duration of symptoms (months)	15.0	14.4	0.7121
LvS	3.2	2.87	0.3186
LvF	2.946	2.956	0.9693
Average 2-point discrimination (mm)	3.28	3.04	0.28

Table 2. Postoperative parameters at one month follow-up

	Group A (15)	Group B (15)	p-value
LvS 1 month	1.76 ± 0.33	1.88 ± 0.42	0.372
LvF 1 month	2.07 ± 0.54	2.12 ± 0.59	0.823
Grip strength (pounds)	52.00 ± 6.49	50.30 ± 6.11	0.475
Pinch strength (pounds)	9.87 ± 1.64	9.93 ± 0.96	0.890
Average 2 point discrimination (mm)	3.18 ± 0.6	3.07 ± 0.62	0.600

Table 3. Postoperative parameters at three months follow-up

	Group A (15)	Group B (15)	p-value
LvS 3 months	1.17 ± 0.17	1.23 ± 1.95	0.380
LvF 3 months	1.28 ± 0.31	1.45 ± 0.50	0.290
Grip strength (pounds)	62.67 ± 5.62	55.67 ± 6.51	0.004
Pinch strength (pounds)	13.60 ± 1.84	12.47 ± 1.55	0.790
Average 2 point discrimination (mm)	2.75 ± 0.62	2.63 ± 0.69	0.630

Table 4. Comparison of operative time and wound's length

	Group A (15)	Group B (15)	p-value
Operative time (min)	11.10 ± 2.20	11.40 ± 2.30	0.691
Wound's length (cm)	1.63 ± 0.13	2.90 ± 0.32	<0.050

reported complete relief of symptoms in over 70% of patients[1]. However, the open carpal tunnel release was usually associated with more postoperative scar pain and prolonged time to return to work[3,4,6]. The arthroscopic carpal tunnel release had been introduced to address these problems. Unfortunately, the reported complication after arthroscopic carpal tunnel release was quite high compared to standard open carpal tunnel release[10,11]. These include incomplete release, injury to neurovascular structures. The limited open carpal tunnel release popularized by J Strickland was introduced[6]. Several reports comparing limited open carpal tunnel release with endoscopic carpal tunnel release showed comparable results especially in terms of lessening postoperative scar pain and time to return to work[6,12,13]. The reported complication after limited open carpal tunnel release is comparable to standard open carpal tunnel release[6,13,14]. The decrease in postoperative scar pain in limited open carpal tunnel release can be explained by less soft tissue violation and preservation of skin at the proximal palm where there are more sensory receptors[14]. Most techniques of limited open carpal tunnel release use special instruments such as knife-light, Strickland's instruments[5-7]. The limited open technique in the present study modified from Bromley GS used no special instruments[15] and the authors modified some steps in management of surrounding soft tissue and cutting technique, as described in operative technique. The primary outcome of the present study is functional outcome and symptom severity outcome in early postoperative periods. The results showed no significant difference between the two groups in terms of both aspects. The grip strength was greater in the limited open carpal tunnel release group at 3 months postoperatively. This can be explained by a decrease in postoperative scar tenderness that may interfere when measuring grip strength.

These results favor limited open carpal tunnel release in the short-term grip strength recovery. This may affect the time to return to work indirectly. However, the functional and symptom severity score did not differ significantly between both groups. Therefore, the standard open carpal tunnel release is still the gold standard of treatment in carpal tunnel syndrome. The only benefit of limited open carpal tunnel release from the present study is an improvement in grip strength in the early postoperative period and improvement in skin's cosmesis. Concerning complications, the limited open carpal tunnel release with the present technique has comparable complication to the standard open carpal tunnel release. In summary, the LOCTR with this technique can be performed in a general operating room with simple instruments. The result is comparable to gold standard without any increase in complication. The patient will have the benefit of improvement of grip strength in early postoperative period and improvement of skin's cosmesis.

Potential conflicts of interest

None.

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การศึกษาเปรียบเทียบผลการรักษาโรคพังผืดทับเส้นประสาทข้อมือระหว่างวิธีผ่าตัดแบบเปิดแผลจำกัดและวิธีมาตรฐาน

สรศักดิ์ ศุภผล, ภัทรวัณย์ วรธนารัตน์, วิโรจน์ กวินวงศ์โกวิท, ปรีชา พิทยาวุธวินิจ

วัตถุประสงค์: *เพื่อศึกษาเปรียบเทียบผลการรักษาโรคพังผืดทับเส้นประสาทข้อมือด้วยวิธีการผ่าตัดแบบเปิดแผลจำกัดและวิธีมาตรฐาน*

วัสดุและวิธีการ: *การศึกษานี้เป็นการศึกษาเชิงทดลองโดยการสุ่มผู้ป่วยจำนวนทั้งสิ้น 28 ราย ออกเป็นสองกลุ่ม โดยกลุ่มแรกจะเป็นผู้ป่วยที่จะได้รับการผ่าตัดโดยวิธีแบบเปิดแผลจำกัด ส่วนกลุ่มที่สองจะได้รับการรักษาแบบวิธีมาตรฐาน โดยใช้คะแนนของลีวีนซึ่งประกอบไปด้วย คะแนนที่เกี่ยวกับอาการผู้ป่วย และคะแนนที่เกี่ยวกับการใช้งานมือของผู้ป่วยเป็นผลลัพธ์การศึกษาหลัก นอกจากนี้ยังใช้ความแรงในการกำมือและในการหนีบนิ้ว และค่าเฉลี่ยสองจุดในการรับความรู้สึกที่นิ้วมือเป็นผลลัพธ์รอง*

ผลการศึกษา: *พบว่าไม่มีความแตกต่างของผลลัพธ์ระหว่างวิธีทั้งสองวิธีอย่างมีนัยสำคัญทางสถิติ ยกเว้นความแรงในการกำมือที่สามเดือนหลังผ่าตัด พบว่ากลุ่มการผ่าตัดแบบเปิดแผลจำกัดให้ค่าความแรงในการกำมือมากกว่าอย่างมีนัยสำคัญ*

สรุป: *การผ่าตัดรักษาโรคพังผืดทับเส้นประสาทข้อมือแบบเปิดแผลจำกัด ให้ผลการรักษาได้เท่ากับวิธีผ่าตัดแบบมาตรฐาน นอกจากนี้วิธีการเปิดแผลจำกัดยังมีข้อดีตรงที่ความสวยงามของแผลผ่าตัดซึ่งจะมีความยาวที่น้อยกว่าและผู้ป่วยสามารถใช้แรงในการกำมือได้มากกว่าในช่วงเวลาสามเดือนหลังจากการผ่าตัด*