

Endoscopic carpal tunnel release surgery: retrospective study of 390 consecutive cases

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Summary

Endoscopic carpal tunnel release (ECTR) surgery was developed by Okutsu and Chow in 1989. Many reports indicated that the endoscopic technique reduces postoperative morbidity with minimal incision, minimal pain and scarring, a shortened recovery period and high level of patient satisfaction. To evaluate these reports, a retrospective study was conducted with 390 procedures of two-portal Chow technique for idiopathic carpal tunnel syndrome. Follow-up was performed at 1, 3 and 6 months and overall results were backed up by telephone questionnaire (Health Outcomes Carpal Tunnel Questionnaire, Health Outcomes, Bloomington, MN, USA). Results were favourable in 98% and 2% unfavorable for persistent pain. Rate of satisfaction of the patients was 90%. Average time of patient's return to work was 20 days. Eleven procedures (2.8%) were converted to open release. There was one case (0.2%) of incompleting section of the perineurium due to failure of endoscopic visualization of the ligament. In this case the procedure was converted to open and was completed with perineurium suture. In six cases (1.5%) there were injury to superficial palmar arch. During the follow-up period there were no recurrences and no re-exploration. The mean preoperatively obtainable distal motor latency (DML) and sensory conduction velocity (SCV) values were 6.7 m/s and 29.2 m/s, respectively. The mean DML and SVC values at final follow-up were 3.8 msec and 42.3 m/s, respectively. In conclusion, ECTR can be used in the carpal tunnel syndrome and is a reliable alternative to the open procedure with excellent self-report of patient satisfaction. Reduced recovery period with minimal tissue violation and incisional pain can be expected.

Keywords: Carpal tunnel syndrome; endoscopic release; electromyographic evaluation.

Introduction

Endoscopic carpal tunnel release (ECTR) was introduced by Okutsu in 1987 [21]. He developed a single-portal technique with a system called "The Universal Subcutaneous Endoscopic System". In 1989, James Chow first reported the use of two incisions (Dual-Portal Technique) to dissect the transverse carpal ligament (TCL) endoscopically [12]. This tech-

nique had significant success in the following years and many reports described modifications in instrumentation and surgical procedures. Several controversies arose between the proponents of open and endoscopic surgery. Certain disadvantages have been associated with open transaction, including sensitive and scar tenderness, muscular injuries, hand weakness, anterior displacement of the median nerve and prolonged recovery time [4, 16, 18, 19, 22, 27]. In recent years, a tendency has developed to use minimal open surgery to reduce postoperative complications [1, 3, 7, 9, 12, 18, 25]. The proponents of the endoscopic release indicate patient satisfaction as one of the most important parameters in the evaluation of the surgical results. Other benefits include: minimal incision, less incisional postoperative pain, better healing, shortened recovery period and accelerated return to work [4, 6, 9, 11, 13, 15, 16, 18, 23]. However, controversy still exists between supporters of the open vs the endoscopic technique.

This paper reports the overall results and complications of a retrospective study on ECTR with two-portal technique in patients at the Neurosurgical Unit of the General Hospital of Cosenza (Italy).

Materials and methods

This study involved a total of 390 surgical procedures in 356 patients (34 bilateral) performed between July 1999 and December 2002 at our institution. There were 283 females and 73 males. Age range was 20–86 with an average age of 49.8 years. ECTR surgery was performed in patients on the basis of classical clinical symptoms in association with neurophysiological (EMG/NG) findings of carpal tunnel syndrome (CTS). The neurophysiological protocol utilized standard test and segmentary test and/or comparative test if standard test was negative (Fig. 1) [10, 17, 24]. Neurophysiological signs were classified into the following categories:

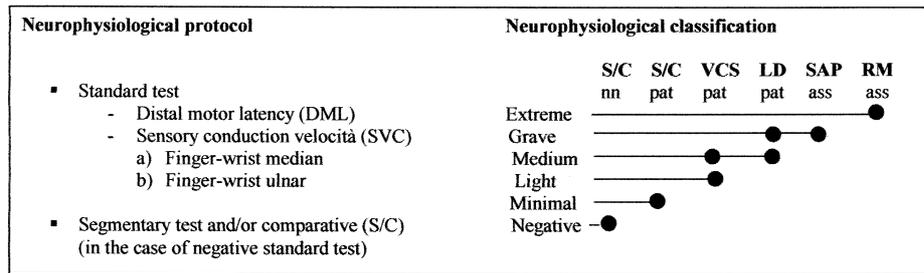


Fig. 1. Neurophysiological protocol

- A) distal motor latency (DML) ≥ 4.3 ;
 B) sensory conduction velocity (SVC) ≤ 28.1 ;
 C) SAP absence;
 D) MAP absence.

The procedure was performed in day-surgery under local anaesthesia using approximately 6–7 cc of bupivacaine hydrochloride 0.5% in association with lidocaine injected along the surgical field. The follow-up was conducted after 1–3 and 6 months whereas the overall results were evaluated after one year with a telephonic interview (modified Health Care Outcomes Institute Carpal Tunnel Questionnaire, Health Outcome Institute, Bloomington, MN, USA) [16]. This questionnaire measures a wide spectrum of variables symptoms pre and post-surgery, co-morbidities, ability to complete activities of daily living and ability to maintain the previous work. In fifty patients a neurophysiological study 6 months after treatment was conducted.

Surgical procedure

The biportal technique was used as described by James Chow in 1989 [12]. The entrance and exit wounds were <1.5 cm (Fig. 2). After introduction of a fenestrated cannula deep into the transverse carpal tunnel, a 4.0 mm 30 degree angle endoscope was introduced. The TCL was transected with a retrograde hook knife under direct visualization. The skin incisions were closed using either #4.0 nylon suture and the wrist was draped in an ice bendage which was removed after eight days. Immediate finger movements were encouraged to perform a range of gentle and active motion exercises.

Results

The average time of surgery was 15 min. and patients were discharged after two hours. Overall results analysis was performed based on the modified questionnaire with 15.8 months average follow-up (range 6–36 months). Sixty-five percent ($n = 230$) answered the questionnaire and 50 patients (14.5%) were studied with neurophysiological examination with a follow-up of 6 months. Clinical results were subdivided into 4 groups (Fig. 3). Ninety-eight percent reported excel-

lent or good results. Only 2% of the patients reported poor results. At final follow-up there were no recurrences or new surgical exploration. Average time to return to daily life activities and work were 10 and 20 days, respectively. In the eleven cases (2.8%) the technique was changed to open because of difficulties with introduction instruments. In these cases persistent pain at the wrist for 6 months was observed. However, at final control the results were satisfactory. Figure 4 demonstrates the level of patient satisfaction: approximately 90% of patients indicated in the questionnaire that they were completely or very satisfied. To informatively compare neurophysiological results hands were classified into three groups: those with DML 4.3–6.0 msec and SVC 32.1–29.2 m/s as group I; those with MLD 6.0–8.5 msec and SVC 29.2–26.2 m/s as group II; those with MLD 8.5/ $>$ msec and SVC 26.2/ $<$ m/s as group III. Postoperatively, 98% of group I and 86% of group II reported excellent results. In group III only 21% reported favourable results



Fig. 2. The procedure of Chow's endoscopic biportal technique after introduction of fenestrated cannula

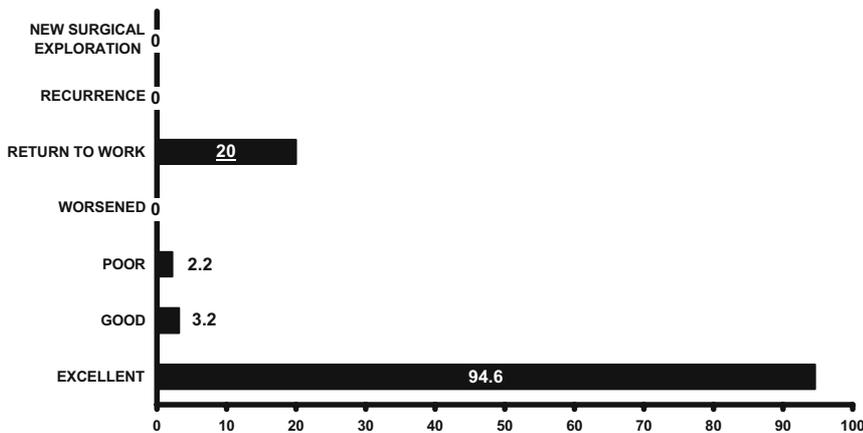


Fig. 3. Results (average follow-up 15,8 months – range 6–30 months). *Excellent* absence of pain in the first week; *Good* absence of pain in the first 20 days; *Poor* persistent paresthesia > 6 months; *Worsened* new sign; 20 days return to work

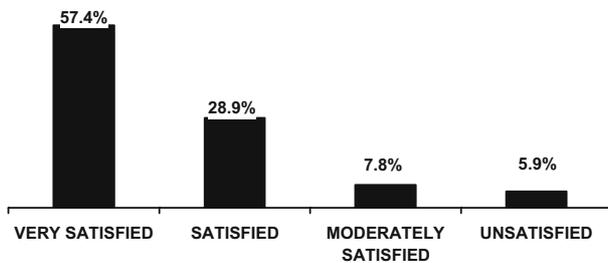


Fig. 4. Graph showing patient satisfaction with results of surgery

(Table 1). Complications encountered in this series included 14 cases (3.6%): five cases of wound infection with resolution after antibiotic therapy. In six cases there were injuries to the superficial palmar arch and two cases of wound haematomas (Table 2). In one case there was laceration of the perineurium sutured in open surgery. After two years of physiotherapy treatment the patient presented transient paresthesia.

Discussion

The carpal tunnel syndrome is currently the most common peripheral nerve compression neuropathy. The incidence, as reported by Nordstrom *et al.* [20], is of 3.46 cases per 1,000 person-year (95% confidence interval = 3.07–3.84). Tanaka *et al.* [26] reported that

an estimated 1.55% (2.65 million) of 170 million adults self-reported CTS in 1988, based on a sample of 44,233 households (response rate, 91.5%). According to these authors, the incidence of CTS appears to be increasing in computer workers. Baldasseroni *et al.* [5] showed in this report a statistically significant risk for some ISTAT (Italian National Institute of Statistics) job classes, in particular class 53, 54, 742, 45, 63 and 85 (spinners, weavers, tailors, knitters, tanners, hotel and restaurant cooks, carpenters and similar job).

Surgical treatment for CTS may be performed by open or endoscopic techniques. In recent years, there has been a growing interest in minimally invasive surgery and ECTR has gained a great deal of popularity. Major controversy has ensued between the camps (open vs endoscopic) and within these camps regarding safety, success and complication rates of the two procedures. In the literature, the success rate of the open surgery (OCTR), minimally or standard, is greater than 95%, with a complication rate of less than 3% [18]. The results of ECTR techniques are comparable to those of OCTR procedures with overall success and complication rates of 98% and 0.97–2.67% with iatrogenic injury of 0.8% respectively. The endoscopic technique is associated with less incisional pain and scarring, faster recovery time and return to work [4, 11, 13, 15, 16, 18].

Table 1. Outcome|EMG|patients %

EMG	Excellent (LD \leq 3,8 msec.)	Good (LD \geq 4,0 msec.)	Poor (LD > 4,0 msec.)	Worsened
Group I	97,8	2,2	0	0
Group II	86,3	10,9	2,8	0
Group III	21,4	73,8	4,8	0

Table 2. *Complications*

Wound infection	5 (1.3%)
Transitory tendon pain	4 (1%)
Transitory thenar pain	9 (2.3%)
Injury superficial palmar arch	6 (1.5%)
Injury perinuerium	1 (0.2%)

Since July 1999, to achieve less surgical invasiveness and early rehabilitation, we selectively performed ECTR using a biportal technique as described by Chow. Our findings are comparable with the results reported in the literature. The average time to return to activities of daily living and work were 10 and 20 days respectively and 97.8% of the cases reported excellent results. Moreover, 86.3% of our patients were completely or very satisfied with the surgical results (Fig. 4). The most important risk encountered in our experience is injury of the superficial palmar arch that occurred in six cases (1.5%). This iatrogenic damage occurs when the TCL is released. We believe that this potential vascular injury from ECTR can be prevented by direct visualization and by superficial palmar arch during the procedure before the ligament is released. Another important complication in our experience is injury to the perineurium of the median nerve for which an incidence has been reported of 0.3 to 2% [2, 8, 14]. Inaccurate insertion of the cannula and insufficient identification and visualization of the undersurface of the ligament accounts for these damages. Following Chow *et al.* [13] we believe that these complications are often found in early stage cases and the incidence being inversely proportional to the number of years of experience. In fact, our case happened in the first three months of training with ECTR. Release of the TCL under complete endoscopic vision via two small incisions is important to prevent injury to the median nerve. Moreover, to assure the best results of endoscopic technique, we believe that it is necessary to respect several principles:

- A) Appropriate patient selection: only patients with classic CTS should be considered candidates. Contraindications include patients with anatomical anomalies, synovial cysts, neuromas, previous trauma or surgery. Patients with very large, bulky hands or with longer preoperative symptomatology are sometimes technically difficult to operate because of adhesences.
- B) Adequate learning curve and familiarity with endoscopic techniques and instruments.

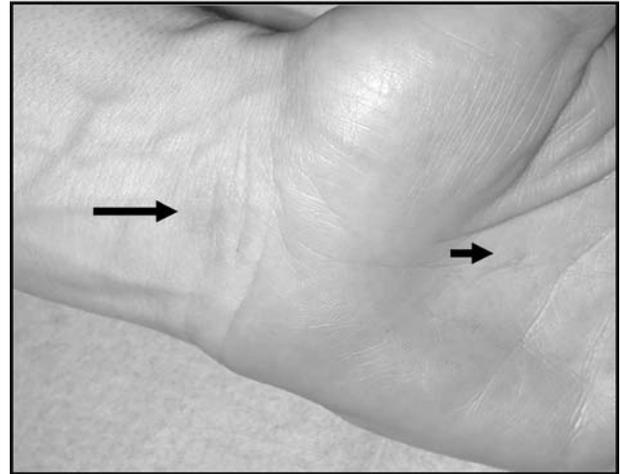


Fig. 5. Typical appearance two months following the biportal technique

- C) Good knowledge of open surgery. The surgeon should not begin with endoscopic surgery.

Conclusion

Our study demonstrated that the endoscopic carpal tunnel release is a safe technique with overall results and complications comparable to those of open surgery. This method presents minimal postoperative morbidity with faster return to work, reduced disability time and better cosmetic results (Fig. 5).

In our experience, correct positioning of the hand with proper anatomical landmarks, correct use of instruments, perfect knowledge of the anatomy and possibility of conversion to open surgery at the slightest doubt concerning visibility of the carpal ligament, are essential for a safe and successful procedure.

References

1. Abdullah AF, Wolber PH, Ditto EW III (1995) Sequelae of carpal tunnel surgery: Rationale for the design of a surgical approach. *Neurosurgery* 37: 931–936
2. Agee JM, McCarroll HR Jr, Tortosa RD, Berry DA, Szabo RM, Peimer CA (1992) Endoscopic release of the carpal tunnel: a randomized prospective multicenter study. *J Hand Surg* 17A: 987–995
3. Andrew Lee WP, Strickland JW (1998) Safe carpal tunnel release via a limited palmar incision. *Plast Reconstr Surg* 101: 418–424
4. Atroshi I, Johnson R, Ornstein E (1998) Patient satisfaction and return to work after endoscopic carpal tunnel surgery. *J Hand Surg* 23: 58–65

5. Baldasseroni A, Tartaglia R, Carnevale F (1995) The risk of the carpal tunnel syndrome in some work activities. *Med Lav* 86: 341–351 (abstr)
6. Brief R, Brief LP (2000) Endoscopic carpal tunnel release: report of 146 cases. *Mount Sinai J Med* 67: 274–277
7. Bromely GS (1994) Minimal-incision open carpal tunnel decompression. *J Hand Surg* 19A: 119–120
8. Brown RA, Gelberman RH, Seiler JG III, Abrahamsson S-O, Weiland AJ, Urbaniak JR, Schoenfeld DA (1993) Carpal tunnel release: a prospective, randomized assessment of open and endoscopic methods. *J Bone Joint Surg* 75A: 1265–1275
9. Brown MG, Rothenberg ES, Reyser B, Woloszyn TT, Wolford A (1993) Results of 1,236 endoscopic carpal tunnel release procedures using the Brown technique. *Ctemp Orthop* 27: 251–262
10. Chang MH (2002) Usefulness of sensory and motor conduction testing in carpal tunnel syndrome. *Neurology* 58: 1597–1607 (abstr)
11. Chen HT, Chen HC, Wei FC (1999) Endoscopic carpal tunnel release. *Changcheng Yi Xue Za Zhi* 22: 386–391 (abstr)
12. Chow JC (1989) Endoscopic release of the carpal ligament: a new technique for carpal tunnel syndrome. *Arthroscopy* 5: 19–24
13. Chow JC (1999) Endoscopic release of the carpal ligament for carpal tunnel syndrome: long-term results using the Chow technique. *Arthroscopy* 15: 417–421
14. Menon J (1994) Endoscopic carpal tunnel release: preliminary report. *Arthroscopy* 10: 31–38
15. Davies BW, Pennington GA, Fritz AM (1998) Two-portal endoscopic carpal tunnel release: an outcome analysis of 333 hands. *Ann Plast Surg* 40: 542–548 (abstr)
16. Ghaly RF, Saban KL, Haley DA, Ross RE (2000) Endoscopic carpal tunnel release surgery: report of patient satisfaction. *Neurol Res* 22: 551–555
17. Jablecki CK (2002) Electrodiagnostic testing for diagnosing carpal tunnel syndrome. *Neurology* 58: 1583–1584 (abstr)
18. Jimenez DF, Gibbs SR, Clapper AT (1998) Endoscopic treatment of carpal tunnel syndrome: a critical review. *J Neurosurg* 88: 817–826
19. Kerr CD, Gittens ME, Sybert DR (1994) Endoscopic versus open carpal tunnel release: clinical results. *Arthroscopy* 10: 266–269
20. Nordstrom DL, De Stefano F, Vierkant RA, Layde PM (1998) Incidence of diagnosed carpal tunnel syndrome in a general population. *Epidemiology* 9: 342–345
21. Okutsu I, Ninomiya S, Natsuyama M *et al* (1987) Subcutaneous operation and examination under universal endoscope. *J Jpn Orthop Assoc* 61: 491–498
22. Okutsu I, Ninomiya S, Takatori Y, Ugawa Y (1989) Endoscopic management of carpal tunnel syndrome. *Arthroscopy* 5: 11–18
23. Papageorgiou CD, Georgoulis AD, Mekris CA, Moebius UG, Varitimidis SE, Soucacos PN (1998) Difficulties and early results of the endoscopic carpal tunnel release using the modified Chow technique. *Knee Surg Sports Traumatol Arthrosc* 6: 189–193 (abstr)
24. Senda M, Hashizume H, Terai Y, Inoue H, Nagashima H (1999) Electromyographic evaluation after endoscopic carpal tunnel release in idiopathic carpal tunnel syndrome. *J Orthop Sci* 4: 187–190
25. Shapiro S (1995) Microsurgical carpal tunnel release. *Neurosurgery* 37: 66–70
26. Tanaka S, Wild DK, Seligman PJ, Behrens V, Cameron L, Putz-Anderson V (1994) The US prevalence of self-reported carpal tunnel syndrome: 1998 National Health Interview Survey data. *Am J Public Health* 84: 1846–1848 (abstr)
27. Thurston A, Lam N (1997) Results of open carpal tunnel release: A comprehensive, retrospective study of 188 hands. *Aust NZ J Surg* 67: 282–288

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