Turkish Neurosurgery 2007, Vol: 17, No: 3, 219-223

Ultrasonographically Checking the Sectioning of the Transverse Carpal Ligament During Carpal Tunnel Surgery with Limited Uni Skin Incisions

Sınırlandırılmış Tek Cilt İnsizyonlu Karpal Tunel Cerrahisinde Transverse Karpal Ligamentin Kesildiğinin Ultrasonografik Olarak Kontrol Edilmesi

Kerametin AYDIN[1]
Cengiz ÇOKLUK[2]
Ahmet PİŞKİN[3]
Ersoy KOCABIÇAK[4]

[1,2,4] Ondokuzmayıs University, Department of Neurosurgery, Samsun, Turkey
[3] Ondokuzmayıs University, Department of Orthopedics and Traumatology, Samsun, Turkey

ABSTRACT

AIMS: The goal of this clinical study was to evaluate the capability of intraoperative ultrasonographical examination to demonstrate the sectioning of the transverse carpal ligament during open surgical treatment of carpal tunnel syndrome with limited uni skin incision (mini skin incision technique).

METHODS and MATERIAL: Intraoperative ultrasonography was used in the detection of complete sectioning of the transverse carpal ligament, and sufficient release of median nerve. Thirty-two female cases were operated with the limited uni skin incision technique. Intraoperative ultrasonography showed the sectioned transverse carpal ligament in all cases.

RESULTS: We adopted the sonographic examination to check the ligament during surgical intervention. The capability of ultrasonography is sufficient to demonstrate the median nerve and transverse carpal ligament especially when performing limited uni mini skin incision technique for carpal tunnel surgery.

CONCLUSIONS: We suggest the use of ultrasonogarphy for intraoperative checking of the sectioning of the transverse carpal ligament during the surgical treatment of carpal tunnel syndrome with limited uni skin incision.

KEY WORDS: Carpal tunnel surgery, Intraoperative ultrasonography, Uni skin incision

ÖZ

AMAÇ: Bu klinik çalışmanın amacı sınırlandırılmış tek cilt insizyonuyla yapılan açık karpal tunel cerrahisi sırasında transvers karpal ligamentin kesildiğinin intraoperatif ultrasonografik inceleme ile gösterilebileceğinin gösterilmesidir.

YÖNTEM ve GEREÇ: İntraoperatif ultrasonografi transverse karpal ligamentin tam kesildiğinin ve median sinirin serbestleştirildiğinin gösterilmesinde kullanılmıştır.32 olgu sınırlandırılmış cilt insizyonu kullanılarak ameliyat edilmiştir.Tüm olgularda intraoperatif ultrasonografi ligamentin tam kesildiğini göstermiştir.

BULGULAR: Cerrahi girişim sırasında ligamentin kontrolünde sonographic inceleme kullanılmıştır. İntraoperatif ultrasonografi özellikle sınırlı cilt insizyonunun kullanıldığı olgularda yararlı bir inceleme yöntemi olarak bulunmuştur.

SONUÇ: Sınırlandırılmış cilt insizyonu kullanılarak yapılan karpal tunel cerrahisinde transvers karpal ligamentin tam olarak kesildiğinin gösterilmesinde intraoperatif ultrasonografi kullanılabileceğini savunmaktayız.

ANAHTAR SÖZCÜKLER: İntraoperatif ultrasonografi, Karpal tünel cerrahisi, Tek cilt insizyonu

Received: 13.03.2007
Accepted: 14.05.2007

Correspondence address:
Kerametin AYDIN
Ondokuzmayıs University,
Department of Neurosurgery,
Samsun, Turkey
E-mail: kaydin@omu.edu.tr

INTRODUCTION

Median nerve entrapment neuropathy at the wrist is one of the most common entrapment syndromes encountered in neurosurgical practice (1, 2, 3). 1% of the general population is affected from carpal tunnel syndrome but it is more seen in some people whose work requires repetitive wrist motion (1, 3, 4, 5).

The diagnosis can be easily made from the history, physical examination, electromyographic studies, and nerve conduction velocities (3). The concept of open median nerve release has been approved as the effective standard surgical treatment of carpal tunnel syndrome for several years (3, 4, 6, 8, 9, 10). Surgical division of transverse carpal ligament with different type of palmar skin incision is common open surgical technique for decompression of entrapped nerve into the tunnel (3, 4, 6, 8, 9, 10). Various types of skin incisions have been regarded as minimally invasive and effective surgical treatment for avoiding excessive scar formation, and for better cosmetic results (2, 9, 11, 12).

In this clinical study intraoperative ultrasonography was used in the checking of the complete sectioning of the transverse carpal ligament with limited uni skin incisions.

PATIENTS and METHODS

This clinical study was designed to evaluate the capability of intraoperative ultrasonographical examination to demonstrate sectioning of the transverse carpal ligament during open surgical treatment of carpal tunnel syndrome with limited uni skin incisions (Figure 1).

Figure 1: Technique of intraoperative ultrasonographic neuroexamination. (USG: Ultrasonographic probe).

This study included 32 female cases with carpal tunnel syndrome that underwent microsurgical intervention for median nerve release using the limited uni skin incision technique with the assistance of intraoperative ultrasonography between 2001 and 2003. The postoperative follow-up period 18 months. The pathology was diagnosed from the patient's history, physical examination, the results of electromyographical studies, and nerve conduction velocities in all cases.

Surgical technique

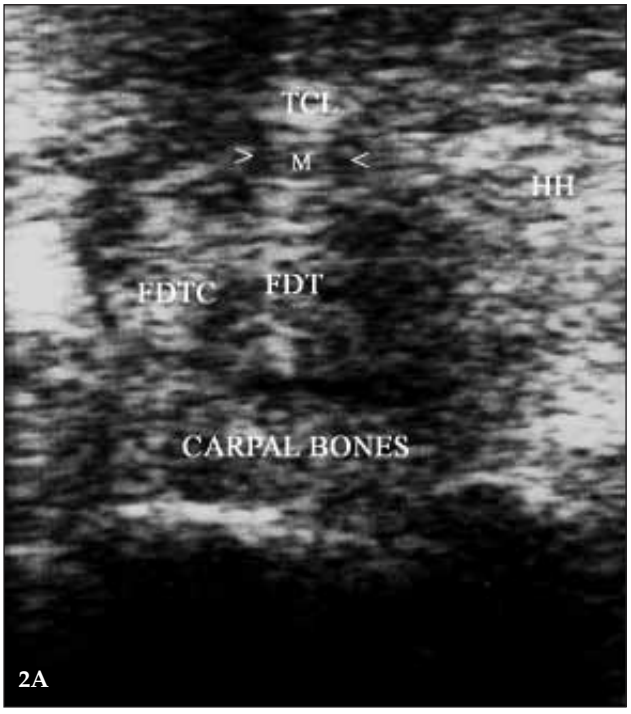
Surgery was performed on the right hand in 22 cases and on the left hand in 10 cases. All patients were operated in the supine position. The affected hand was positioned on the hand-holding apparatus of the operating table. The forearm, wrist, and hand were cleaned before surgery with povidone iodine solution (Isosol 1000 ml; Merkez Laboratuarı, Istanbul, Turkey) to provide sterile surgical conditions. The line of surgical incision was drawn with a sterile surgical pen. The surrounding area was covered with sterile cotton compresses to isolate the hand. The operation was performed under local anesthesia induced with 2% prilocain hidrocloride (Citanest 20 ml; Flacon Astra Zeneka, Istanbul, Turkey). No tourniquet was used in any surgery. An operative microscope (Carl Zeiss contraverse microscope, Opmi CS-NC) was used for all cases. The surgical technique for the uni skin incision has previously been described by the author (13).

The operations and the ultrasonographic examinations were performed by one of the authors (CC) in all cases using a Tosbee real-time ultrasound scanner (Tosbee, Toshiba Inc. Japan) with 5-7, 5 MHz transducer (Figure 2, 3). There was no reoperation or skin infection along follow up period.

RESULTS

Sectioned transverse carpal ligament was easily seen in all cases. Air was located under the skin and it was seen in hypo-echoic appearance and blood appeared hyperechoic in sonographic examination. In some cases, air can artefact in the visualisation of the median nerve and palmar tendons. In these cases for better visualisation, the surgical space was filled with water.

Ten to 15 minutes is necessary for sonographic examination. Surgeon should obtain preoperative images to compare them with intraoperative images. Longitudinal and perpendicular images are



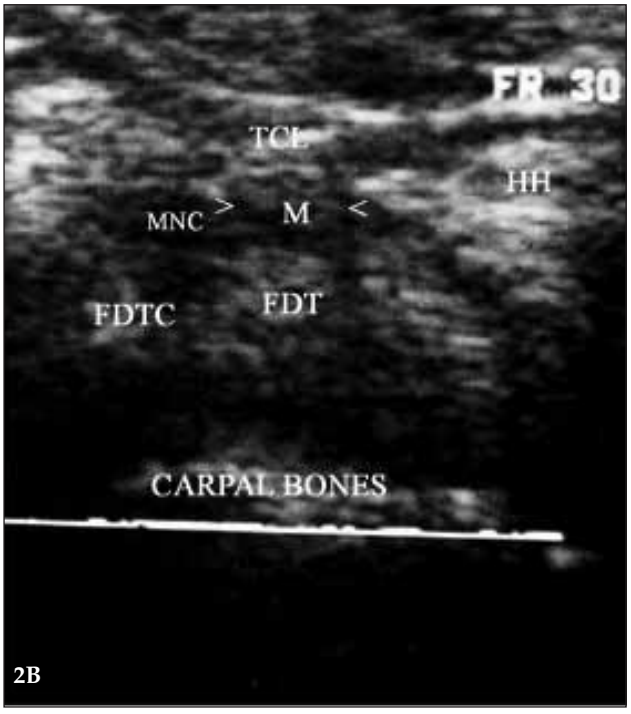
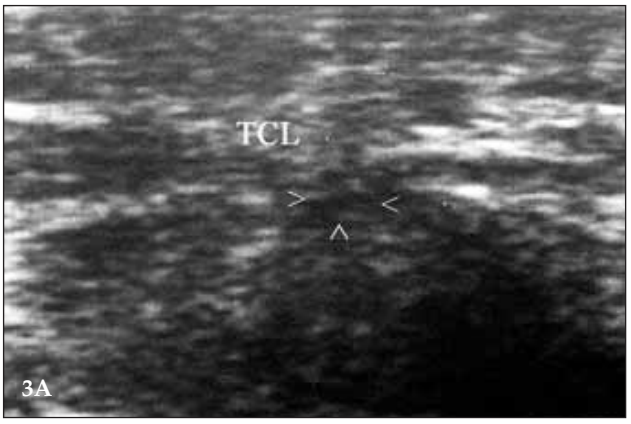


Figure 2: A. Ultrasonographic appearance of carpal tunnel contents in a CTS case (TCL: Transverse carpal ligament, HH: Hook of the hamate, MNC: Median nerve compartment, M: Median nerve, FTD: Flexor digitorum tendons, FDTC: Flexor digitorum tendons compartment)
B. Ultrasonographic appearance of carpal tunnel contents in a normal case (TCL: Transverse carpal ligament, HH: Hook of the hamate, MNC: Median nerve compartment, M: Median nerve, FTD: Flexor digitorum tendons, FDTC: Flexor digitorum tendons compartment)



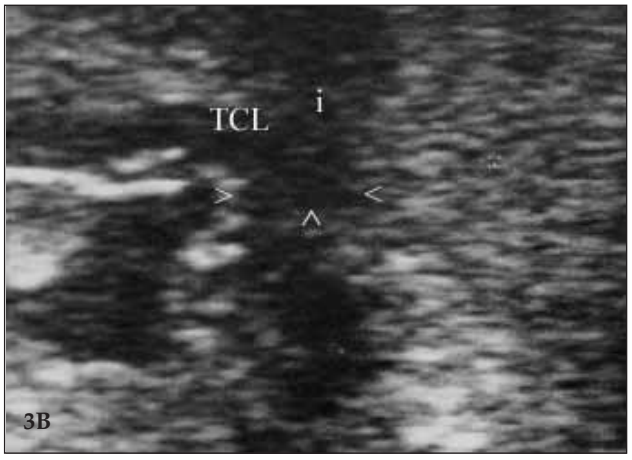


Figure 3: A. Ultrasonographic examination before sectioning of the ligament revealed the compression of the median nerve in the carpal tunnel (TCL: Transverse ligament, Arrows shows the median nerve.
B. Intraoperative ultrasonographic examination shows the decompressed median nerve. (TCL: Transverse ligament, I: incision of the ligament, Arrows show the decompressed median nerve).

mandatory for complete examination of proximal, distal and middle part of the ligament.

The capability of sonographic images in the showing of sectioned the carpal ligament was showed in (Table I).

Chi-square test was used for statistical analysis. The differences between good results and others (moderate and poor results) were statistically significant ($p< 0.001$).

DISCUSSION

The surgical technique should be less traumatic and minimally invasive for both the median nerve and palmar skin. The most common sequels of carpal tunnel surgery related with skin incisions are hypertrophic scar formation, sensitive scar and

Table I. The capability of intraoperative ultrasonography for checking complete sectioning of the transverse carpal ligament

Type of incision	The capability of intraoperative ultrasonography					
	Good		Moderate		Poor	
	n	%	n	%	n	%
Uni skin incision	32	94	1	3	1	3

tenderness (1, 4). The incidence of these types of sequels has been reported in some series at 24% (1).

Open transverse carpal ligament section for median nerve decompression can be performed using various types of palmar skin incisions (4, 11, 12, 14, 15, 16). Rengachary (13) described that the standard skin incision for carpal tunnel surgery is made from the wrist flexion crease and extends curvilinear to a point in line with the distal border of the fully extended thumb. In this technique, the incision is generally placed 2 to 3 mm medial to the volar crease, in line with the long axis of the ring finger.

Recently some types of limited skin incisions have been described in the surgical treatment of carpal tunnel syndrome (2, 9, 11, 12). The goal of limited skin incisions is to achieve better cosmetic results and less scar formation and postoperative pain at the site of the incisions (2, 4, 9, 11, 12, 13, 14, 15, 16).

We previously described the technique of uni mini incision and clinical results (13). Limited skin incisions may obscure complete observation of the transverse carpal ligament during surgical intervention. The repositioning of the hand may help in the observation of the ligament. But this procedure is generally insufficient for complete checking of the ligament.

Numerous investigators have addressed the benefits and guidance of intraoperative ultrasonography during neurosurgical operations (17). Some pathomorphological changes in the transverse carpal ligament, median nerve and tendons can be demonstrated by using ultrasonography. We adopted sonographic examination to check the ligament during surgical intervention. The capability of ultrasonography is sufficient to demonstrate the median nerve and transverse carpal ligament. The preoperative images are helpful in the comparison of intraoperative images for differentiation from operative artefacts.

The use of sonographic examination can offer the neurosurgeon a way to check complete sectioning of the carpal ligament, especially in patients operated using the limited uni skin incision. We can see all borders of the ligament and we can also check the total cutting of the ligament ın open carpal tunnel surgery with a classical incision. However, we need more advanced techniques to check the total cutting of the ligament if we use the limited skin incision in the open treatment of carpal tunnel surgery. In this situation there are two ways to control the total section. One of them is to use the endoscopic vision and light, another option is to use real-time ultrasonographic examination. In the case of the hybrid technique with endoscopic view, we could see the upper border of the ligament but we could not check the total border. In the case of ultrasonographic examination, we can see all the border and underneath the ligament and median nerve and we can also see the vessels under the median nerve and tendons. On the other hand, ultrasonographic examination can provide a different view with dynamic examination. In this examination we can put the hand in flexion and extension and see the position of the median nerve and tendons.

It is possible to determine possible entrapment of the median nerve in this situation with experienced eyes (7).

CONCLUSION

Ultrasonography is a useful diagnostic tool for the detection of complete sectioning of the transverse carpal ligament during surgical procedures, especially in the limited uni skin incision techniques. It is easy to use, simple and readily available in the operating room. It is also cheap and safe.

REFERENCES

1. Abdullah AF, Wolber PH, Ditto EW. Sequela of carpal tunnel surgery: rationale for design of a surgical approach. Neurosurgery 1995; 37: 931-36.
2. Biyani A, Downes EM. An open twin incision technique of carpal tunnel decompression with reduced incidence of scar tenderness. J Hand Surg 1993; 18: 331-34.
3. Bromley GS. Minimal incision open carpal tunnel decompression. J Hand Surg 1994; 19: 119-20.
4. Cotton P. Symptoms may return after carpal tunnel surgery. JAMA 1991; 265: 1922-25.
5. Delaere O, Bouffioux N, Hoang P. Endoscopic treatment of the carpal tunnel syndrome: review of the recent literature. Acta Chir Belg 2000; 100: 54-7.
6. Frank CE."Two stitch" carpal tunnel surgery. A mini-incision technique. Am J Orthop 1996; 25: 650.
7. Hwang Py, Ho CL. Minimally invasive carpal tunnel decompression using the knifelight. Neurosurgery 2007; 60: 162-9.
8. Keramettin A, Cengiz C, Nilgun C, Ayhan B. Microsurgical open mini uniskin incision technique in the surgical treatment of carpal tunnel syndrome. Neurol India 2006; 54(1):64-7.
9. Lee WP, Strickland JW. Safe carpal tunnel release via a limited palmar incision. Plast Reconstr Surg 1998; 101: 418-24.
10. Nakamichi K, Tachibana S. Ultrasonographically assisted carpal tunnel release. J Hand Surg (Am) 1997, 22 (5): 853-62.
11. Nathan PA. Carpal tunnel release using minimally invazive technique. Plast Reconstr Surg 1997; 99: 1195-6.
12. Pagnanelli DM, Barrer SJ. Carpal tunnel syndrome: surgical treatment using the Paine retinaculatome. J Neurosurg 1991; 75: 77-81.
13. Rengachary S. Entrapment neuropathies, in Wilkins R, Rengachary S (eds): Neurosurgery. New York, McGraw-Hill Book Co., pp 1771-1776, 1985.
14. Schmidt W, Gruber AA, Hammer R. Results of different incisions in treatment of carpal tunnel syndrome. Handchir Mikrochir Plast Chir 2000; 32: 67-9.
15. Scott S. Microsurgical carpal tunnel release. Technique and application. Neurosurgery 1995; 37: 66-70.
16. Serra JM, Benito JR, Monner J. Carpal tunnel release with short incision. Plast Reconstr Surg 1997; 99: 129-35.
17. Wilson KM. Double incision open technique for carpal tunnel release: an alternative to endoscopic release. J Hand Surg (Am) 1994; 19: 907-12.
18. Zimmerli W. Double incision for operation of carpal tunnel syndrome-14 years experience. Helv Chir Acta 1992; 58: 395-400.