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

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 ultrasonography 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
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).

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 Laboratuari, 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
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
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 in 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


