Ultra mini-invasive sonographically guided carpal tunnel release: a preliminary report

Ultra małoinwazyjna operacja zespołu kanału nadgarstka w asyście USG: wstępne wyniki

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Abstract

Ultra mini-invasive sonographically guided carpal tunnel release allows division only the deepest fibrous layer of the retinaculum, leaving intact the more superficial palmar layer. It uses a special retrograde hook-knife. The operation can be safely performed in a dressing room (not in the operative theatre) which significantly reduces costs and waste, comparing to standard technique of carpal tunnel decompression. Twelve patients, 10 women and 2 men, in the mean age of 54 years, with clinically and electrophysiologically confirmed carpal tunnel syndrome were operated on in using ultra mini-invasive, sonographically guided technique. The results were assessed at 2 weeks post-operatively. Ten patients declared complete resolution of symptoms typical for CTS. Seven of these patients who were employed, returned to work within 2 weeks. Two patients failed to improve and they were operated on 1,5 month later with small incision technique. Intraoperatively, an enormously thickened flexor retinaculum was found, what may (in part) explain failure of the first, “ultra-mini” operation.

Key words: carpal tunnel syndrome, mini-invasive surgery, percutaneous release

Streszczenie

Ultra małoinwazyjne odbarczenie kanału nadgarstka, jest techniką umożliwiającą przecięcie głębokiej warstwy troczka zginaczy pod kontrolą USG wykorzystującą nóż hakowy wsteczny, wprowadzony przez cięcie skórne długości 1-3 mm. Operacja może być bezpiecznie wykonana w gabinecie zabiegowym, co pozwala na redukcję kosztów oraz zmniejszenie ilości odpadów, w porównaniu do standardowego leczenia operacyjnego. U 12 pacjentów z klinicznie i elektrofizjologicznie potwierdzonym ZKN wykonano dekompresję kanału nadgarstka przez przecięcie troczka zginaczy, opisaną techniką. U 10 pacjentów uzyskano ustąpienie dolegliwości. 2 pacjentów wymagało reoperacji techniką małego cięcia po ok 1,5 miesiąca od pierwszego zabiegu i w obu przypadkach śródrodzienne stwierdzono istotne pogrubienia troczek zginaczy. Siedem osób (wszyscy czynni zawodowo) wróciło do pracy w ciągu 2 tygodni.

Słowa kluczowe: zespół kanału nadgarstka, chirurgia mini-inwazyjna, przecięcie przeszkode
Introduction

Controversy persists regarding the effectiveness and safety of various methods of carpal tunnel release including conventional open (4 cm long incision going from proximal palm onto the distal forearm), limited open (2-3 cm), mini (1-2 cm), ultra-mini (0.5-1 cm) and endoscopic techniques. The mini-invasive and endoscopic methods are considered by some surgeons to be superior to open release because of reduced tissue trauma, lower postoperative morbidity and pain rates, faster return to normal activities, including return to work, and better cosmetic results. However, they are still considered to have a higher complication and incomplete flexor retinaculum release rates. Review of the literature shows the effectiveness of limited open carpal tunnel decompression by either technique to be comparable to that of the endoscopic method in respect of reduced postoperative pain, quicker recovery, time of return to work, recovery of grip strength and complication rate [1-3]. Limited open carpal tunnel release techniques are also considered to be easier to perform and safer than the endoscopic method and did not require a specific equipment. With regard to mini and ultra mini-invasive techniques there is concern that the proximal part of the procedure is performed blindly, what may result in the median nerve damage or incomplete flexor retinaculum release.

Recent anatomical studies showed that carpal tunnel may be effectively released (the median nerve decompressed) by division only the deepest fibrous layer of the retinaculum, leaving intact the more superficial palmar layer. This technique protects small sensory nerve fibers localized superficially in the retinaculum, what, in assumption, may cause lower postoperative pain and lower rate of unpleasant phenomenon such as pillar pain. This, however, requires USG assist for identification of the appropriate layer of the flexor retinaculum and control of the knife position during tissue sectioning.

The objective of this study was assessment of the results of ultra mini-invasive, sonographically guided technique of carpal tunnel release.

Materials and Methods

In 2019, 12 patients, 10 women and 2 men, in the mean age of 54 years (range 43-65), with clinically and electrophysiologically confirmed carpal tunnel syndrome were operated on in the authors institution using ultra mini-invasive, sonographically guided technique. Duration of the disease was 15 months in average (range 6-34); right hand was operated in 7 patients and left hand in five. In all patients the operation was performed under WALANT (wide-awake local anaesthesia with no tourniquet) anaesthesia, in the dressing room on the surgical ward, in a standard sterile conditions. All operations were performed by a single surgeon (ZS), familiar with USG technique of visualization structures in the carpal tunnel.

Operative technique

The set of instruments required to this operation consists of a retrograde hook-knife (Acufex 3.0 mm; Smith & Nephew), vascular clamps, surgical blade and sterile USG gel (Fig. 1).

- During doing local anaesthesia of the operative field (Fig. 2), 10 ml of 1% lignocaine is injected into the space between flexor retinaculum and intracarpal structures to create a room for safe introduction of the hook-knife (Fig. 3).
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Next, a 3 mm transverse incision along the distal wrist crease is made; through this incision, a vascular clamps are introduced and carpal fascia is perforated under USG control. This allows a hook blade to be placed under the junction of the antebrachial fascia and the retinaculum (Fig. 4).

Fig. 4. Perforation of the carpal fascia with vascular clamps.

Then, the hook-knife blade is steadily advanced under the flexor retinaculum with continuous ultrasound monitoring, until it reaches a few millimetres beyond it (Figs. 5, 6).

Fig. 5. Hook-knife placement under the retinaculum.

Fig. 6. An USG view of the hook-knife place under the retinaculum. The blade is turned palmarly and hooked against distal margin of the retinaculum.

The hook is then turned vertical and the deep layer of the retinaculum is then transected proximally (in a retrograde manner) with continuous ultrasound monitoring (Fig. 7).

Fig. 7. Retrieving of the hook-knife and transection of the retinaculum.

After cutting is completed, the knife is retrieved from the wound (Fig. 8).

Fig. 8. Introduction of the vascular clamps along the knife route.

Next, vascular clamps are introduced into the wound with USG monitoring, along the knife route, to control the completeness of the transection of the retinaculum (Figs 9, 10).

Fig. 9. An USG view of vascular clamps inside the carpal tunnel.
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Fig. 10. View of the wrist one week after surgery.

Operative wound is closed with strips of a single stitch and dressing is put on it.

The wrist is not immobilized and the patient is allowed to use the hand in light daily activities. Almost normal loading of the hand (except of heavy manual work and full-strength exercises) is allowed about 2 weeks after the operation.

Results

The results were assessed at 2 weeks post-operatively. Ten patients declared complete resolution of symptoms typical for CTS, i.e. night pain and paraesthesiae, awaking them from sleep and return to normal function of the operated hand, the same as before surgery. Seven of these patients who were employed, returned to work within 2 weeks. Two patients failed to improve and their complaints did not resolve (although slightly decreased). Both these patients were operated on 1.5 month later with small incision technique (Fig. 11). Intraoperatively, an enormously thickened (1 cm) flexor retinaculum was found, what may (in part) explain failure of the first, "ultra-mini" operation.

Cost-effectiveness

The "ultra-mini" operation is performed in "one-day care" setting, in a dressing room without anaesthesiologist assistance. All these circumstances considerably reduce costs associated with this surgery which include: hook-knife – 150 PLN and other medical materials – 30 PLN. The patient is not accommodated, thus the total costs of the "ultra-mini" procedure amount 180 PLN. For comparison, the costs of the operation by a traditional mini-open technique include: 350 PLN for 30 minutes use of the operative room, 200 PLN for operative equipment and 400 PLN for a one-day stay on the ward, what amounts totally 950 PLN. The NFZ reimbursement for the procedure is equal 1350 PLN for either technique (the H43 procedure).

Discussion

The presented technique is not standard for carpal tunnel release and locates somewhere between endoscopic and traditional mini-open methods. To perform this operation, several preconditions are required, including: a special, commercially available hook-knife, an USG unit equipped with 12 MHz transducer and the surgeon who is familiar with USG examination and operating under USG monitoring. These preconditions may limit availability of this method for standard hand surgical unit. We believe, however, that this technique has some merits, not only economical, and thus may be recommended for institutions having an equipment and adequately educated staff. It is also beneficial for the patients, because it allows faster return to normal activity, comparing to other, traditional techniques. The problem which was found in this study is relatively high rate of failures caused by incomplete transection of the flexor retinaculum. This suggests necessity of either modification of the operative technique or proper selection of patients to this method.

Literature provides some evidence for effectiveness of sonographically assisted mini and percutaneous approaches for carpal tunnel release [4-6]. For instance, Nakamichi et al. compared a distal anterograde, USG assisted mini-open carpal tunnel release vs traditional technique, and, in their other study, USG guided percutaneous technique vs an USG assisted, mini-open carpal tunnel release [7, 8]. Both works reported significant clinical differences regarding grip, pain and scar tenderness until the 6th week and less scar sensitivity at 13th week favoring the technique with the smallest approach. We believe that presented technique of carpal tunnel release may be an alternative for more traditional methods, although it needs validation by studies based on more numerous patients’ cohorts.
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References


