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SIMPLE IN SITU DECOMPRESSION FOR IDIOPATHIC CUBITAL TUNNEL SYNDROME USING MINIMAL SKIN INCISION

In-Ho JEON, Ivan MICIĆ, Poong-Tak KIM and Predrag STOJILJKOVIĆ

Summary – Cubital tunnel syndrome is one of the most frequently occurring compression neuropathy in the upper limb next to carpal tunnel syndrome. Recent minimal invasive technique has prompted us to gain clinical experience with simple in situ decompression with minimal skin incision for idiopathic cubital tunnel syndrome. Sixty six consecutive patients with cubital tunnel syndrome were treated using minimal skin incision technique. The mean age of the patients was 49.7 (range: 15-77) years and average follow up period was 23.9 months (range: 12-60 months). The severity of ulnar neuropathy was classified according to the McGowan classification: there were 17 in grade I, 47 in grade II and 2 in grade III. A preoperative nerve conduction study was done by inching method, which revealed motor conduction delay around the medial epicondyle. All operations were carried out in a day surgery unit under local anesthetics. The postoperative outcome was evaluated by Messina classification. The mean duration of the operation was 12 minutes. The technique was highly satisfactorily esthetic for all. Over 80% of the patients were completely satisfied with the procedure taking into consideration their symptoms. Postoperative outcome measures and patient satisfactions (pain, return to normal activities and work, scar and pillar tenderness) were comparable with published series of anterior transposition. The overall satisfactory results were recorded 81% in the patients of McGowan stage I and II. There were 2 cases of hematoma as a postoperative complication. This procedure is comparably effective alternative which involves less surgical trauma, morbidity and rehabilitation time with good surgical outcomes especially in mild and moderate degrees. Minimal skin incision is a simple, safe and effective method to treat patients with idiopathic cubital tunnel syndrome.

Key words: Decompression, Surgical; Cubital Tunnel Syndrome; Ulnar Nerve; Ulnar Nerve Compression Syndromes; Skin + surgery

Introduction

Cubital tunnel syndrome is one of the most frequently occurring compression neuropathy in the upper limb next to carpal tunnel syndrome [1].

In a mild case, conservative therapies such as non-steroidal anti-inflammatory drugs (NSAIDS) and rest are useful. Passive hyperextension of the elbow and wrist joint is recommended to improve the excursion of the ulnar nerve as a physical therapy. A surgical treatment is indicated when there is no improvement of symptoms after a certain period of a conservative treatment or when wasting of intrinsic muscles is obvious. As for surgery methods, anterior transposition of the ulnar nerve [2], simple in situ decompression [3,4], medial epicondylectomy [5,6] are reported.

Minimally invasive surgical procedures have been developed to avoid conventional open invasive surgery with less surgical trauma in the various orthopaedic fields, and simple in situ decompression using minimal skin incision for cubital tunnel syndrome has been reported to provide similar results compared to conventional open procedure [7].

The purpose of this study is to describe the surgical technique of simple in situ decompression using minimal skin incision and report its clinical results in large series of patients treated by a single surgeon.

Material and Methods

Between January 2003 and May 2006, 66 elbows in 62 patients with cubital tunnel syndrome who had undergone surgical treatment at our institute were retrospectively reviewed.

An inclusion criterion was idiopathic cubital tunnel syndrome without associated pathology in the elbow joint. Any neuropathy related with elbow joint deformity or arthrosis, postoperative, double crush syndrome or tumorous condition were excluded. The study group consisted of 26 men (29 cases) and 36 women (37 cases). Three men and one woman presented bilateral cubital tunnel syndrome. The mean age of the patients was 49.7 years (ranging from 15 to 77 years) and the mean follow up period was 23.9 months (ranging from 12 to 60 months) (Table 1).

The clinical examination showed that 89% of patients had positive Tinel sign and elbow flexion test was positive in 86% of patients.

Preoperative severity of the symptoms was graded according to McGowan classification [8]. Grade I is for the patients who have paresthesia, grade II is for the patients who have weakness of interosseous muscle and grade III is for those who have definite paresthesia and weakness of interosseous muscle and claw hand. Seventeen cases were included in
grade I (mild), forty seven in grade II (moderate), and two in grade III (severe).

The diagnosis was made on the basis of clinical and neurophysiologic study.

Neurophysiologic Study

The preoperative neurophysiologic study was carried out using inching method (Figure 1). The technique is as follows. The room temperature was maintained between 20° to 24° and the patient’s arm was abducted 45°, externally rotated and the elbow joint was flexed to 90°. An active electrode was placed at the belly of abductor digiti minimi muscle and a reference electrode was attached to the tendon of distal part. Along the course of the ulnar nerve, five different points centered at medial epicondyle; (1) 3 cm proximal from medial epicondyle, (2) 1 cm proximal to medial epicondyle, (3) medial epicondyle, (4) 1 cm distal to medial epicondyle, (5) 3 cm distal to medial epicondyle, were marked and stimulated. Two points of each interval were stimulated and then latency gap between proximal and distal point was measured to calculate the ulnar nerve conduction velocity. The preoperative EMG study showed that the average nerve conducting velocity was 34.4 m/sec which was comparable to a normal range (56.3 ±3.9 m/sec).

Postoperative Evaluation

The postoperative outcome was evaluated using Messina’s [9] index. According to Messina’s index, an excellent result is full recovery, a good result is almost complete recovery but with a decreased sensation and weakened motor activity, and a fair result presents a persistent change of sensation, loss of motor activity and muscle wasting, at the end, a poor results means no improvement of symptoms. The follow-up examinations evaluating pain and motor/sensory deficits were performed 3 and 9 months postoperatively.

Abbreviations:

FCU – flexor capiti ulnaris

Table 1. Demographics of study population

<table>
<thead>
<tr>
<th></th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of patients</td>
<td>62</td>
</tr>
<tr>
<td>Total number of procedures</td>
<td>66</td>
</tr>
<tr>
<td>Female</td>
<td>23</td>
</tr>
<tr>
<td>Male</td>
<td>39</td>
</tr>
<tr>
<td>Preoperative EMG study</td>
<td>using inching method</td>
</tr>
<tr>
<td>Average follow up</td>
<td>23.9 months (12-60 months)</td>
</tr>
<tr>
<td>Average duration of symptoms</td>
<td>21 months (12-48 months)</td>
</tr>
</tbody>
</table>

 grade I (mild), forty seven in grade II (moderate), and two in grade III (severe).

Operative technique

All the procedures were performed by a senior surgeon in an outpatient setting under local anesthesia. The patient was in the supine position, and standard sterile draping with abducted shoulder and supinated forearm and a pneumatic tourniquet were used.

After the injection of local anesthetics (1% lidocaine 5 ml) into the posterior part of the medial condyle, 2 ml of pethidine and 2 ml of diazepam mixture was administered intravenously.

The skin incision was marked between the olecranon and medial epicondyce. A 1.5-2 cm longitudinal skin incision was made along the ulnar nerve just at the equal distance from the medial epicondyce.

After the skin incision had been done, a blunt soft tissue dissection revealed the ulnar nerve just posterior to the medial epicondyce. Special care was taken to avoid damaging the medial cutaneous nerve of forearm. Just behind the medial epicondyce, the proximal part of the ulnar nerve was exposed. A distal dissection along the ulnar nerve with fine scissors revealed the two heads of flexor carpi ulnaris (FCU). A fibrous band between the two heads of FCU, the so called „Osborne ligament”, was exposed and divided under

Fig 1. Electrophysiologic study using an inching method. The right elbow is demonstrated with medial epicondyce marked with white arrow head. The patient’s arm was abducted 45°, externally rotated and the elbow joint was flexed to 90°. An active electrode is placed at the belly of abductor digiti minimi muscle and a reference electrode is attached to the tendon of distal part. Along the course of the ulnar nerve, five different points centered at medial epicondyce; (1) 3 cm proximal from medial epicondyce, (2) 1 cm proximal to medial epicondyce, (3) medial epicondyce, (4) 1 cm distal to medial epicondyce, (5) 3 cm distal to medial epicondyce, were marked and stimulated.

Slika 1. Elektrofiziološka studija upotrebom inching metode. Pokazan je desni lakat sa medijalnim epikondilom označenim belom strelicom. Ruka pacijenta je u abdukciji na 45°, rotrirana spolja i savijena u laktu pod uglom od 90°. Aktivna elektroda je postavljena na pripoj mišića abduktor digitii minimi, a referenatna elektroda je prikačena na tetivu distalnog dela. Duž pravca ulnarnog nerva, pet različitih tačaka oko medijalnog epikondila markirano je i stimulišano; (1) 3 cm proksimalno od medijalnog epikondila, (2) 1 cm proksimalno od medijalnog epikondila, (3) medijalni epikondil, (4) 1 cm distalno od medijalnog epikondila, (5) 3 cm distalno od medijalnog epikondila.
This was the main pathologic structure of the ulnar nerve entrapment. The transection of the Osborne ligament proceeded snip by snip and was carefully directed with the scissors in the longitudinal axis of the ulnar nerve. Upon completing the transection of the ligament, the distal part of the ulnar nerve was shown penetrating into the muscle of FCU (Figure 3).

After the ulnar nerve decompression, any associated pathologies such as a mass lesion or ganglion should be inspected. The stability of the ulnar nerve was checked with passive flexion and extension of the elbow joint. After the complete hemostasis and incision suturing, the compressive dressing was applied and the patient was advised to immobilize the elbow for a couple of days. After that, a range of motion for activities of daily living was allowed.

Results

1. Clinical results

The mean duration of the operation was 12 minutes. The mean length of skin scar was 1.9 cm (ranging from 1.5–2.5 cm) According to Messina's patient's satisfaction classification, the result of postoperative satisfaction was excellent in 24 cases, good in 29 cases, fair in 12 cases, and poor in 1 case.

Over 80% of patients reported that the symptoms were relieved after the operation. Generally speaking, satisfactory results were recorded in over 81% of the patients of McGowan stage I and II but in one out of two patients of McGowan stage III (Table 2).

2. Operative finding

Most of the ulnar nerve was compressed by the Osborne ligament and this was effectively decompressed after the surgical release of the ligament. The compressed area of the ulnar nerve was measured using a ruler during the operation. The average width and length was 3 cm and 2.7 cm, respectively (range: width from 2.4–3.3 cm, length from 2.6–3.2 cm).

Table 2. Clinical outcomes based on Messina's classification

<table>
<thead>
<tr>
<th>McGowan I (n=17)</th>
<th>McGowan II (n=47)</th>
<th>McGowan III (n=2)</th>
<th>Total (n=66)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odličan (Excellent)</td>
<td>7 (42%)</td>
<td>17 (36%)</td>
<td>/</td>
</tr>
<tr>
<td>Dobar/Good</td>
<td>8 (47%)</td>
<td>20 (43%)</td>
<td>1 (50%)</td>
</tr>
<tr>
<td>Umeren/Fair</td>
<td>2 (11%)</td>
<td>9 (19%)</td>
<td>1 (50%)</td>
</tr>
<tr>
<td>Slab/Poor</td>
<td>/</td>
<td>1 (2%)</td>
<td>/</td>
</tr>
</tbody>
</table>

Table 2. Klinički ishod zasnovan na Messininoj klasifikaciji

Fig 2. Schematic drawing of the medial elbow. The ulnar nerve and medial epicondyle (M.E.) are marked with black arrows and fibrotic arch between two heads of flexor carpi ulnaris (Osborne’s ligament) is marked with white arrow.

Slika 2. Šematski prikaz unutrašnje strane lakta. Ulnarni nerv i medialni epikondil (M. E.) označeni su crnim strelicama. Vlačnasti luk između dve glave flexor carpi ulnaris (Osbornov ligament) označen je belom strelicom.

Fig 3. A. A 1.5-2cm longitudinal skin incision was made between the medial epicondyle and the olecranon (white arrow head). B. The Osborne’s ligament was transected and the ulnar nerve was visualized.

Slika 3. A. 1,5–2 cm uzdužni rez ne koži urađen je između medijalnog epikondila i olekranona (vrh bele strelice). B. Osbornov ligament je rasečen i ulnarni nerv je postao vidljiv.

During the operation, we found nine cases of a variant muscle between the olecranon and medial epicondyle which covered the ulnar nerve. This was anconeus epitrochlearis muscle, and it was transected longitudinally and excised for complete decompression of the nerve. The average width was 3 cm and length was also 2.7 cm (range: width 2.4–3.3 cm, length 2.6–3.2 cm) (Figure 4).
3. Complications

Two patients had postoperative hematoma, without further surgical intervention. None of the patients complained of paresthesia over the medial forearm. No superficial or deep infection was recorded. No dysesthesia at the incision site or hypertrophic scar was reported.

Discussion

Cubital tunnel syndrome can be caused by various etiologies, such as osteoarthritis, cubitus varus after lateral condyle nonunion, ganglion etc. In this study, all patients had idiopathic cubital tunnel syndrome and we excluded other patients with secondary associated pathologies.

The diagnosis of cubital tunnel syndrome is based both on the clinical and neurophysiologic study. Symptoms such as paresthesia in the ulnar nerve territory, weakness of the grip strength or claw hand deformity and Tinel sign, elbow flexion test, Froment sign and Wartenberg sign can be positive at physical examination. Neurophysiologic study could be used to confirm the entrapment of the nerve.

Inching method applied in this study has been reported in the literature. Imaoka et al reported in their clinical series of carpal tunnel syndrome that even a subtle change at the short span of nerve conduction could be detected by this method, since this method is characterized by high sensitivity and specificity for the diagnosis of carpal tunnel syndrome [10].

As for surgical technique, subcutaneous or submuscular anterior transposition of the ulnar nerve [2], simple in situ decompression [3,4], medial epicondylectomy [5] are reported. Simple in situ decompression method is indicated if there is no cubitus valgus deformity or subluxation of the ulnar nerve. Anterior transposition is suitable for athletics who throw the ball, because during that movement, excessive strain in the medial elbow and ulnar nerve is loaded. When there is subluxation of a nerve or associated pathologies, medial epicondylectomy can be used. Medial epicondylectomy was done to 16 patients in the 1950s by King and Morgan [5]. They decompressed the ulnar nerve as in a simple in situ decompression with intravenous or partial anesthesia. Keeping the continuity with flexor/pronator muscles and the ulnar collateral ligament are essential. Complications such as postoperative tenderness over the removed bone, weakness of flexor or pronator muscles have been reported [11–14]. Three methods of ulnar nerve anterior transposition have been described: subcutaneous, subfacial, submuscular and each has advantages and disadvantages. Subcutaneous transposition is relatively less complicated but hypersensitivity due to direct trauma is a reason for concern. Sufficient vascular supply to the decompressed nerve is a benefit of intramuscular transposition, but additional compression by fibrous scar can be a problem [15,16] Submuscular transposition is a relatively extensive operation which requires z-lengthening of the flexor pronator muscle and postoperative immobilization is inevitable for a certain period of time after the operation [9,16,17].

We found nine anconeus epitrochlearis muscle during the operation. This is an anomalous muscle which arises from medial border of olecranon and inserts into the medial epicondyde, it crosses the ulnar nerve from medial epicondyle to olecranon. The human muscle is about 30 mm in width and its thickness is 3 cm in the middle, and it is believed to protect against the pressure, help the function of triceps brachii and prevent the dislocation of the ulnar nerve when the elbow joint is extended. We excised all these muscles to avoid recurrence or exacerbation of symptoms due to inadvertent scarring.

Previous reports in the literature state that the result of operation in cubital tunnel syndrome depends on the duration and severity of symptoms as well as the age rather than on the operation method. Heitloff claims that every operation for cubital tunnel syndrome has similar results, so the operation method should be selected depending on simplicity [17]. Nabhan et al performed 32 simple decompression and 34 subcutaneous ulnar nerve transposition out of 66 patients and found that there were no significant differences between the outcomes of the two groups at either postoperative follow-up examination. Thus, they recommended simple decompression of the nerve in cases without deformity of the elbow, as this is the less invasive operative procedure [18].

In their prospective randomized study comparing 35 simple decompressions and 35 submuscular transpositions in severe cubital tunnel syndrome Gervasio et al found no statistically significant difference between the two groups with regard to the clinical or the electroneurophysiological outcome. Their results were good and excellent in 80% (simple decompression) and 82.86% (submuscular transposition) of cases [19].
Taniguchi et al. did a simple in situ decompression surgery in 17 patients (18 elbows) with 1.5-2.5 cm skin incision. All patients improved symptoms without the ulnar nerve dislocation [20]. In their meta-analysis of randomized controlled trials Zlowodzki et al. suggest that simple in situ decompression of the ulnar nerve is a reasonable alternative to anterior transposition for the surgical management of the ulnar nerve compression at the elbow in patients with cubital tunnel syndrome [21].

Conclusion

The advantage of this simple decompression using minimal skin incision is 1) it is as effective as transposition procedure, 2) early return to work without hospitalization, 3) a small surgical scar, 4) minimal surgical complications.

Future research in this area should evaluate the efficacy of simple decompression in comparison with anterior transposition of the ulnar nerve (study with objective outcome measures and blinded outcome assessments).

Literatura


Sažetak

Uvod

Sindrom kubitalnog tunela jedna je od najučešćijih kompresivnih neuropatija gornjih ekstremiteta pored sindroma karpalnog tunela. Skorozinje minimalno invazivne tehnike podstakle su kliničko istraživanje za jednostavnim i minimalnom kožnom incizijom kod idiopatskog sindroma kubitalnog tunela.

Materijal i metode

Sažetak je bilo jedan od najučešćijih sindrom karpalnog tunela. Skorozinje minimalno invazivne tehnike podstakle su kliničko istraživanje za jednostavnim in situ dekompresijom minimalnom kožnom incizijom kod idiopatskog sindroma kubitalnog tunela.

Literatura

procedurom, uzimajući u obzir simptome. Postoperativni rezultati kod pacijenata (bol, povratak normalnim aktivnostima i poslu, osetljivost ožiljka) bili su uporedivi sa objavljenim serijama anteriorne transpozicije. Zadovoljavajući rezultati bili su zabeleženi kod 81% pacijenata sa I i II stepenom. Bilo je dva slučaja sa hematomom kao postoperativnom komplikacijom.

**Zaključak**
Jednostavna dekompresija uz korišćenje minimalne kožne incizije jednostavna je, sigurna i efikasna metoda za tretman pacijenata sa idiopatskim sindromom kubitalnog tunela. Metoda je jednako efikasna alternativa drugim metodama za rešavanje sindroma kubitalnog tunela koja podrazumeva manju hiruršku traunu, manji morbiditet i kraći period oporavka sa dobrim hirurškim ishodom, naročito kod blagih i umerenih slučajeva.

**Ključne reči:** Hirurška dekompresija; Sindrom kubitalnog tunela; Ulnarni nerv; Kompresivni sindrom ulnarnog nerva; Koža + hirurgija

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