



Preoperative Etiological Diagnosis and Redefinition of Ulnar Tunnel Syndrome

Xinying Huang^{1,2,4,5#}, Zongqi You^{1,4,5#}, Lei Xu^{1,4,5}, Junjian Jiang^{1,4,5*} and Chunyuan Cai^{3*}

¹Department of Hand Surgery, Huashan Hospital, Fudan University, China

²Shanghai Medical College, Fudan University, China

³Department of Orthopedics, The Third Affiliated Hospital of Wenzhou Medical University, China

⁴Key Laboratory of Hand Reconstruction, Ministry of Health, China

⁵Shanghai Key Laboratory of Peripheral Nerve and Microsurgery, China

#These authors contributed equally to this work

Abstract

Background: Clarification of etiologies behind Ulnar Tunnel Syndrome (UTS), a compressive neuropathy of the ulnar nerve, has not been valued in clinical practice, which results in impacted therapeutic effect. Here we report a consecutive series with UTS focusing on etiologic diagnosis, which guide surgical strategies choices.

Purpose: To clarify etiologies behind Ulnar Tunnel Syndrome (UTS).

Methods: 13 patients with UTS have been enrolled in this study between June 2018 and March 2020. All patients adopted imagological examination and electrophysiologic evaluation before operation and received surgical management. The follow-up period was set at least 12 months after surgical intervention and QuickDASH score served as assessment of outcomes.

Results: All the etiologies behinds UTS of patients can be clarified by preoperational imagological examination and surgical managements were employed as etiological treatments. All of them gained satisfactory prognosis after more than 12 months of follow-up.

Conclusion: All these cases with UTS stem from explicit etiologies and thus careful imaging investigation, early etiologic diagnosis and surgical management guided by preoperative assessment ought to be indispensable for a good rehabilitation, so that choosing surgical management for cases without clear imaging findings should be more cautious and different diagnoses should be considered. Also, since nearly all UTS cases can be found explicit etiologies, the diagnosis of “ulnar tunnel syndrome” seems to be too vague while all these cases can be classified to ulnar nerve injury by clear etiology located at ulnar tunnel.

Keywords: Ulnar tunnel syndrome; Compressive neuropathy; Etiologic diagnosis; Surgery; Ulnar nerve injury

Key Points

- Almost all cases of UTS can be clarified explicit etiologies.
- Highlight the importance of preoperational etiological diagnosis of UTS by ultrasound.
- Surgical strategy choice should be based on clear etiological imaging diagnosis.

Abbreviations

UTS: Ulnar Tunnel Syndrome; DASH: Disability of the Arm, Shoulder and Hand Questionnaire; EMG: Electromyography; CTS: Carpal Tunnel Syndrome; CuTS: Cubital Tunnel Syndrome

Introduction

The ulnar tunnel proper, known as “Guyon’s canal,” is one potential but not unique site of ulnar nerve compression at the wrist. It also includes pisohamate tunnel and hypothenar segment. Bachoura et al. [1] elaborated it in their anatomical study that the ulnar tunnel defined as a triangular bone fiber pipe, surrounded by the bone and ulnar flexor tendon, with the palmar fascia and palmar

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*Correspondence:

Junjian Jiang, Department of Hand Surgery, Huashan Hospital, Fudan University, Shanghai, 200040, China, E-mail: jjdoctor@126.com

Chunyuan Cai, Department of Orthopedics, The Third Affiliated Hospital of Wenzhou Medical University, Zhejiang, China, E-mail: charles_caicy@163.com

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brevis at the top and the flexor support band at the bottom. There are 3 typical sites of compression: Before the bifurcation of the nerve, on the motor branch and on the superficial branch.

Our understanding of the anatomy of the ulnar tunnel has increased and there were multiple managements applied to UTS patients and their effects have been confirmed. Among them, Murata et al. [2] initiatively described management and outcomes of UTS in 31 surgical treated cases, of which all cases achieved improved clinical symptoms after surgery. Subsequently, Villarruel et al. [3] employed research about endoscopic decompression for ulnar nerve, and entire 26 patients recovered with more than acceptable outcome. In addition, conservative management was reported to be effective for UTS as well [4]. These studies, however, have failed to investigate regarding correlation between preoperative etiologic diagnosis and treatment strategies choice. We report here a consecutive series of 13 patients with UTS focusing on etiologic diagnosis, which guide surgical strategies choices.

Methods

Patients

In our retrospective series, 13 cases diagnosed with primary UTS (9 males and 4 females) were enrolled in our study from June 2018 to March 2020 (Table 1). The ages of the patients at surgery ranged from 37 to 69 years, with a mean age of 53 years. The patients experienced symptoms 8 in the right hand and 5 in the left hand.

Preoperative evaluation

The clinical symptoms included numbness, tingling and/or paresthesia in the ulnar nerve distribution, positive Tinel's sign at the ulnar tunnel, Phalen's test, and motor weakness or muscle atrophy of intrinsic muscles. The preoperative electrophysiologic evaluation all presented typical reduction of motor potential in hypothenar muscles and first dorsal interosseous muscles.

Ultrasound can be useful for exploring space occupying lesions. The etiologies were basically divided into ganglion cyst (n=5), fascia compression (n=4), vascular dilatation and compression variation (n=2), neurinoma (n=1) and lipomyoma (n=1).

Surgical managements

The surgical procedures differed according to the pattern of

etiologies. There were 3 different surgical strategies applied to these patients (release of Guyon's tunnel for 4 cases, mass excision for 7 cases, and hyperplasia resection and synovectomy for 2 cases). After surgery, the wound was closed, and a bulky dressing or plaster splint was applied. Sutures were frequently removed at 10 to 14 days postoperatively and everyone was immobilized for 3 weeks.

Prognosis

Clinical evaluation of UTS patients after surgery typically uses the Italian validated QuickDASH scores measure of postoperative outcome (A good recovery was defined as QuickDASH scores 15) [5]. The follow-up started after surgery and physical examination and electrophysiological examination were routinely taken from 12 to 20 months afterward.

Results

All patients gained satisfactory prognosis (QuickDASH scores 15) within 12 months of follow-up (Table 1).

Typical case

38 years young female IT practitioner presented with a 10 months' history of progressive weakness of the left hand. She always sensed a slow onset weakness in her left hand during daily working. On examination, there was wasting of hypothenar eminence. Tinel's sign, Book test and Card test were also positive, confirming the weakness of adductor pollicis and interossei both palmar and dorsal. Sensory impairment was present in the distribution of ulnar nerve in hand. Electromyographic (EMG) examination demonstrated that the left ulnar nerve for interosseous muscle showed delayed latencies. Despite continued conservative therapy, the patient's symptoms worsened over a period of time.

Preoperative ultrasound showed space occupying lesion in the ulnar tunnel site, (Figure 1A) which is considered to be the etiology behind symptoms of the patient. After finishing other routine preoperative examination and taking proper consent, the patient was operated through Brunner- type incision over the interval between pisiform and hook of hamate. When the ulnar-carpal canal was separated, a neurinoma was detected and there were distinct narrowing and flattening of ulnar nerve beneath the distal edge of the volar carpal ligament. Then we carefully peeled off the neurinoma and finally an extra-neural neurolysis of ulnar nerve at the wrist was

Table 1: Summary of Patient Characteristics and Clinical Outcomes.

Patient No.	Age/Sex	Dominant Side	Diseased Side	Etiology	Surgical Strategy	Follow-up Month	Outcome
1	38/F	Right	Left	Neurinoma	Mass excision	13	GR
2	69/F	Right	Left	Fascia Compression	Synovectomy	12	GR
3	63/M	Right	Right	Fascia Compression	Synovectomy	12	GR
4	46/M	Right	Right	Vascular Dilatation	Nerve Decompression	18	GR
5	51/M	Right	Right	Ganglion Cyst	Mass excision	14	GR
6	53/M	Right	Right	Ganglion Cyst	Mass excision	12	GR
7	37/M	Right	Right	Ganglion Cyst	Mass excision	14	GR
8	61/M	Right	Right	Lipomyoma	Mass excision	18	GR
9	56/M	Right	Left	Ganglion Cyst	Mass excision	20	GR
10	49/M	Right	Right	Ganglion Cyst	Mass excision	14	GR
11	65/F	Right	Right	Vascular Dilatation	Nerve Decompression	12	GR
12	57/M	Right	Left	Fascia Compression	Nerve Decompression	13	GR
13	43/F	Right	Left	Fascia Compression	Nerve Decompression	12	GR

F: Female; M: Male; GR: Good Recovery (QuickDASH scores \leq 15)

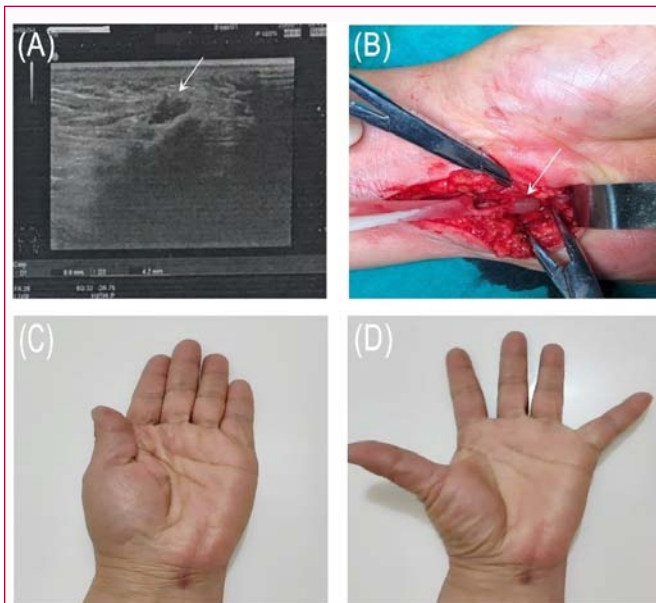


Figure 1: A) Preoperative ultrasound examination; B) Intraoperative exposure of neurinoma at ulnar nerve in Guyon's canal; C, D) Functional recovery at 13 month after neurinoma excision and ulnar nerve release.

completely performed. The wound was closed in layers as a rule. Postoperatively, the patient was placed in a volar splint for 2 weeks and then weaned out of the splint and began early range of motion and strengthening exercises.

The symptoms improved 12 months after the surgery with partial recovery of motor weakness and sensibility and achieved 15 scores of QuickDASH questionnaire. The electromyographic control was performed, showing increase in the conduction velocity at final follow up.

Discussion

Ulnar-nerve compression syndromes were first described by Shea and McClain [6]. In short, UTS is derived from ulnar nerve compression from surrounding structures, which lie within ulnar-carpal canal [7]. Although the pathogenesis of this disorder remains complex, several etiologies have been proposed, including trauma, ganglion, thrombosis, lipomyoma, neurinoma, vascular dilatation and so on. It is now well established that surgical management, endoscopic surgery and conservative treatment have shown curative effects for UTS respectively. Specifically, clinical work from our group confirmed choosing surgical strategies based on preoperative etiologic diagnosis are safe and reliable to deal with secondary UTS.

To date, few reports have specifically addressed the relationship between etiologic factor and treatment choice of UTS in previous studies. It is generally accepted that the incidence of UTS is much less than that of either Carpal Tunnel Syndrome (CTS) or Cubital Tunnel Syndrome (CuTS).

Numerous factors may cause UTS, and in fact, a large proportion of the literature on UTS is dedicated to anatomic review that describe the various classification of this disease [8,9]. This study, however, emphasized that in almost all cases with UTS, explicit etiologies can be located with the aids of preoperative imaging investigation. And these patients should receive early and targeted surgical treatment.

Regarding the cause of UTS, it seems that most cases owe it to

compression of ganglion on a segment of the ulnar nerve [6,7,10]. In our experiences, likewise, the most common cause for ulnar nerve compression was ganglion. The possible reason for this same consequence is that the ganglion was of frequent occurrence at this site and UTS was secondary to it in common. Reviews of medical literature indicated that conservative management seems initiated and effective in some cases [4,11]. Nevertheless, little or no evidence exists regarding the role of non-operative treatment for UTS in our experiences because the surgical management is necessary based on the definite etiologies.

In clinical practice, preoperative assessment, and diagnosis from clinicians for UTS are mostly based on typical symptoms and remain at the symptomatic diagnosis. If compression exists in a single site and then predicts the specific site of ulnar nerve compression from the presenting clinical symptoms can be reliable diagnosis and surgical treatment can be safe. However, when compression occurs in more than one site or there is other underlying etiologies with similar symptoms, diagnosis of the compressive site by clinical symptoms seems to be unreliable. On the other hand, considered the fact that almost all the UTS can receive etiologic diagnosis before surgeries, those cases fail to find specific cause through sufficient preoperative investigation should be taken more curious for differential diagnosis, and other potential primary etiology should be excluded for those cases before surgical management.

Also, since all the etiologies behind UTS cases in our studies can be clarified by preoperative assessment, which can also be achieved in other hospitals with the aid advanced diagnostic techniques now, it can be too vague to use "syndrome" to describe these cases and the diagnosis of "ulnar nerve syndrome" seems to be controversial. We prefer to classify those cases of UTS to ulnar nerve injury with clear etiologies located at ulnar nerve in clinical practice. This redefinition can be better for etiological diagnosis and guiding surgery choice.

From our experience with such cases, imagological examination such as ultrasound and subsequent targeted surgical exploration are extremely reliable way to clarify the cause of compression. In our study, all cases associated with clinical symptoms of UTS were examined by electrophysiologic evaluation and imaging investigation on the ulnar nerve distributing area, and apparent impairments of the ulnar nerve at or distal to the wrist and explicit etiologies were confirmed. And surgical exploration and decompression of the ulnar tunnel acquire favorable results. Case series and comparative studies remains to be warranted and addressed forward in future.

Conclusion

In conclusion, our study summarizes 13 cases and illustrated that most cases of UTS are derived from explicit etiologies which can be detected by preoperative investigation. Surgical strategies choices depend on etiologic diagnosis based on ultrasound can be safer and more effective for nerve decompressing and symptoms relieving. Also, the "ulnar nerve syndrome" can be considered to be redefined as ulnar nerve injuries with clear etiologies located at ulnar tunnel.

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