

A Review of the Diagnosis, Treatment, Prognosis and Revision of Cubital Tunnel Syndrome

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Abstract

Cubital tunnel syndrome (CuTS) is one of the most common peripheral nerve entrapment diseases, which incidence rate is second only to carpal tunnel syndrome. Electromyography plays a key role in disease diagnosis. High frequency ultrasound and MRI make the diagnosis more accurate. Conservative treatment is effective in patients with early and mild symptoms. For patients with conservative failure or surgical indications, the effect of early operation is better than delayed operation. Although the curative effect of surgery is accurate, most severe cases have residual symptoms, and the best operation method is controversial. With the progress of applied anatomy and the summary of clinical experience, its surgical methods are constantly improved. At the same time, the application of microscope and endoscope in the treatment of cubital tunnel syndrome is becoming more and more mature. Paying attention to minimally invasive treatment, reducing complications and standardizing the diagnosis and treatment of cubital tunnel syndrome has gradually become the focus of research.

Keywords

Cubital tunnel syndrome; Diagnosis; Treatment.

1. INTRODUCTION

When the ulnar nerve is oppressed along the way, it will cause nerve function damage, and most of the clinical manifestations are ring little finger numbness and hand muscle atrophy. The main compression plane is the elbow and wrist segment, Among them, CuTS refers to the compression of the ulnar nerve at the elbow plane. In the cubital canal and its distal and proximal parts, there are many structures that may oppress the ulnar nerve, including proximal Struthers tendinous arch, medial arm septum, Osborne ligament, flexor Carpi ulnaris aponeurosis, flexor-pronator teres deep aponeurosis. The ulnar nerve in the cubital tunnel is shallow, the nerve is easy to be pulled under the flexion movement of the elbow, the nerve is affected and leads to the increase of internal pressure, external compression or internal volume, which may lead to cubital tunnel syndrome. The above are the causes on the basis of CuTS anatomy, others include: ulnar nerve traction; local trauma and strain; abnormality of elbow bone; including tendon sheath cyst, mass and other space occupying lesions; congenital abnormalities such as congenital elbow valgus, nerve dislocation, compression of posterior elbow muscle on trochlea, etc. [1]. In recent years, people gradually use high-frequency ultrasound, magnetic resonance and other auxiliary diagnosis of CuTS, etiological diagnosis has also been improved, pay attention to the early etiology in the treatment. Now there are a variety of treatment options, but also to provide more options to solve the different problems of patients, the ultimate goal is to restore the function of the affected limb. This article reviews its diagnosis, treatment, prognosis and revision.

2. SACCURATE DIAGNOSIS OF CUTS

The early clinical manifestations of cubital tunnel syndrome were abnormal sensation in the ulnar ring of the limb, the skin of the little finger and the ulnar skin of the back of the hand, and the skin sensation decreased significantly with the aggravation of the disease. The late progression is motor dysfunction, which is clinically characterized by weakness of muscles such as interosseous muscle, adductor pollicis muscle and vermis muscle, which can eventually lead to hand deformities in specific positions. The diagnosis is mainly based on the combination of medical history, the results of precision examination and electromyography.

Neuroelectrophysiological examination is the gold standard for the diagnosis of cubital tunnel syndrome, which can detect nerve injury in the early stage. Its limitation is invasive examination, and can not directly show the morphology of the ulnar nerve and the surrounding tissue structure, can not determine the cause. Ultrasound can determine the morphological changes of ulnar nerve more accurately and intuitively by measuring the cross-sectional area, swelling rate, internal echo, blood flow and flattening ratio of ulnar nerve [2]. MRI has good soft tissue resolution and can clearly display nerves and surrounding soft tissue. In order to make the inner structure of the nerve show more detailed, people try a variety of techniques, such as fat reduction, neuroimaging and so on. Magnetic Resonance Neuroimaging (MRN) clearly displays the interior of peripheral nerves and obtains high-resolution neural images. Although MRN has the advantages of fine resolution, it cannot show the growth of nerve axons, so it is inconvenient to judge nerve regeneration, and the inspection cost is high [3].

3. SCURRENT STATUS AND PROGRESS OF TREATMENT

3.1. Conservative Treatment

Mild and moderate patients received early conservative treatment, and most symptoms were significantly relieved. Shah et al. prospectively analyzed the symptom improvement of mild to moderate CuTS treated with rigid night splint and improved corrective activities [4]. The patient improved significantly. Conservative treatment mainly includes health education, immobilization, elbow pads, physical therapy, neurotrophic, non-steroidal anti-inflammatory drugs, and corticosteroid injections. Choi et al. reported a new method [5]. Intra-plane injection of triamcinolone acetonide 40mg and 1% lidocaine 2mL under the precise guidance of ultrasound can improve the symptoms and electrophysiological results of patients. Ultrasound-guided intraplanar injection may be a safe and effective non-operative treatment.

3.2. Surgical Treatment

For the ineffective conservative treatment, patients with surgical indications should be treated early and actively. With regard to the choice of surgical methods, there are many surgical methods for the treatment of cubital tunnel syndrome, but it is still controversial to unify the best surgical methods. Common surgical methods include in situ release, subcutaneous ulnar nerve preposition, intramuscular ulnar nerve preposition and submuscular ulnar nerve preposition, resection of medial epicondyle of humerus and so on.

In situ release: the ulnar nerve of the elbow was located directly and the incision was opened on the inside of the elbow joint. This method is the simplest, does not destroy the accompanying blood supply of the nerve, the operation time is short, and the effect is determined. The disadvantage is that the nerve is still in the original cubital canal and the original tissue bed, which can not treat the nerve subluxation and can not avoid the influence of elbow flexion and extension movement on the pressure in the nerve. Therefore, it is not suitable for patients with ulnar nerve dislocation, elbow fracture and bony deformity.

Anterior ulnar nerve: The main surgical methods for the treatment of CuTS include submuscular, intermuscular and subcutaneous preposition of ulnar nerve. The purpose is to remove the compression and traction of the ulnar nerve so as to decompress the ulnar nerve completely. at the same time, because of the limitation of the indication of simple decompression, the anterior operation has gradually become the most commonly used method for the treatment of CuTS. Intramuscular preposition is the most controversial in preposition, which is seldom used because of excessive bleeding and easy scar formation after muscle bed operation, so the choice between subcutaneous preposition and submuscular preposition depends on the complete relief of nerve entrapment after nerve transposition, the good quality of nerve bed and the smoothness of nerve passage. as long as these three requirements are met, the two surgical methods can achieve satisfactory results. Confirmed by a large sample size of follow-up, subcutaneous prepectoral is close to the overall efficacy of submuscular prepectoral, and the subcutaneous prepectoral procedure is less traumatic and has few complications and is currently adopted by most scholars [6,7].

Resection of the medial epicondyle: the medial epicondyle of the humerus adjacent to the ulnar nerve is removed to achieve the release effect, which was first reported by King in 1950[8]. In this operation, the medial epicondyle of humerus was fully exposed and resected, and the ulnar nerve was loosened properly. The disadvantage lies in the risk of injury of the medial collateral ligament of the elbow joint caused by total resection of the medial epicondyle, resulting in the instability of the elbow joint. A study in 2020 compared orthotopic decompression with partial medial supracondylar resection[9]. The study showed that both operations had satisfactory results in the long run, while the former had better grip strength and better curative effect than the latter. therefore, for patients who are also suitable for indications, in situ decompression may be sufficient.

3.3. Selection of Decompression Operation

At present, there is a consistent point of view: patients with osseous abnormalities of the elbow choose anterior surgery; for patients without osseous abnormalities of the elbow, decompression alone may be the first choice, and its complexity is low. and there is no evidence that the effect is worse than other decompression operations [10,11]. For severe patients, the trend of surgical treatment is to release in situ. In 2019, Said et al. published a Meta analysis article comparing simple release and preposition [12]. The study found that there was no difference in surgical efficacy between the two groups, but there was a significant increase in pre-operative complications. Some scholars [13] conducted a clinical retrospective study of 146 patients with preoperative evaluation of McGowan III grade, and found that there was no significant difference between simple release and subcutaneous preposition surgery.

3.4. Progress in the Application of Surgical Techniques

Compared with decompression methods, the application of appropriate minimally invasive techniques is equally important, pay attention to avoid iatrogenic injuries, careful hemostasis and adequate decompression to reduce complications. The application of microsurgical technique in the surgical treatment of CuTS has a good clinical effect. The application of endoscopic technique has made great progress in the minimally invasive treatment of CuTS. At present, endoscopic preposition of the ulnar nerve can be completed and achieved significant results [14]. There was no significant difference in the long-term effect between endoscopic surgery and open surgery, but endoscopic treatment had shorter recovery time and fewer complications. In addition, a new minimally invasive technique is increasingly becoming a research hotspot. That is to use small incision release operation, which uses 1-2cm incision and "dilatator" to fully decompress to achieve the best curative effect, which is simpler and more cost-effective than endoscopic surgery [15].

4. PROGNOSIS AND REVISION OF CUTS

The prognosis of mild to moderate cubital tunnel syndrome is good, and the active operation of severe patients can be recovered. However, the recovery period is long and the symptoms remain, especially in patients with high stage with muscular atrophy and hand claw deformity, which recover for 3-5 years or more. The study shows that the preoperative course and age are negatively correlated with the prognosis, while the preoperative nerve motor conduction velocity is positively correlated with the prognosis [16]. It is worth noting that no matter which kind of operation, there is the possibility of failure. When symptoms worsen, new symptoms occur, symptoms persist or relapse, they may need to be treated again. If the patient is willing and the doctor evaluates the surgical significance, revision can be recommended to help the patient alleviate the pain. However, the choice of the best revision procedure is still controversial. Nellans and Tang [17] proposed that submuscular preposition of the ulnar nerve should be the first choice for revision.

5. SUMMARY AND PROSPECT

Accurate diagnosis of CuTS provides a basis for the identification of etiology and the selection of surgical methods. The progress of imaging and anatomical research and the summary of clinical experience have continuously improved the surgical methods, and provide support and promotion for the application of endoscopic minimally invasive treatment. Although the curative effect of ulnar nerve surgery is satisfactory, the prognosis of patients with long course and severity is poor, especially in patients with late surgery or revision surgery. At the same time, with the increase of surgical treatment, the reports of surgical failure, recurrence and revision have also increased in recent years, patients bear more pain and economic pressure, and the recovery effect of the second-stage operation is also worse. In the future clinical work, it is still necessary to standardize the diagnosis and treatment of CuTS. In addition, the reduction of complications is as important as the efficacy of treatment. Compared with decompression methods, appropriate surgical techniques are more important. Paying attention to minimally invasive treatment, reducing complications and reducing the revision rate of recurrence are also the focus of research.

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