Cubital tunnel syndrome: A retrospective analysis of surgical management

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Abstract

Introduction: Cubital tunnel syndrome (CuTS) is a condition of ulnar nerve dysfunction due to prolonged compression at the elbow often caused by cubitus valgus deformity of lateral epicondyle fracture. The main objective of this study is to share our experience of and to review the role of surgical decompression and anterior transposition (SDAT) of ulnar nerve in long-term relief of the symptoms.

Materials and Methods: Retrieval of case records of CuTS and retrograde analysis of data was performed. The inclusion criteria were availability of relevant clinical information, finding of severe nerve compression in nerve conduction study (NCS), insignificant MRI of cervical spine and SDAT. About 100 cases of ulnar nerve compression underwent surgical management from 2008 till 2021. Of them, only 54 fulfilled all the criteria. Minimum follow up period was 18 months after surgery.

Results: Among 54 cases, 20 were females, 34 males, and mean age was 31 years. Three most common clinical features were paresthesia, motor weakness and hand muscle atrophy. Symptomatic relief was achieved in 54/54 (100%) and complete motor recovery in 34/54 (63%) cases after SDAT. However, muscle atrophy recovery was not observed in any. There was no surgical complication, no features of recurrence nor was there re-surgery in any at least for 18 months after surgery.

Conclusions: SDAT provides long-term relief for CuTS without recurrence. Muscle atrophy is irreversible though other symptoms improve. Therefore, early surgery before appearance of muscle atrophy is advocated.

Key words: CuTS, recovery, SDAT, surgical management

Introduction

Ulnar nerve is a branch of brachial plexus with its nerve roots arising mainly from C8 and T1. It travels down the posterior and medial aspects of arm, forearm and hand. The ulnar nerve has motor supply to muscles of anterior forearm and must of the intrinsic muscles of hand. It also has sensory supply to the medial one and half fingers, hypothenar of the palm and the underside of the forearm through a palmar and dorsal branch. Ulnar nerve entrapment commonly occurs at cubital tunnel at elbow and thus can cause pain, numbness and tingling in the forearm and medial two fingers. In severe cases, it can also cause motor weakness, muscle atrophy and thus ultimately leading to claw hand deformity if not treated in time.

Cubital tunnel syndrome (CuTS) is a chronic condition of ulnar nerve dysfunction. It is caused by chronic compression of the nerve at elbow and symptoms appear years later, and thus is also called Tardy Ulnar Nerve Palsy.[1,2] It occurs mainly due to stretch and progressive compression of ulnar nerve over the medial epicondyle. It typically occurs when there is valgus deformity of elbow as a result of lateral epicondyle fracture during childhood. Ulnar nerve palsy can also occur due to recent or old direct trauma to ulnar nerve at elbow or wrist.

Different surgical procedures are currently in practice like decompression of nerve, anterior transposition, osteotomy of medial epicondyle etc.[3] The ultimate aim of surgical management is adequate decompression of nerve with no or minimal possibility of recurrence in future. Different surgical procedures may have pros and cons.

We have been practicing surgical decompression and anterior transposition (SDAT) of nerve for more than 15 years and we have found it technically easy and very

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effective not only in alleviating the symptoms but also in preventing recurrence. Thus, we hypothesized that SDAT is an ideal surgical management for CuTS.

In this article, we have tried to retrospectively analyze the cases of CuTS and share our experience of its surgical management and long-term outcome.

2. Materials and methods

This is a retrospective case series analytical study of ulnar nerve compression at elbow. This study was approved by our Institutional Review Board and all patients provided informed consent before participation.

Patient selection

The cases of CuTS were classified according to Dellon classification into mild, moderate and severe groups for the sake of management. Moderate and severe groups were taken for surgery. According to this system, intermittent paresthesia and subjective weakness were classified as mild ulnar nerve compression (grade I). Intermittent paresthesia and measurable weakness in pinch and grip strength were classified as moderate compression (grade II). Persistent paresthesia, measurable weakness in pinch and grip strength with intrinsic atrophy were classified as severe compression (grade III).

The cases included in this study were any case of ulnar nerve compression at elbow, male and female, with clinically and electrodiagnostically confirmed CuTS irrespective of cause, cubital valgus deformity or direct trauma. Electrodiagnostic study, nerve conduction study (NCS), was conducted and interpreted by a neurophysician, a coauthor of this research article, at our institution. She was also one of the major referrer of the cases for surgical management. The inclusion criteria were Dellon grade II and III, availability of relevant clinical information, finding of moderate to severe nerve compression in NCS, insignificant MRI findings of cervical spine and SDAT. The excluded cases are those with ulnar nerve compression at other than elbow, those without MRI of cervical spine, those with nerve injury and repair and those without adequate medical records and information.

Those with mild compression of ulnar nerve in NCS, even though clinically moderate or severe, were not operated and considered for conservative management. Many of them got better with conservative treatment with oral steroid, analgesics etc. for few weeks. If not relieved, NCS was repeated and considered for surgery if it showed worse findings. Surgery was considered if motor symptoms and muscle atrophy were present even though NCS showed only moderate compression.

About 100 cases of ulnar nerve compression underwent surgical management from 2008 till 2021. Of them, only 54 fulfilled all the criteria and thus their retrograde analysis was performed.

Surgical procedure

Surgery was performed under local (LA) or general anesthesia (GA), patient was placed in supine or semi-lateral position, facing towards affected arm, with the arm stretched out. The arm was rotated slightly laterally and elbow slightly flexed so that the medial epicondyle comes in the central and top position of surgical field.

About 5-7 cm long curvilinear incision was given in the medial aspect of the elbow, the center point of incision being located just behind the medial epicondyle. Subcutaneous dissection was done, ulnar nerve was identified proximally and further dissection and its exposure was carried out more distally. Once complete dissection and decompression was accomplished by releasing fascia and aponeurosis then the segment of the nerve was transposed anteriorly, anterior to medial epicondyle. A sling of subcutaneous soft tissue or fascia was prepared. The anteriorly transposed segment of nerve was covered under the sling, which was then sutured and fixed to surrounding tissues (Figure 1). No osteotomy or any other orthopedic procedure was performed in our cases.

Total duration of surgery was less than one hour and patient was discharged from hospital after two hours' observation. Patient was admitted in the hospital for one day or more for observation if indicated and in case of GA. GA was considered when patient denied LA or when anesthetist preferred GA. Intravenous antibiotic was given intraoperatively followed by oral antibiotics for 7 to 10 days. Intravenous steroids, methyl prednisolone, was used only if nerve was markedly inflamed and if patient admitted for few days. The dosage was 125-250 mg 2-3 times intravenously in a day for few days followed by oral prednisolone, 30-40 mg in a day in divided doses for about one week. Other medications included analgesics and anti-inflammatory agents.

Statistical Analysis

SPSS Statistical software, version 26.0 (SPSS Inc., IBM®, Chicago, IL, USA), was used for statistical analyses. Symptoms of patients were classified as per Visual Analogue Scale (VAS) for the sake of statistical analysis. Score for symptoms were given from 0-10, 0 being no pain or symptom and 10 the worst pain or symptom (Figure 2). The patients were further grouped on the basis of scores given into mild for VAS $\leq$2, mild to moderate for VAS $\leq$4, moderate for VAS $\leq$6, moderate to severe for VAS $\leq$8 and severe or worst for VAS $\leq$10. Above mentioned grouping of the patients was done both before and after surgical decompression and was compared. Mann-Whitney rank test was used to compare the symptom relief before and after surgical decompression.

Results

Out of about 100, only 54 cases fulfilled all the criteria and thus they were included in this retrograde analysis. Details of the cases are as shown in Table 1.

Follow up period ranged from 18 months to few years after surgery. The average age at the time of surgery was 31years (range, 19-57 years).

Most of our cases had moderate to severe symptoms according to VAS classification. Of total, 22 had moderate, 23 had moderate to severe and 9 had severe or worst symptoms. Muscle atrophy was found in 27 cases among which mild in 15 and severe in 12 cases.

There were no significant post-operative complications and nobody had further neurological worsening. Symptomatic relief was achieved in 54/54 cases (100%) *(p=<0.05)* immediately after surgery. However, residual numbness of involved hand and fingers remained for some time after surgery in more than half of the patients. In 46/54 cases (85%) residual numbness was mild, and in 8/54 (15%) moderate after about 2 weeks of SDAT (Table 2). The findings were statistically significant.

At 18 months follow up after surgery, most of the patients got much better with much less numbness and better hand grip. Complete motor recovery was observed after SDAT in 39/54 cases (72%) *(p=<0.05)*, even in cases with mild muscular atrophy. However, motor function recovery was only partial in the cases with severe atrophy. There was no significant recovery in muscular atrophy especially in those with severe atrophy. None of the patients had moderate to severe or worst residual symptoms.

Similarly, of 45 patients with moderate (n=22) to severe symptoms (n=23) (VAS=6-8), almost all of them improved significantly with mild residual (VAS <2) *(P<0.05)*. Of those with worst symptoms (VAS 10), residual symptoms were moderate (VAS<4) *(P<0.05)* (Table 3).

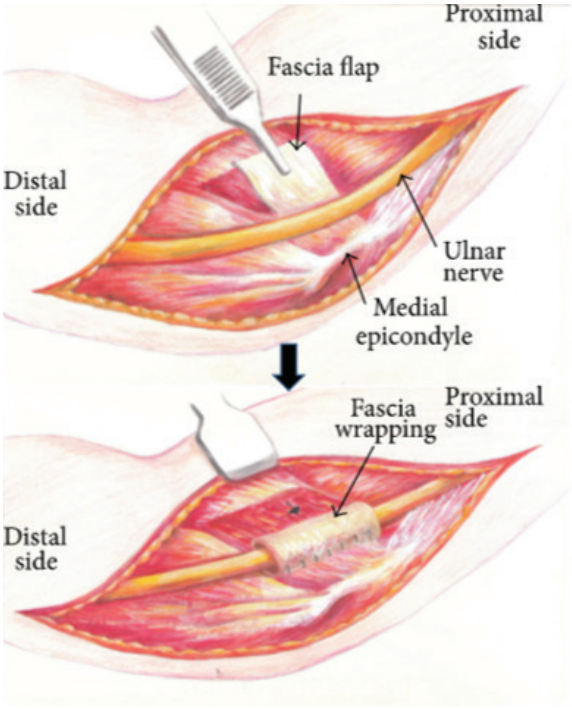

Figure 1: Technique showing anterior transpositioning and wrapping nerve with a soft tissue sling. (Courtesy: The Scientific World Journal/2014/Article/Fig 3)

Characteristics	Number of Patients (n=54)
Mean age (years)	31
Male:Female (n)	31:23
Mean duration of symptoms (months)	26
Dellon Classification	
Moderate (n)	22
Severe (n)	32

Table 1: Demographic and clinical characteristics of the cases

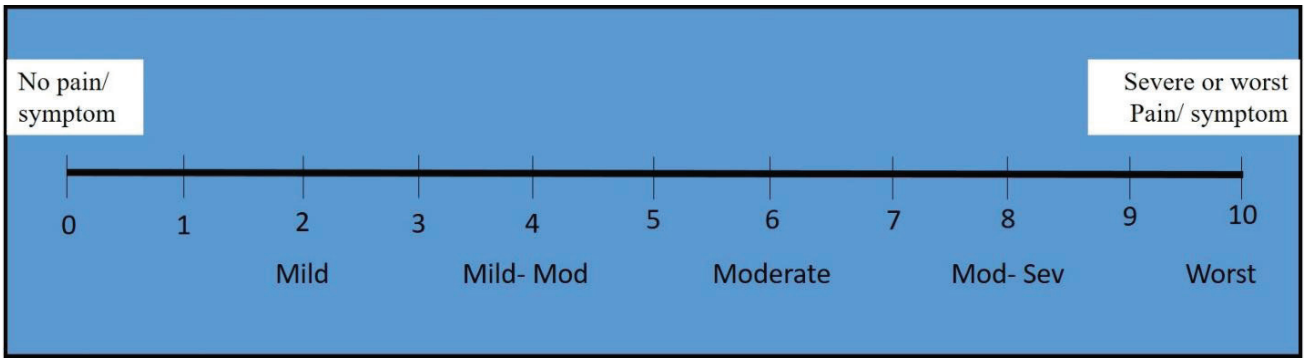

Figure 2. Visual Analogue Scale (VAS) showing classification of patients in different groups. Note: Mod- Moderate, Sev- Severe

Symptoms VAS	Before surgery (n)	After surgery (n)	p
Mild	0	0	
Mild-Mod	0	46	<0.05
Moderate	22	8	<0.05
Mod-Sev	23	0	<0.05
Severe-Worst	9	0	<0.05
Total	**54**	**54**	

Table 2: Comparison of number of patients among each group of VAS classification before and after 2 weeks of surgery. Note: n- number of cases, Mod- moderate, Sev- severe

Symptoms (VAS)	Before surgery	After surgery	p
Moderate	VAS ≤6	VAS ≤2	<0.05
Mod-Sev	VAS ≤8	VAS ≤2	<0.05
Severe-Worst	VAS ≤10	VAS ≤4	<0.05
Total	**54**	**54**	

Table 3. VAS outcome after SDAT at 18 months follow up

Discussion

Ulnar nerve is vital for normal function of hand, forearm and arm as it is responsible for the innervation of several principal muscles in this region. Its dysfunction not only causes discomfort such as pain and numbness but also leads to disability of upper limb. CuTS is the commonest peripheral nerve compression in the upper limb after carpel tunnel syndrome.[4]

In most of the cases, conservative management helps especially in mild to moderate cases. But in severe and the resistant cases surgery is the most for timely decompression in order to prevent possible complications such as muscle atrophy and motor weakness. Only surgical decompression without transposition may lead to recurrent compression due to the anatomical location of the nerve.

The main objective of this article is to emphasize that SDAT is the ideal choice of surgical management of CuTS not only in terms of clinical outcome but also for the prevention of recurrence.[5,6]

There are various ways of treating the cases of CuTS surgically and there is no consensus on the optimal operative procedure so far. At times there is confusion and conflicting opinions regarding simple decompression compared with anterior transposition of the ulnar nerve in the treatment of this condition. A meta-analysis conducted by Zlowodzki and team showed that there is no significant difference between these two procedures in terms of clinical outcome.[7] However, that study doesn't seem to have evaluated the possibilities of recurrence after each procedure. Adam Carlton and team also showed same type of results in their literature review.[8] They found that the only consensus was transposition preferred where the ulnar nerve tends to subluxate either on preoperative or intraoperative examination.

Some studies hypothesized that SDAT is more invasive and thus is more prone to infection.[9] However, our experience denies that and shows that SDAT is simple and without any significant complication.

The surgical procedure that we have been practicing is SDAT. Literatures show that anterior transposition of the ulnar nerve is one of the most commonly performed procedure for CuTS.[10]

SDAT can be done with minimal invasive technique with small incision [11] or with a relatively longer incision and dissection. We have been doing this surgery with relatively longer incision and wider dissection. However, there was no significant post-operative complication of wound healing. Subcutaneous suturing also helps in minimizing the scar and thus is more cosmetic friendly.

We have found the surgical technique of SDAT excellent in terms of immediate symptom relief and prevention of recurrence. Moreover, the surgery itself is simple, can be performed under local anesthesia without any need of hospital stay. In our experience most of our cases improved significantly and only a few had residual symptoms especially in those with severe pre-operative symptoms. We found severe case with muscle atrophy has worse outcome.

Previously published studies also showed the same results. One study showed that decompression and transposition not only relieve symptoms but also allows athletes to go back to their sports.[12] Another study also suggested that SDAT is helpful in case of subluxated nerve at elbow.[13]

Studies have shown that ulnar nerve becomes more vulnerable to compression during flexion movement due to traction. It becomes more so and thus aggravated by the valgus deformity of elbow due to previous lateral epicondyle fracture.[1,14] That is the reason why it has been claimed that CuTS can be permanently cured only by SDAT by avoiding further traction of the nerve.

Even though SDAT requires longer and deeper dissection it is not that invasive in our experience. Few studies have claimed that surgical cost is higher in case of SDAT,[15] however in our practice the cost is the same whatever procedure we do as it hardly needs any extra instruments or materials even though total time required is about 15 minutes longer. However, simple decompression without transposition definitely has some benefits such as shorter surgery, faster wound healing and early rehabilitation.[7,15-17]

Our study does have some flaws and limitations. Our series is small in terms of total cases and it contains

only SDAT without any comparison with simple decompression. Moreover, our study included the cases of CuTS due to both traumatic and idiopathic causes. Even though our experience showed muscle atrophy a predictor of poor outcome, we didn't statically analyze other factors influencing post-operative clinical outcomes.

Conclusion

On the basis of our experience, we conclude that SDAT is an ideal choice for managing the cases of CuTS surgically. Even though, incision size, duration of surgery, time taken for healing etc are some drawbacks of this procedure, our patients are happy with the final outcome. Severe symptoms with muscle atrophy are the poor prognostic factors. By this surgical procedure there is less possibility of recurrent compression.

Disclosure: There is no financial assistance from any source to conduct this study.

Conflict of Interest: None

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