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Role of Sulcus view radiograph of elbow in Ulnar Nerve Decompression

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Abstract

Cubital tunnel syndrome is the second most common compressive neuropathy after the median nerve. Different methods of treating have evolved over the years from simple decompression in situ to osteotomies and transpositions. Different modalities have been used to investigate the problem. In our report we would like to show that for a complete working and treating diagnosis of cubital tunnel EMG studies with a sulcus view radiograph are sufficient, cheap and quick. More detailed investigations like MRI, CT scan are although more detailed; do not add anything more worthwhile with regards to the management. An Electromyogram (EMG) will confirm the diagnosis of cubital tunnel decompression and a sulcus view will tell us the state of the ulnar bed for the purpose of deciding whether to do a simple decompression or a transposition.

INTRODUCTION AND AIM

Cubital tunnel syndrome is the second most common compressive neuropathy after carpal tunnel syndrome. Different methods of treatment have evolved over the years, each with its advantages and disadvantages. A study by Heithoff 1 suggests that for most cases a simple decompression is all that is required. Cases where there were additional problems like cubitus valgus, scarred bed, osteophytes, ganglion or a tumour, may require something other than a simple decompression, and a medial condylectomy was suggested.

Our hypothesis in this regard is that if we see bony encroachment of the ulnarnerve bed at the elbow, it may need an anterior transposition. However in most cases a simple decompression would suffice. We propose a simple plain radiograph to diagnose bony encroachment of the cubital tunnel. The aim of our study is to assess the value of a simple sulcus view radiograph of the elbow in deciding whether a patient with cubital tunnel syndrome needs either a simple decompression or a more extensive procedure like transposition of the nerve.

MATERIAL AND METHODS

A prospective study was carried between June 2003 and November 2004. All patients presenting with signs and symptoms suggestive of ulnar nerve entrapment at the elbow were studied. Detailed history and examination was carried out and patients were graded according to their symptoms using the McGowan’s classification.

McGowan established the following classification system:

Grade I - Mild lesions with paresthesia in the ulnar nerve distribution and a feeling of clumsiness in the affected hand; no wasting or weakness of the intrinsic muscles.

Grade II - Intermediate lesions with weak interossei and muscle wasting.

Grade III - Severe lesions with paralysis of the interossei and a marked weakness of the hand.

Nerve conduction studies were done to confirm the diagnosis. The exclusion criteria were: diabetic neuropathy, previous surgery or significant trauma to the elbow, and those with ulnar nerve neuropathy due to other causes such as cervical or Guyon’s canal entrapment. Cubital tunnel sulcus view radiographs were taken and evaluated for any evidence of bony encroachment of the ulnar nerve bed. Those with normal cubital tunnel views underwent a simple decompression procedure whereas those having positive findings underwent a subfascial anterior transposition of the nerve.

The results of the surgery were then assessed at follow-up using the Wilson and Krout’s 2 criteria:

Good: Alleviation of symptoms

Fair: Improvement with some persistence or recurrence of symptoms or inhibition of elbow function

Poor: No improvement after surgery

Patients were followed up at 6 weeks, 3 months, 6 months and one year.

RESULTS

We treated 30 patients with 31 elbows having undergone surgery (one patient had bilateral surgery). There were 21 males and 9 female patients. Side distribution was relatively equal (right = 15; left = 16). The mean age of the patients was 51 years with a range from 22-77years. All patients were classified according to McGowan's classification (Table 1). Sulcus views were done on all patients (Table 2).

Figure 1

Table 1: McGowan's Classification (n = 31)

Grade I	5
Grade II	18
Grade III	8

Figure 2

Table 2: Findings on radiograph

n	31
Positive findings	09
No positive findings	22

Out of the 9 patients with positive findings on sulcus view, osteoarthritic changes with impingement were present in five patients (16.1%), and the other 4 patients had other positive findings without impingement. As per the protocol 26 patients underwent a simple decompression procedure whereas the five patients with impingement underwent an anterior subfascial transposition. The patients were followed up at 6 weeks, and at 3, 6 and 12 months. They were graded according to Wilson and Krout criteria. At the close of the study the follow up was from 6 months to one year with a mean of 42 weeks. The post operative results were noted as a whole (Table 3) and then individually between the two groups (Tables 4 and 5). Three patients with poor results had ongoing problems as well. One patient had made partial recovery due to concurrent diabetic neuropathy whereas two patients with poor results were Grade III at the start. One of those also had concurrent cervical entrapment as suggested by the nerve conduction studies. Surgery on these patients was done to stop progression of the cubital tunnel entrapment. Early results have suggested that using the sulcus view in helping to decide the operative procedure has produced a favourable outcome without any compromise.

Figure 3

Table 3: Wilson Krout criteria at follow up

	At 3 months	At 6 months
Poor	3	3
Fair	8	7
Good	20	21

Total patients n = 31

Figure 4

Table 4: Follow up for patients who had simple decompression only

	At 3 months	At 6 months
Poor	3	3
Fair	7	6
Good	16	17

n = 26

Figure 5

Table 5: For patients who had anterior transposition n = 5

	At 3 months	At 6 months
Poor	0	0
Fair	1	1
Good	4	4

DISCUSSION

ANATOMY

The Ulnar nerve is the terminal branch of the medial cord of the brachial plexus and at the elbow is susceptible to compression due to a number of anomalies. At the level of the coracobrachialis insertion, the nerve passes through the medial intermuscular septum to enter the posterior compartment. This is potentially the site for compression. Next potential site is as it passes the arcade of Struthers formed by attachment of the fascial extension of the coracobrachialis tendon, superficial fibres of the medial head of the triceps and medial intermuscular septum. The ulnar nerve could be compressed at the cubital tunnel roof, which is formed by the ligament of Osbourne and investing fascia of flexor carpi ulnaris (FCU). The next sites of compressions are: as it passed through the two heads of FCU and, finally at the fibrous common origin of the flexor/pronator aponeurosis.

PATHOPHYSIOLOGY

The basic pathophysiology behind cubital tunnel syndrome is ischemia to the nerve. Feindel and Stratford3 showed how the normal oval shape of the tunnel transformed to a narrow slit-like opening when the elbow went from extension to flexion due to tightening of the roof and bulging of the floor. Vanderpool4 et al demonstrated anatomic narrowing of the cubital tunnel with elbow flexion, causing a decrease in volume. Numerous studies have shown significant increases in both intraneural5 and extraneural6 pressures in the cubital tunnel with elbow flexion. These pressures can easily increase to the 50 mm Hg range and even quadruple if accompanied with wrist extension and shoulder abduction. This elevated pressure range has been shown by Ogata and Naito7 to block intraneural circulation. Szabo8 showed that the increased pressure produces electrodiagnostic changes and clinical symptoms. Lundborg 9 pointed out that the ulnar nerve at the elbow is “asking for trouble.” The nerve is superficial and potentially exposed to multiple insults, including direct mechanical pressure, ischemia from elevated pressures within the cubital tunnel, and stretching around the medial epicondyle. It remains controversial which of these forces is most important. Whatever the specific mechanism, there is abundant evidence that the primary lesion exists in the cubital tunnel.

Figure 6

Figure 1: Sulcus view

Figure 7

Figure 2: Sulcus view with bony encroachment in ulnar bed

DIAGNOSIS

Diagnosis of cubital tunnel syndrome is mainly a clinical diagnosis which when in doubt can be confirmed with nerve conduction studies. It is important to precisely localise the area of entrapment by stimulating the nerve over small areas. An electromyography (EMG)/Nerve conduction study is not essential when the diagnosis of cubital tunnel syndrome is obvious on clinical examination. However, it is important to perform an EMG when the diagnosis of cubital tunnel syndrome is unclear or to determine the efficacy of conservative treatment. Findings on EMG are considered positive for cubital tunnel syndrome when the motor conduction velocity across the elbow is less than 50m/s or the difference between the motor conduction velocity across the elbow and that below the elbow is greater than 10m/s. During the test, it is important to stimulate the nerve over 2cm intervals to precisely localize the area of entrapment. Compression of the ulnar nerve is probably at the level of the retrocondylar groove when the point of maximum conduction delay and drop in amplitude of the compound muscle action potential is at or just proximal to the medial epicondyle. In contrast, compression probably is in the cubital tunnel when the point of maximum conduction delay and drop in amplitude of the compound muscle action potential is 2 cm distal to the medial epicondyle. Unfortunately, false-positive results are obtained in 15% of cases.

Although diagnosis of cubital tunnel syndrome is relatively straightforward, establishing the cause of cubital tunnel syndrome is another matter. Expensive and time consuming investigations like MRI and CT scans can help in establishing a cause but they do not offer much in terms of changing treatment options and actually delay the treatment process due to long waiting lists. MRI is the gold standard in localizing the cause of cubital tunnel syndrome and with the high definition will give the most information with regards to the status of the nerve and area of compression. Britz et al10 examined the use of MRI in diagnosing cubital tunnel syndrome using a short tau inversion recovery sequence. They studied 31 elbows with documented ulnar nerve entrapment and found increased signal in the ulnar nerve in 97% of their cases and enlargement of the ulnar nerve in 75%. However it is an expensive investigation with long waiting lists. In addition, it does not help in changing the management plan, and most of the information an MRI provides will be visible when a decompression is performed. The same applies to CT scan. High-resolution ultrasound is another modality that has also been used to evaluate the morphological changes of the ulnar nerve at the cubital tunnel. Using high-resolution ultrasonography, Chiou et al11 found that the mean value of the area of the ulnar nerve at the level of the medial epicondyle in symptomatic patients was significantly larger than the control group and of the unaffected contralateral side. Their p value was less than 0.001. Their conclusions were that if the area of the ulnar nerve was greater than 0.075cm², at the level of the medial epicondyle, the patient probably had cubital tunnel syndrome. However this again involves specialist equipment and a waiting list involving a trained ultrasonographer and the results are notoriously user dependent. Once the diagnosis has been confirmed, the question to be answered is whether the nerve needs more than a decompression and typically that information can be obtained by simple radiographs.

CONCLUSION

A sulcus view (cubital tunnel projection radiograph) gives a good view of the ulnar bed (example Figures 1 & 2) and whether there are any bony projections in the cubital tunnel, such as from previous trauma or osteoarthritis. If they are present, a simple decompression may not solve the problem. If a supracondylar process on the medial aspect of the humerus is suspected, an elbow radiograph 5cm proximal to the medial epicondyle should be obtained. These investigations are cheap, quick, and readily available and can be used in everyday clinics to help make prompt decisions in the operative management of cubital tunnel syndrome.

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