



# Subcutaneous Anterior Transposition Versus Decompression and Medial Epicondylectomy for the Treatment of Cubital Tunnel Syndrome

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## abstract

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A review of the literature often fails to uncover the best procedure for the treatment of cubital tunnel syndrome. This article compares 2 frequently used methods (subcutaneous anterior transposition vs decompression and medial epicondylectomy) for their effectiveness in relieving both subjective and objective symptoms of cubital tunnel syndrome. Between August 1991 and October 1993, nineteen patients underwent surgical decompression by a single surgeon for ulnar neuropathy at the elbow. Factors evaluated included upper extremity range of motion, elbow valgus stress, grip strength, pinch, 2-point discrimination, and pre- and postoperative nerve conduction. A standardized questionnaire was administered to assess subjective relief of symptoms.

In the transposition group, grip strength averaged 71.2% of normal and pinch strength 86.6% of normal, and 2-point discrimination averaged 8.0 mm. The derived subjective assessment score was 23.2 of a possible 40. The average ulnar motor conduction velocity across the elbow was 50.1 m/sec preoperatively and 56.3 m/sec postoperatively. In the medial epicondylectomy group, grip strength averaged 79.5% of normal and pinch strength 81.7% of normal, and 2-point discrimination averaged 8.0 mm. The average ulnar motor conduction velocity across the elbow was 45.7 m/sec preoperatively and 55.7 m/sec postoperatively. No statistically significant difference existed between the 2 groups for the aforementioned indexes. These results do not indicate a difference between the outcomes of the patients undergoing either of the procedures. Because epicondylectomy is less technically demanding, with less soft tissue dissection of the nerve, it may be preferred over ulnar transposition.

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Compression neuropathy of the ulnar nerve at the elbow is the second most common entrapment neuropathy of the upper extremity.<sup>1</sup> This condition was first described by Panas in 1878.<sup>2</sup> Surgical options include simple decompression, decompression with medial epicondylectomy, anterior transposition to a subcutaneous position, and anterior transposition to a submuscular position.<sup>3-5</sup> Choice of a particular treatment option is often based on the personal bias of the surgeon rather than the clinical study. A review of the literature often fails to uncover the superiority of 1 procedure over another.<sup>6,7</sup>

In 1950, King and Morgan<sup>8</sup> first reported medial epicondylectomy as a means of decompressing the ulnar nerve at the elbow, reporting good improvement in sensory and motor function. Göbel et al<sup>9</sup> reported promising results with a minimal medial epicondylectomy with in situ decompression. Of 64 patients with refractory cubital tunnel syndrome who subsequently underwent minimal medial epicondylectomy and in situ decompression, 50 achieved excellent or good results. The main postoperative complaint was tenderness at the osteotomy site, but no cases of ulnar nerve palsy or medial elbow instability were reported.<sup>9</sup>

Foster and Edshage<sup>10</sup> reported comparable results with 48 patients who underwent either simple decompression or subcutaneous transposition. However, recurrence of symptoms after anterior transposition has been described. Broudy et al<sup>11</sup> reported their intraoperative findings on 10 patients with recurrent symptoms after anterior transposition. Re-exploration demonstrated that the nerve was embedded in dense scar tissue and constricted by fascial bands. Additionally, transposition may result in damage to the vasa vasorum, leading to secondary ischemic neuritis.<sup>12</sup> Despite this possibility, no consistent data exist to support 1 procedure over another. In 1 of the few prospective, randomized trials in the literature, Nabhan et al<sup>13</sup> found

no significant difference between simple decompression and subcutaneous anterior transposition. Matev<sup>14</sup> followed patients up to 10 years after anterior transposition, and approximately 90% of patients still had improved symptoms.

This article compares 2 frequently used methods (transposition vs decompression and medial epicondylectomy) for their effectiveness in relieving both subjective and objective symptoms of cubital tunnel syndrome.

### MATERIAL AND METHODS

Over a 3-year period, 19 patients underwent surgical decompression by a single surgeon (R.J.M.) for ulnar neuropathy at the elbow. Average patient age at surgery was 47.8 years, and average follow-up evaluation was at 17±7 months. There were a total of 20 procedures: 9 patients underwent transposition alone, 9 underwent decompression and medial epicondylectomy, and 1 underwent epicondylectomy on 1 extremity and transposition on the contralateral extremity. The procedure choice was based on surgeon preference and was not randomized preoperatively. Early in the time period, transposition was the procedure of choice, whereas later in the series, epicondylectomy became the procedure of choice based on apparent superior clinical results. Diagnosis was based on a combination of clinical symptoms, signs, and objective testing. Preoperative conduction studies were performed on 15 patients, and postoperative nerve conduction studies were performed in 6.

### SURGICAL TECHNIQUE

Anterior transposition was to a subfascial location and involved decompression from a point 8 cm proximal from the cubital tunnel to a point 5 cm distal to release the deep flexor pronator aponeurosis. The medial intermuscular septum was released and partially excised. The nerve was held anteriorly with a fascial sling made from the flexor pronator mass. A limited epicondylectomy described by O'Driscoll et

al<sup>15</sup> was used for the remaining cases. In an attempt to preserve the attachments of the anterior portion of the ulnar collateral ligament, an oblique osteotomy taking the medial 20% and the posterior portion of the epicondyle were performed. Postoperative management for epicondylectomy consisted of a posterior splint for 1 week, and then a hinged brace locked at 75° to 30° with active range of motion (ROM) thereafter. Initial limited ROM is designed to prevent the released ulnar nerve from subluxating anterior to the epicondyle. Transposition cases were placed in a posterior splint for 1 to 2 weeks and then placed in a sling and allowed unrestricted motion. Patients were evaluated for routine follow-up at 1, 2, 4, and 6 weeks; 3, 6, and 12 months; and then yearly.

Patients were evaluated for subjective and objective resolution of symptoms by several means at an average follow-up of 17.5 months. Physical examinations and dynamic testing were performed on 13 of the 20 patients by 1 examiner (J.T.C.) who was not the operative surgeon. The clinical data of the remaining patients was taken from their charts in a retrospective fashion. All study procedures were followed in accordance with the ethical standards of the institution's review board.

Factors evaluated included upper extremity ROM, stability of the elbow to valgus stress, grip strength with a grip meter, key pinch with a standard pinch meter, 2-point discrimination, and the presence of Tinel and Phalen signs at the elbow or proximal forearm. Standard anteroposterior and lateral radiographs were taken for all patients, as well as stress radiographs if valgus laxity was detected. A standardized questionnaire was administered to assess subjective relief of symptoms. The 7 patients unavailable for personal follow-up were contacted by phone and administered the same questionnaire. Preoperative nerve conduction studies were obtained on 15 patients, and postoperative studies on 6 patients. Ulnar nerve motor conduction velocity was used as our variable comparison.

Results of the questionnaire were quantified and graded for a possible range of 11 to 40 points, with 40 being complete resolution of symptoms. Questions addressed resolution of paresthesia, pain, weakness, presence of symptoms at night, current work status, and overall satisfaction with the procedure. Physical examination assessment of paresthesia was recorded in a grading system of 0 to 10, with 0 being complete absence of symptoms. The paresthesia index was based on 5 components rated 0, 1, or 2 based on the severity of sensitivity at the incision site, Phalen test at the elbow, Tinel test at the elbow, hyperesthesia, and paresthesia in the elbow, forearm, and hand (Table).

## RESULTS

Average patient age of those undergoing transposition ( $47 \pm 12$  years) and medial epicondylectomy ( $49 \pm 15$  years) ( $P = .77$ ) were similar. Average follow-up in the transposition group was longer than that in the medial epicondylectomy group ( $21 \pm 7$  months vs  $14 \pm 5$  months, respectively) ( $P = .01$ ). In both groups, 7 patients had their dominant hand affected. Range of motion of the elbow averaged  $136^\circ \pm 9^\circ$  (98% of the contralateral side) in the transposition group compared to  $129^\circ \pm 19^\circ$  (94% of the contralateral side) in the epicondylectomy cases ( $P = .49$ ).

In the transposition group, grip strength averaged 71.2% of normal and pinch strength 86.6% of normal, and 2-point discrimination averaged 8 mm. The derived subjective assessment score was 23.2 of a possible 40. The average ulnar motor conduction velocity across the elbow was 50.1 m/sec preoperatively, and 56.3 m/sec postoperatively. The paresthesia index averaged 4.6. In the medial epicondylectomy group, grip strength averaged 79.5% of normal and pinch strength 81.7% of normal, and 2-point discrimination averaged 8.0 mm. The average ulnar motor conduction velocity across the elbow was 45.7 m/sec preoperatively and 55.7 m/sec postoperatively. The paresthesia index av-

Table	
Physical Examination Assessment of Paresthesia	
Paresthesia Index	Score
Sensitivity at the incision site	None (0), mild (1), severe (2)
Phalen test at the elbow	Negative (0), mild (1), severe (2)
Tinel test at the elbow	Negative (0), mild (1), severe (2)
Presence of hyperesthesia	None (0), mild (1), severe (2)
Presence of paresthesia in the elbow, forearm, and hand	None (0), mild (1), severe (2)
Total	0-10

eraged 3.6. There was no statistically significant difference between the 2 groups for the aforementioned indexes.

The subjective assessment score was the only variable that approached statistical significance (23.2 in the transposition group vs 27.6 in the medial epicondylectomy group) ( $P = .091$ ). One transposition patient required reoperation for recurrent symptoms. Mild clinical valgus laxity with a sense of increased opening compared to the contralateral elbow was detected in 1 patient following epicondylectomy, as compared to 2 patients in the transposition group ( $P = .59$ ). There was no radiographic evidence of laxity in these patients.

## DISCUSSION

In a situation where many surgical procedures exist to treat the same condition, it is clear that the etiology must be multifactorial. This is certainly true in case of ulnar nerve compression, despite the fact that the cubital tunnel is most common location of compression. This leads to the discussion of the natural history of ulnar nerve entrapment at the elbow. Padua et al<sup>16</sup> noted that approximately 50% of patients who elect nonoperative management will note improvement. Lifestyle and work-related activity modification demonstrate some effectiveness in relieving symptoms.<sup>16</sup> Nevertheless, a large number of patients will require surgical intervention, and thus the choice of what procedure to perform is in the surgeon's hands.

In our small series, medial epicondylectomy and anterior transposition were equally effective in relieving ulnar nerve entrapment at the elbow. No statistically significant differences existed between the 2 treatment groups in improvement of objective symptoms: grip strength, pinch strength, ROM, and 2-point discrimination. However, there appeared to be an advantage to epicondylectomy in our series in relieving subjective complaints—perceived pain, paresthesia, and satisfaction with the procedure—although these values did not reach statistical significance.

Nabhan et al<sup>13</sup> reported on 66 patients who were prospectively randomized to simple nerve decompression and subcutaneous anterior transposition. Follow-up at 3 and 9 months postoperatively showed no differences between outcomes of the 2 groups in terms of pain, motor and sensory deficits, and nerve conduction velocities.

A meta-analysis of randomized, controlled trials was performed by Zlowodzki et al<sup>7</sup> to evaluate the efficacy of simple decompression of the ulnar nerve compared to anterior transposition. The results suggested that no difference existed in clinical outcome scores or motor nerve conduction velocities between the 2 groups.

A recent meta-analysis by Macadam et al<sup>6</sup> compared the simple decompression vs anterior subcutaneous and submuscular transposition of the ulnar nerve and suggested the same results.

A retrospective study by Efstathopoulos et al<sup>17</sup> evaluated 80 patients (80 elbows) who underwent partial medial epicondylectomy for cubital tunnel syndrome. The cases included 16 McGowan grade I, 40 grade II, and 24 grade III lesions. A follow-up of 32 months revealed an improvement of at least 1 McGowan grade in 86% of cases and 67% improvement in severely impaired patients.<sup>17</sup>

A systematic review by Mowlavi et al<sup>18</sup> analyzed 30 studies from 1945 to 1995. For the minimum severity group, medial epicondylectomy had the best outcome; for the cases with moderate severity, submuscular transposition had the best outcome. No procedure was effective for the severe group.

Another retrospective review analyzed 113 patients in whom 3 different surgical methods (in situ decompression, partial epicondylectomy, and anterior subcutaneous transposition) were performed.<sup>19</sup> The results indicated that in situ decompression and partial epicondylectomy are efficient and safe methods. The patients who underwent anterior subcutaneous transposition had an inferior outcome compared to those who underwent the other 2 procedures.

Although simple ulnar nerve decompression is an effective procedure for ulnar nerve entrapment, it does not address the increased traction/tension on the ulnar nerve during elbow joint movement. Hicks and Toby<sup>20</sup> performed a study on 10 unembalmed cadavers using a microstrain gauge. They measured the strains in the ulnar nerve behind the medial epicondyle between 60° and 140° flexion. They found that medial epicondylectomy following in situ decompression reduces ulnar nerve strains with elbow flexion compared to in situ decompression.<sup>20</sup>

The reported complications of medial epicondylectomy include valgus instability, heterotopic ossification, and loss of the protective role of the medial epicondyle to the ulnar nerve.<sup>19,21</sup> Performing a limited oblique epicondylectomy is effective

in decompressing the cubital tunnel and minimizes the chances for elbow valgus instability by leaving the medial collateral ligament intact.<sup>15</sup> It also diminishes the chances of having recurrent entrapment, a known complication of transposition.<sup>21</sup>

In our series, we detected only 1 case of mild valgus laxity with epicondylectomy and 2 cases with transposition. These results compare favorably with other studies.<sup>17,22,23</sup> These 3 cases were not clinically symptomatic and were not apparent on stress radiographs. The osteotomy site was hypersensitive postoperatively for a short period, but consistently diminished over 4 to 6 months in our series.

Anterior subcutaneous transposition eliminates the pressure exerted on the nerve by the decrease in the volume of the cubital tunnel.<sup>24</sup> It has been mentioned that there is an increased rate of direct trauma and devascularization of the ulnar nerve during the anterior subcutaneous transposition<sup>25</sup>; however, our study did not show a difference in terms of objective and subjective clinical outcome. Baek et al<sup>22</sup> studied 22 elbows treated with minimal medial epicondylectomy and 34 elbows with anterior subcutaneous transposition of the ulnar nerve. They similarly found no significant difference between the 2 groups; however, the transposition group also received a partial medial epicondylectomy.<sup>24</sup> As with most surgical procedures, attempts have been made to perform less invasive therapeutic techniques.

Epicondylectomy is less technically demanding, with less soft tissue dissection of the nerve. This minimizes the devascularization of the nerve and also diminishes the chances of having recurrent entrapment, a known complication of transposition. However, both procedures have been shown to be effective in treatment of this common clinical problem.

Limitations of our study include the small sample size and the built-in bias of the surgeon. Procedure selection was based purely on the surgeon's preference at the time of surgery. Early on, he pre-

ferred transposition, and later in the series he preferred epicondylectomy. The study could have benefited from preoperative treatment randomization or from a protocol with indications for each treatment. Future studies with randomized treatments or established indications will have more power in determining outcome differences between ulnar nerve transposition and decompression with medial epicondylectomy. ■

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