

Minimum 6-Year Follow-Up After Ulnar Nerve Decompression and Submuscular Transposition for Primary Entrapment

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Purpose To retrospectively evaluate patients with 6-year minimum follow-up after submuscular transposition of the ulnar nerve for primary entrapment.

Methods From 1992 to 2005, 142 patients were treated surgically for ulnar neuropathy at the elbow by 2 senior surgeons using a technique that preserved nerve vascularity. A total of 99 cases were eligible, and 82 elbows in 76 patients, average age 48 years, were followed for at least 6 years (average, 8.3 y). Thirty-two (42%) were male, and the dominant limb was involved in 49 (64%). The average duration of symptoms before surgery was 25 months. Clinical records were reviewed, and sensory (S0–2) and motor (M0–5) testing was performed. Dellon scores were determined, and visual analog scale and modified questionnaires from Novak et al and Kleinman and Bishop were completed. Preoperatively, 48 elbows were Dellon grade III, 33 were grade II, and one was grade I.

Results There were clinically and statistically significant improvements in patient and surgeon-reported data regardless of the preoperative disease severity. Visual analog scale questionnaires, sensory scale, and motor strength all improved, with at least antigravity strength in all subjects. Dellon scores also improved, and 38 elbows had normalized to Dellon 0. Of the 33 preoperative elbows that were grade III, 15 improved to grade II, 13 to grade I, and 5 normalized. Of the 48 preoperative elbows that were grade II, 16 improved to grade I and 32 normalized. Preoperative Dellon III elbows had more residual symptoms than grade II elbows. A total of 73 elbows (89%) had a good or excellent outcome. There were no reoperations or infections.

Conclusions Submuscular transposition is a safe and durable option for primary ulnar neuropathy at the elbow. Overall, good or excellent results were achieved in 89% of patients with a low complication rate. (*J Hand Surg Am.* 2013;38(12):2398–2404. Copyright © 2013 by the American Society for Surgery of the Hand. All rights reserved.)

Type of study/level of evidence Therapeutic IV.

Key words Outcomes, transposition, ulnar neuropathy, vascularized.

ULNAR NEUROPATHY IS THE second most common nerve compression syndrome in the upper extremity, with entrapment most often at the elbow.^{1,2} Numerous surgical techniques have

been described for patients whose symptoms prove refractory to conservative management, including *in situ* decompression³; subcutaneous,⁴ submuscular,⁵ or intramuscular anterior transpositions⁶; medial

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TABLE 1. Patient Self-Reported Outcome Instrument Administered at Follow-Up Visits*

Given your outcome, would you still choose to have this surgery?	Yes/no
How long did it take you to become better?	Number of months
Are you now taking medication for pain?	Yes/no
Were you off work for your ulnar nerve problem?	Yes/no/retired
Are you presently working?	Yes/no/retired
Did you change your job?	Yes/no
Was there an injury that caused you to have surgery?	Yes/no
Grade the result of your surgery from 0 (very bad) to 10 (very good)	0–10

*This questionnaire was based on items from the survey developed by Novak et al.¹³

epicondylectomy^{7,8}; and endoscopic release.⁹ The senior authors (J.B.J. and J.G.P.) perform a modified submuscular transposition that preserves the extrinsic vascularity of the ulnar nerve. The purpose of this study was to evaluate retrospectively the long-term outcomes of this technique using patient- and physician-rated outcomes in patients with primary ulnar neuropathy at the elbow with a minimum 6-year follow-up.

MATERIALS AND METHODS

With institutional review board approval, all patients treated surgically from 1992 to 2005 for ulnar nerve compression at the elbow were offered enrollment in the study. A total of 142 cases were performed during the study period using the authors' technique. Patients undergoing primary ulnar nerve decompression and submuscular transposition with a minimum follow-up of 6 years were eligible for the study (n = 142). Exclusion criteria were revision cases (23), elbow deformity resulting from premature physal closure (3), posttraumatic sequelae (9), inflammatory arthritis (3), and a systemic neurologic diagnosis (5). Thus, 99 eligible cases remained. Seventeen patients declined enrollment, could not be located, or did not return for follow-up. The final study cohort was composed of 82 of the 99 eligible cases (83%). All patients were treated by 2 senior hand surgeons at separate medical centers using a standardized technique of submuscular transposition.

Patients were evaluated preoperatively and postoperatively at standard intervals (every 6 mo for the first 3 y, annually until year 6, every 2 y from years 6–10, and every 3 y afterward) by the treating surgeons. Disease severity was classified using the Dellon scale.³ We measured sensation for each patient using static 2-point discrimination (MacKinnon-Dellon Disk-Criminator; Neuroregen, LLC, Bel Air,

MD) and the Yale Sensory Scale (S0–2)¹⁰ using a Wartenberg esthesiometer. The Yale Sensory Scale assigns a score of S0 to S2, corresponding to increasing sensibility; S0 indicates absent sensation, S1 decreased or abnormal sensation, and S2 intact sensation.¹¹ Unless otherwise indicated, all reporting of sensation uses the Yale Sensory Scale.

We graded motor strength clinically using the British Medical Research Council Scale (M0–5)¹² and measured grip strength with a standard grip meter (Jamar Dynamometer; Lafayette Instrument Company, IN). Abductor digiti minimi and the first dorsal interosseous were tested together via abduction. The first and third volar interossei were tested together via adduction. The first dorsal interosseous muscle was also tested separately using the Froment maneuver. Antigravity strength of the first dorsal and third volar interossei was tested with the forearm in neutral rotation. We also noted intrinsic atrophy, presence of clawing or a Wartenberg sign, and the results of the Froment and crossed-finger tests.

Pain was evaluated using a visual analog scale (VAS) at rest and during activity. Pain frequency was also recorded from 0 (no pain) to 10 (constant pain, including pain at night). We also measured VAS patient satisfaction, modified Kleinman and Bishop postoperative scores,^{6,13} as well as an 8-item questionnaire based on that developed by Novak et al¹⁴ (Table 1). The modified Kleinman and Bishop rating system assesses the presence of residual symptoms, overall improvement, work status, grip strength, and sensibility. Possible scores range from 0 to 9. Patients scoring 8 to 9 were considered to have an excellent outcome, 5 to 7 a good outcome, 3 to 4 a fair one, and 0 to 2 a poor one.^{6,13}

We assessed continuous variables using Student *t* test and compared ordinal values, such as Dellon grade, using chi-square analysis. The relationship between length of follow-up and improvement based

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