Neurolysis of the ulnar nerve for neuropathy following total elbow replacement

D. M. Rispoli, G. S. Athwal, B. F. Morrey

From the Mayo Clinic, Rochester, Minnesota, United States

Ulnar neuropathy presents as a complication in 5% to 10% of total elbow replacements, but subsequent ulnar neurolysis is rarely performed. Little information is available on the surgical management of persistent ulnar neuropathy after elbow replacement. We describe our experience with the surgical management of this problem.

Of 1607 total elbow replacements performed at our institution between January 1969 and December 2004, eight patients (0.5%) had a further operation for persistent or progressive ulnar neuropathy. At a mean follow-up of 9.2 years (3.1 to 21.7) six were clinically improved and satisfied with their outcome, although, only four had complete recovery. When transposition was performed on a previously untransposed nerve the rate of recovery was 75%, but this was reduced to 25% if the nerve had been transposed at the time of the replacement.

Ulnar neuropathy is a complication in 5% to 10% of total elbow replacements (TERs). The number of these patients that require neurolysis is not known. This study describes our experience with this procedure for patients with symptomatic persistent or progressive ulnar neuropathy following TER.

Patients and Methods

Patients. Between 1969 and 2004, 1168 patients underwent a primary TER and 439 had a revision procedure at our institution. There were 856 primary and 344 revision Coonrad-Morrey implants (Zimmer, Warsaw, Indiana), 41 primary and five revision Capitellocondylar implants (Codman and Shurtleff, Cintor Division, Randolf, Massachusetts), 80 primary and 28 revision Pritchard-Walker prostheses (Depuy, Warsaw, Indiana), and 191 primary and 62 revision replacements using various other designs of implant. Of those undergoing primary TER, 508 (43.5%) were for traumatic and 660 (56.5%) were for non-traumatic conditions. Of those undergoing primary TER, 508 (43.5%) were for traumatic and 660 (56.5%) were for non-traumatic conditions.

Post-operative ulnar neuropathy occurred in 5.3% (85/1607) of all TERs. Of the eight patients, five had evidence of ulnar neuropathy prior to TER with paraesthesiae in two patients, diminished sensation in one, weakness in two, a positive Tinel’s sign at the elbow in two, and decreased two-point discrimination in one. Three patients presented with a sensory neuropathy following TER, two immediately post-operatively and one 18 months later.

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The eight patients had undergone a mean of 1.0 procedures (0 to 3) prior to TER, as compared with a mean of 0.8 procedures for all primary elbow replacements undertaken at our institution. Five patients had a TER secondary to trauma, four for an acute fracture and one for a nonunion of the distal humerus. Two patients had a TER for rheumatoid arthritis (one adult, one juvenile), and one for a crystal-line arthropathy. In four patients the ulnar nerve had been transposed at the time of TER.

The indications for neurolysis were sensory, motor, or mixed neuropathic symptoms in the distribution of the ulnar nerve which failed to improve with conservative treatment and which were severe enough to warrant surgery. Electromyographic and nerve conduction studies were carried out at the discretion of the consultant prior to neurolysis in five patients and confirmed ulnar neuropathy in four of these.

Eight patients (0.5%) were identified who had undergone TER and subsequent ulnar neurolysis for persistent ulnar neuropathy (Table I). There was pain in four elbows, sensory disturbance in five elbows, and motor weakness in five elbows in the distribution of the ulnar nerve. The mean age of the patients at the time of the replacement was 56 years (27 to 76).
by questionnaire in four patients, clinical review in three and assessment by a physician elsewhere in one.

The classification of McGowan\(^3\) was used to monitor motor dysfunction; grade I describes a minimal lesion with no detectable motor weakness of the hand, grade II an intermediate lesion with weakness of the small muscles of the hand and grade III a severe lesion with paralysis of one or more of the ulnar intrinsic muscles. There were three grade I lesions and five grade II lesions. No patient had an isolated or primary complaint of motor weakness.

Two patients had sensory symptoms with decreased sensation in one and decreased two-point discrimination in another.

The final outcome was graded as satisfactory if patients had resolution of their symptoms and normal function of the ulnar nerve. Otherwise the outcome was graded as unsatisfactory.

**Management.** The mean time from TER to neurolysis was eight months (1 to 25). Four patients had neurolysis of the ulnar nerve in the cubital tunnel and anterior subcutaneous transposition. Four had neurolysis of an anteriorly transposed nerve, with a further subcutaneous transposition in three and submuscular placement in one.

The technique of neurolysis was not standardised but the aim was to produce a transposition free of compression without bends or kinks, allowing normal excursion of the nerve throughout the range of movement of the elbow. Transposition was performed with meticulous attention to minimise trauma to the nerve and its vascular supply.

At neurolysis, all patients with documented intra-operative findings (7 of 8 patients) had evidence of irritation or damage of the ulnar nerve (Table II). There was dense scarring in four, bending and tethering in two, and subluxation into the ulnar-humeral joint in one.

**Results**

At a mean follow-up of 9.2 years (3.1 to 21.7) four patients had no residual symptoms and four had McGowan\(^3\) grade I dysfunction. The early post-operative results were good in seven, but two patients had recurrent symptoms, with one undergoing a further neurolysis. One patient had mild recurrence of symptoms at 16 months, but was satisfied with the results at the latest follow-up. All four patients undergoing ulnar neurolysis of a nerve which had not been transposed previously had immediate resolution of symptoms. One had recurrence of symptoms three months later.

Of the four patients who underwent neurolysis and further transposition of an already transposed nerve, three had initial resolution of symptoms, however, at a later stage one had a partial recurrence, and one a recurrence necessitating a further neurolysis with a submuscular nerve transposition. One patient had no improvement.
Discussion

In a review of the English literature Gschwend et al\(^1\) noted an overall complication rate of 43% after TER, 15% of which were permanent. Ulnar neuritis was a common post-operative complication with a rate of 10.5%.\(^1\) Aldridge et al\(^4\) recently reported good long-term results in 40 patients undergoing TER, with five (12.2%) transient post-operative ulnar nerve palsies in 41 elbows. Others have reported similar rates of ulnar nerve complications, between 7%\(^5\) at the senior author’s institution, 12%\(^6\) and 14%.\(^7\) The overall rate of ulnar neuropathy in this series was 2.5%, with 2.1% in replacements with transposition of the nerve and 4.5% in those without this procedure.

The high rate of neuropathy experienced following elbow replacements in the 1970s was reduced when transposition or decompression of the nerve was incorporated into the standard approach.\(^8\) Ewald et al\(^9\) noted a decrease in the rate of post-operative transient ulnar nerve neuropathy from 31% to 15% after including decompression of the nerve. The rate, however, remains very variable. Landor et al\(^10\) recently published the results of 58 Souter-Strathclyde TERs in 49 patients at a mean follow-up of 9.5 years. There had been symptoms of paraesthesia in ten forearms before operation and in eight after the procedure, giving an overall rate of 31%. Anterior transposition had been undertaken at the time of surgery. No further operations were carried out for ulnar neuropathy.

In 1996 Gschwend et al\(^1\) described three lesions of the ulnar nerve following operation in 172 TERs. Kelly, Coghlan and Bell,\(^11\) in their experience with the GSB III prosthesis, noted one post-operative neuropathy requiring a further operation in 28 TERs. The patient had normal function six years after operation.

Rozing\(^12\) found a post-operative ulnar neuropathy in 34% of 59 patients undergoing Souter-Strathclyde TERs at a mean of eight years follow-up. In one patient with complete motor and sensory loss, re-operation with neurolysis was done with partial recovery at follow-up.

Ikävalko et al\(^13\) observed post-operative ulnar neuropathy requiring further surgery in two of a consecutive series of 525 Souter-Strathclyde elbow replacements.

### Table II. Ulnar nerve findings

<table>
<thead>
<tr>
<th>Patient</th>
<th>Prior to TER(^*)</th>
<th>After TER</th>
<th>At re-operation</th>
<th>After neurolysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EMG(^1)/NCV(^2) symptoms</td>
<td>EMG findings</td>
<td>Clinical findings</td>
<td>Mcgowan grade(^3)</td>
</tr>
<tr>
<td>1</td>
<td>Normal pre-operative EMG (7 mths). No ulnar nerve symptoms</td>
<td>Denervation of 1st dorsal interossei, marked decrease in motor conduction velocities</td>
<td>Acute post-operative sensory and motor deficit</td>
<td>II</td>
</tr>
<tr>
<td>2</td>
<td>No EMG. Minimal paraesthesias in distribution of the ulnar nerve, weak intrinsics, &gt; 1 cm 2 pt discrimination</td>
<td>None performed</td>
<td>Sensory and motor deficit. Mechanical snapping of nerve on olecranon hardware</td>
<td>II</td>
</tr>
<tr>
<td>3</td>
<td>No EMG. No ulnar nerve symptoms</td>
<td>Severe ulnar neuropathy</td>
<td>Persistent pain in an ulnar nerve distribution</td>
<td>I</td>
</tr>
<tr>
<td>4</td>
<td>No EMG. Right hypothenar musculature weak</td>
<td>Ulnar neuropathy</td>
<td>Persistent pain in an ulnar nerve distribution</td>
<td>I</td>
</tr>
<tr>
<td>5</td>
<td>No EMG. No ulnar nerve symptoms</td>
<td>None performed</td>
<td>Acute post-operative sensory and motor deficit</td>
<td>II</td>
</tr>
<tr>
<td>6</td>
<td>No EMG. No ulnar nerve symptoms</td>
<td>Median neuropathy with evidence of cross-over phenomenon in forearm</td>
<td>Persistent pain in an ulnar nerve distribution. Mild motor deficit</td>
<td>II</td>
</tr>
<tr>
<td>7</td>
<td>Normal pre-operative EMG (16 mths) + Tinel’s at cubital tunnel, ↓ sensation in ulnar nerve distribution</td>
<td>None performed</td>
<td>Acute post-operative sensory and motor deficit. Sensory deficit the predominant feature</td>
<td>II</td>
</tr>
<tr>
<td>8</td>
<td>No EMG. Paraesthesia in ulnar nerve distribution + Tinel’s over anterior transposed nerve</td>
<td>Ulnar neuropathy with compression distal to medial epicondyle</td>
<td>Persistent pain in an ulnar nerve distribution. Sensory deficit</td>
<td>I</td>
</tr>
</tbody>
</table>

\(\text{* TER, total elbow replacement}\)
\(\text{† EMG, electromyography}\)
\(\text{‡ NCV, nerve conduction velocity}\)
In patients with symptomatic neuropathy following TER, nerve conduction studies and electromyography may help in localising the site of compression. However, in our series neurolysis was carried out for sensory symptoms and surgery would have been undertaken regardless of the results of electrodiagnostic studies.

This series is the first to evaluate the incidence of further surgery for persistent ulnar neuropathy following TER. Although ulnar neuropathy was seen in one of every 40 TERs, the need for surgical intervention was exceedingly low. Patients can be counselled that post-operative ulnar neuropathy complicating TER is symptomatic enough to warrant surgery at a rate of 0.5%. However, only 50% of patients who undergo such further surgery have resolution of symptoms. No recommendations can be made with respect to method of transposition, pre-existing symptoms, or a history of trauma.

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References