



# Ulnar neuritis after open elbow arthrolysis combined with ulnar nerve subcutaneous transposition for post-traumatic elbow stiffness: outcome and risk factors

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**Background:** Ulnar neuritis (UN) is a common complication of open elbow arthrolysis for elbow stiffness. The purpose of this study was to evaluate the outcome of subcutaneous anterior transposition of the ulnar nerve during open elbow arthrolysis and to describe the risk factors for UN.

**Methods:** We retrospectively studied 260 patients with post-traumatic elbow stiffness who underwent routine ulnar nerve transposition during open elbow arthrolysis. Patient demographics, clinical characteristics, and incidence and reoperation rate of UN were recorded. UN was defined as new-onset ulnar nerve symptoms and no relief or worsening of pre-existing ulnar nerve symptoms during the period of postoperative rehabilitation. Factors affecting the development of UN were analyzed by univariate and multivariate analyses.

**Results:** A total of 9.2% of the patients had UN, 25% of whom required reoperation for progressive neuropathy. The Dellon grade of patients associated with UN at last follow-up improved significantly compared with that preoperatively. The mean arc of motion in patients with UN decreased during follow-up in a time-dependent manner. Univariate analysis showed that male sex, limited preoperative flexion and arc of motion, preoperative heterotopic ossification (HO), and preoperative ulnar nerve symptoms were significantly associated with the development of UN. Multivariate regression analysis revealed that preoperative HO was the only independent risk factor for the development of UN.

**Conclusions:** UN is still an important complication, although ulnar nerve subcutaneous transposition was performed during open arthrolysis for post-traumatic elbow stiffness. Identified risk factors for UN, especially preoperative HO, should be taken into consideration before surgery.

**Level of evidence:** Level IV; Case Series; Treatment Study

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The Ethics Committee of Shanghai Jiao Tong University Affiliated Sixth People's Hospital concluded that no approval is necessary for study based on its retrospective design. Data were analyzed anonymously; all patients approved the results of this study by oral consent. The oral consent approval was documented in the patients' files. This was approved by the Ethics Committee of Shanghai Jiao Tong University Affiliated Sixth People's Hospital. All clinical investigations were conducted in accordance with the guidelines of the Declaration of Helsinki.

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Elbow stiffness is a common result of trauma, with significant morbidity of 10% to 15%.<sup>10</sup> Surgical treatment, including arthroscopic and open elbow arthrolysis, is indicated to restore the range of motion (ROM) in patients who continue to experience major functional limitations despite adequate conservative treatment. Previous reports suggest that open elbow arthrolysis results in satisfactory functional outcomes in most cases.<sup>23</sup>

Although the outcomes of open elbow arthrolysis have continued to improve in recent years, the management of postoperative complications remains a significant problem.<sup>4</sup> This procedure is associated with the potential risk of damage to neurovascular structures, with ulnar neuritis (UN) being the most common complication. Some studies have reported on the use of prophylactic ulnar nerve release to prevent UN after surgery, although the validity and suitability of the different methods remain controversial.<sup>11,16,26</sup> We previously compared the results of routine surgical management of the ulnar nerve by simple decompression (with in situ decompression or epicondylectomy) and subcutaneous anterior transposition for patients with elbow stiffness from January 2010 to December 2012 and concluded that subcutaneous anterior transposition was more effective for preventing UN.<sup>5</sup> After that period, ulnar nerve subcutaneous transposition was performed in the subsequent cases of elbow stiffness to reduce the incidence of UN as long as elbow release was performed from the medial side. In this study, we further evaluated the outcome of subcutaneous anterior transposition of the ulnar nerve during open elbow arthrolysis in a larger sample population and identified risk factors that might predict the development of UN.

## Materials and methods

### Patients

This was a retrospective study in patients suffering from elbow stiffness who were treated with open arthrolysis by a single surgeon (C.F.) at our institution from January 2010 to December 2014. Patients were eligible if they met the following inclusion criteria: (1) age  $\geq 18$  years; (2) post-traumatic elbow stiffness; and (3) ulnar nerve transposition performed as part of the open arthrolysis procedure. Exclusion criteria were (1) stiffness caused by severe burns, central nervous system injury, or nontraumatic arthritis; (2) previous ulnar nerve surgery of the involved elbow; and (3) inadequate follow-up (for cases without UN,  $< 8$  months; for cases with UN,  $< 12$  months after latest surgery).

A total of 260 patients were included in the study after consideration of the inclusion and exclusion criteria. Specifically, 52 patients were excluded as they underwent arthrolysis

**Table I** Patient demographics and clinical characteristics

Characteristic	No. (%) or mean $\pm$ SD (range)
Sex	
Male	166 (63.8)
Female	94 (36.2)
Age, years	37 $\pm$ 12 (18-68)
BMI, kg/m <sup>2</sup>	24.7 $\pm$ 3.5 (17-33)
Time from initial injury, months	31 $\pm$ 69 (3-720)
Types of initial injury	
Radial head fracture	30 (11.5)
Monteggia fracture	41 (15.8)
Terrible triad injury	44 (16.9)
Distal humerus fracture	75 (28.8)
Olecranon fracture	27 (10.4)
Elbow dislocation	43 (16.5)
Prior surgery	
Yes	156 (60.0)
No	104 (40.0)
Origin of the contracture	
Contracture with HO	136 (52.3)
Contracture without HO	124 (47.7)
Preoperative ROM, degrees	
Extension	40 $\pm$ 19 (0-95)
Flexion	79 $\pm$ 25 (15-140)
AOM	39 $\pm$ 28 (0-110)
Preoperative ulnar nerve symptoms	17 (6.5)
Surgical approach	
Medial approach	53 (20.4)
Medial and lateral approaches	132 (50.8)
Posterior approach	73 (28.1)
Posterior and lateral approaches	2 (0.8)

SD, standard deviation; BMI, body mass index; HO, heterotopic ossification; ROM, range of motion; AOM, arc of motion.

without ulnar nerve transposition. Patient demographics and clinical characteristics are shown in Table I. The patients included 166 men and 94 women, with an average age at the time of surgery of 37  $\pm$  12 years (range, 18-68 years). Types of initial injury included radial head fracture (11.5%), Monteggia fracture (15.8%), terrible triad injury (16.9%), distal humerus fracture (28.8%), olecranon fracture (10.4%), and elbow dislocation (16.5%); 156 patients (60.0%) had undergone prior surgery. Routine preoperative examinations of radiographs and computed tomography scans of the elbow were carried out to assess the origin of the contracture and the presence and location of heterotopic ossification (HO). The origin of the contracture was classified as contracture with HO ( $n = 136$ ) and contracture without HO ( $n = 124$ ), according to the presence or absence of HO on the radiographs. ROM including extension, flexion, and arc of motion (AOM) was

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