

Nerve Injury and Recovery After Traumatic Humeral Shaft Fractures in a Level I Trauma Center

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Background/Purpose: Nerve palsy is detected in up to 22% of humeral shaft fractures, and the radial nerve is the most commonly injured. Classically, distal third humeral shaft fracture (Holstein-Lewis fracture) has been associated with radial nerve palsy, but recent studies report nerve injury with transverse or spiral fracture of the middle to distal third humerus. Isolated nerve injuries after humeral fracture usually recover spontaneously, and operative intervention is rarely indicated. Our goal in this study was to review traumatic nerve injuries associated with humeral shaft fractures and their recovery and response to operative and nonoperative management.

Methods: Records of 603 adult patients with humeral shaft fracture over 15 years (1999-2014) were reviewed, and 326 patients with adequate follow-up and complete nerve function documentation were included in the study. Fracture pattern was classified using AO/OTA classification.

Results: Nerve palsy was present in 91 (27.9%) patients at the time of injury. The radial nerve was the most commonly injured nerve (76.9%), followed by ulnar nerve (5.5%) and axillary nerve (3.3%); 13 patients (14.3%) had multiple nerves palsies. Nerve injury was significantly more common in middle and distal third fractures (45.5% and 41.8%, respectively) compared to proximal third (12.7%, $P = 0.02$). High-energy trauma was associated with nerve palsy (32.1% vs 22.3%, $P = 0.045$) versus low-energy injury. There was lower risk of nerve injury with isolated humeral shaft fracture (22.3% vs 33.1%, $P = 0.04$). Patients who had concurrent vascular injury had the greatest frequency of nerve injury (88.9% vs 26.5%, $P = 0.001$). There were three bilateral fractures that all had associated nerve injuries. Patients with open fracture had a significantly higher rate of nerve palsy (45.8% vs 22.8%, $P = 0.001$). Nerve palsy was present in 47.3% of patients with simple (Type A), 30.9% of complex (Type C), and 21.8% of wedge (Type B) fractures ($P = 0.83$). Complex comminuted (C3) (20.0%), simple spiral (A1) (16.4%) and oblique (A2) (16.4%) comprised more than half of the fractures associated with a nerve injury. Expectedly, patients treated surgically for their humerus fracture had a higher prevalence of nerve injury (38.3%) compared to nonoperative patients (13.8%, $P = 0.001$). Nerve recovery was detected in 71 (78.0%) patients with 42.3% partial and 58.7% complete recovery. Operative treatment of the fracture had no effect on the outcome of nerve recovery (79.2% vs 73.7%, $P = 0.61$). Presence of concurrent vascular injury predicted worse frequency of nerve recovery (81.9% vs 37.5%, $P = 0.004$).

Conclusion: The prevalence of nerve injury associated with humeral shaft fracture was higher than previously reported in the literature. The radial nerve was the most commonly injured nerve. High-energy trauma, fracture in the middle or distal third of the humerus shaft, bilateral fractures, and concurrent vascular injury are associated with greater risk of nerve injury. Operative treatment of humeral shaft fracture does not affect recovery of nerve injury.