ORIGINAL ARTICLE

Radial Nerve Injury after Operative Management of Humerus Shaft Fractures

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ABSTRACT

Aim: To find out the frequency of iatrogenic radial nerve injury during surgery for humeral shaft fracture.
Methods: The study was performed in department of Orthopedics Medical Teaching Institute Lady Reading Hospital Peshawar from January 2014 to December 2016 including patients with shaft of humerus fracture who underwent surgery for fixation. Medical records were analyzed including radiographs, AO fracture type, level of humerus fracture and post-operative radial nerve palsy with its recovery duration.
Results: Sixty three patients underwent surgery for shaft of humerus fracture, 14 had radial nerve palsy before surgery. Eight (16%) developed radial nerve palsy after surgery. The risk factor is AO type A fracture (61%) and middle third of humeral shaft fracture (63 %), with incidence of palsy to be 20% and 19% respectively.($p<0.05$)
Conclusion: Keeping in view the incidence of post-operative radial nerve palsy, that the radial nerve is injured at mid shaft humerus fractures and transverse and oblique fracture configuration.
Keywords: Iatrogenic, Radial Nerve, Humerous, Fracture, Palsy, Injury

INTRODUCTION

Fracture of the humerous are not uncommon[1]. Fracture may be caused by direct impact, motor vehicle accident, fall or tumours. Management of these fractures differs. It can be managed either conservatively or with surgery[2]. Different type of surgery can be done for different pattern of fracture. It may include s close reduction and internal fixation, open reduction and internal fixation or open reduction external fixation[3]. Internal fixation can be done with dynamic compression plate, Low contact dynamic compression plate, locking compression plate, minimal invasive plate osteosynthesis and intramedullary nails.[4] While treating the fracture with open reduction internal fixation of the middle third of the shaft of humerous it may cause trauma to radial nerve either partially or fully and either permanent or temporary[5,6].

The radial nerve is the commonly injured major nerve in the upper extremity[7]. Radial nerve paralysis can be grouped as primary or secondary, depending upon whether the palsy occurred at the time of presentation or after the treatment. The incidence of radial nerve palsy was found to be 11.8% in a study by Shao et al[8]. The radial nerve with its circuitous relationship to humerus is of special interest with any exposure of the humeral shaft. The radial nerve is tightly bound by lateral intermuscular septum as the nerve enters the anterior compartment and is susceptible to injury at this level[9]. Over the past few decades, agreement has made that a 3 to 4 months period of watchful waiting is appropriate before surgical intervention is attempted[10]. The objective of this study is to find out the frequency of iatrogenic radial nerve injury during surgery for humeral shaft fracture.

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PATIENTS AND METHODS

This descriptive study was carried out at Department of Orthopaedic and Trauma Surgery, Medical Teaching Institute Lady Reading Hospital Peshawar on 63 consecutive patients. All humeral shaft fractures and nonunion of the humerus shaft above 18 years in either gender were included in the study. Patients who had the followings were excluded: (1) nailing for humerus; (2) intra-articular fracture (3) tumors of humerus (4) pre-operative radial nerve palsy; (5) vasculitis and connective tissue disorder. Regardless of previous surgeries done elsewhere, the first surgery in our hospital through any method was measured as the index surgery and following exposures were considered as secondary procedures. Over a period of 2 years, 63 patients with shaft of humerus fractures were operated. The frequent procedure was dynamic compression plating using. Of these 63 cases, 8 developed post-operative radial nerve palsy. The patients were managed with wrist extension splint and physiotherapy was advised. Nerve conduction studies were obtained in all cases. Regular 4 weekly follow up was advised. X-rays were reviewed for fracture location and anatomy. The type of implant and adequacy of reduction were noted especially to the gaps between fracture fragments or between the plate and bone, which would advocate radial nerve entrapment. All operative procedure in these patients was performed by consultants. The data were collected with the help of a proforma and then enter and analyzed with SPSS version 17.

RESULTS

There were 35(78%) males and 14(21%) females. The mean age of patients was 42.7 years. The indication for the surgical procedure was an acute fracture in 25 patients, nonunion in 13 patients and infected nonunion in 11 patients. Of the 49 patients, 8(16%) developed radial nerve palsy after the surgical procedure: 9 received surgery for acute trauma and the rest 2 for nonunion without infection or previous implants. All the other patients recovered within 6 months. Two patients showed full recovery within three weeks (Table 1).

Table 1: Radial nerve injuries associated with post operative treatment of humerus fractures

Variable	Radial Nerve		Total
	Palsy	No palsy	
Gender			
Male	6(17%)	29(83%)	35
Female	2(14%)	12(86%)	14
Total			49
AO Classification			
TYPE A	5(16%)	25(84%)	30
TYPE B	3(18%)	13(82%)	16
TYPE C	-	3 (100%)	3
Total			49
Humerus level			
A) Upper 1/3	2(17%)	11(83%)	14
B) Middle 1/3	6(19%)	25(81%)	31
C) Lower 1/3	-	4(100%)	4
Total			49

DISCUSSION

The incidence of post surgical radial nerve palsy has been reported to be 5.1% in a study by Paris et al[11]. In the present study it was 4.2%. The common types of surgical procedures, it was that better outcomes and fewer complications are associated with either higher surgeon or hospital case volume or both. Bodner et al[12] reported obtaining accurate results using high resolution ultrasound to evaluate the injured radial nerve in humeral shaft fractures. Shao et al[8] while stating that the role of ultrasound has yet to be properly determined, chose to include ultrasound as part of their proposed treatment algorithm.

The radial nerve twisting around the humerus and “tethered” within the lateral intermuscular septum is identified to be always at risk with fractures and surgical exposures of the humeral shaft. The anterolateral approach which requires splitting of the brachialis may be theoretically safe as the radial nerve is not directly dealt with or explored. In his classic manuscript Henry[13] describes the split brachialis belly as a cushion against the radial nerve and even goes on to claim that in all his exposures he encountered only a single radial nerve injury. As the patient is positioned supine there is an additional benefit of easy positioning and anesthesia, especially in multiple injured patients[14]. With the increase in operative procedures for the management of humerus shaft fractures/ nonunion, iatrogenic acute radial nerve palsies can no longer be considered as rare events[15,16]. In our series of 49 patients, the frequency of postoperative deficit was found in 8 patients (16%). In our hospital, procedures on the humeral shaft are routinely performed through the anterior brachialis splitting approach and posterior approach. The incidence of radial nerve palsy for various approaches to the humerus is difficult to ascertain from the existing literature. In a meta-analysis by Shao et al[8] the overall radial nerve palsy in humerus fractures was 11.8%. However incidence of postoperative deficit following the anterolateral and posterior approach is obscure as various studies tend to involve a combination of approaches and fixation modalities for humerus shaft fractures and nonunion.

Wang et al[10] have documented deficit in the range of 4% to 5%, but these studies failed to exclude patients with a preoperative deficit. In the series by Wang et al[10] the mean time to beginning of clinical recovery was 16 (5 to 30) weeks. In our series the documented postoperative deficit was 16% with most recovered in 3 to 6 months. In addition we have noticed that two of our patients showed recovery within a period of 3 weeks which is much earlier than the duration described by Wang et al.[10] Shao et al[8] in their meta-analysis found the prevalence of radial nerve palsy to be more frequent with transverse and spiral fracture patterns and fractures involving the lower and middle third humeral shaft which is significant ($p< 0.05$). Likewise in our study AO type A factures accounted for 62% of postoperative deficits which never occurred in patients with an upper third fracture/nonunion ($p < 0.05$) as compared to 55 % in a study by Ghouse et al[17].

The incidence of postoperative radial nerve palsy in our series is unusually high (16%) as compared with other studies[17]. We attribute this to various causes both analytical and otherwise as the 16% recorded here excludes those with a preoperative deficit. Other possible causes would be inadequate experience of the operating surgeon, keen protection of the nerve around soft tissue, inappropriate retraction or placement of implant and retractors. The soft tissue sleeve is more likely to be intact following a lower energy fracture. Hence insufficient dissection together with overenthusiastic retraction and reduction maneuvers may explain for radial nerve deficits. We also prefer non-operative treatment options now, which are known to have reasonable union rates with low complications and problems and continue to suggest and encourage in most patients with isolated injuries. Considering the incidence of postoperative palsy, we recommend alternate approaches[18,19] to the humerus be employed.

CONCLUSION

Radial nerve is very delicate nerve and can be traumatized even with minor manipulation. Care must be taken while treating fracture of the humerous surgically otherwise one may injure the radial nerve.

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