

Comparative study between posterior and modified posterior approaches of humeral diaphyseal fractures in adults

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Abstract

Introduction The optimal treatment of humeral shaft fractures continues to be debated. In the current investigation, we sought to determine the clinical and radiographic outcomes following the plate fixation of humeral shaft fractures utilizing the modified posterior approach.

Materials and methods A retrospective review identified a consecutive series of 30 humeral shaft fractures (OTA20-A, 10-B, or 0-C) treated with plate fixation via a posterior (14 patients), or modified posterior approach (16 patients) between 2016 and 2017 by a single surgeon. Demographics, operative reports, clinical follow-up, and preoperative radiographs were reviewed. Postoperative radiographs were assessed for angular deformity and time to union. Range of motion and strength testing were also reviewed. Results A total of 30 humeral shaft fractures were reviewed with a mean clinical follow-up of 4 months. The mean time to union was 13.1 weeks and there were 3 patients developed radial nerve palsies in posterior approach group and one case in modified posterior approach postoperatively.

Conclusion both approaches could be used in the management of humeral diaphyseal middle or distal third fractures, And the modified posterior approach confirmed by our results minimizes the complication rate, allow early return of full range of elbow motion and full triceps muscle power and facilitates early return to normal activities of the patient with excellent functional outcomes.

Introduction

Humeral shaft fractures are relatively common fractures of the upper extremity, representing approximately 1–2 % of all fractures (1) historically; these fractures were treated non-operatively with bracing (2), (3) but in the past few decades, patient demand for faster time to union and earlier return to activities has prompted increased surgical management of diaphyseal humerus fractures (3). Management of humeral shaft fractures is still controversial. The main surgical options for treating humeral shaft fractures include internal plate fixation and intramedullary nailing

Even amongst those who advocate for operative fixation through plating, there is no consensus regarding the

optimal approach and technique. The modified posterior approach to the humerus offers several natural advantages, including the ability to visualize and protect the radial nerve, access to a flat diaphyseal surface for plate fixation, adequate exposure for the application of plate. The goal of this study was to report the outcomes of plating of humeral shaft fractures through the modified posterior approach and comparing its results with the posterior approach. We hypothesized that this technique results in a high rate of union and a low rate of secondary nerve palsies, as the approach provides ample visualization of the fracture as well as the radial nerve with early return of full range of elbow joint motion (5).

Methods

Inclusion criteria were skeletally mature patients aging 18 year or more and traumatic closed humeral shaft fractures in the middle or distal third not extending into upper or lower metaphyseal areas. humeral shaft fractures classified as 20-A, 10-B, or 0-C according to the AO/OTA classification scheme (5) and treatment with open reduction and fixation with a 3.5 mm compression plate (DCP), 16 using the modified posterior group and 14 using the posterior group. The data were collected to define patient characteristics, comorbidities, and concomitant injuries. Injury radiographs were reviewed, and fractures were classified according to the AO/OTA classification (5). Postoperative radiographs were assessed for angular deformity and time to union. Sequential radiographs were used to determine fracture healing, and two independent observers, both senior Orthopaedic residents, determined time to union. Radiologic union was defined as the presence of bridging callus or absence of fracture line on orthogonal radiographs, time to achieve full range of elbow joint motion was recorded and incidence of complications namely radial nerve palsy was recorded in both approaches.

Surgical technique

The patient is placed in the lateral decubitus position with the assistance of a beanbag, and the arm is draped over a post on a radiolucent operating table. The fluoroscopic C-arm is

positioned on the other side of the operating room, and radiographs are taken prior to prepping to assure that adequate fluoroscopic views are available. The arm is prepped in the standard fashion. The modified posterior approach to the humeral shaft as described by Gerwin et al. (6) is used in 16 patients. A 12-cm incision is made in line with the posterior humerus. The dissection begins with identifying the lower lateral brachial cutaneous nerve which is used to locate the common radial nerve. A Penrose drain is then wrapped underneath the nerve and clamped to assist in dissection, the triceps is retracted medially to expose the posterior aspect of the humerus, and a radial nerve neurolysis is performed. The fracture is then exposed and reduced. The posterior approach is used in 14 patients as described by Stanley Hoppenfeld (7) after incision and superficial dissection start deep dissection by incising the medial head in the midline down to the periosteum of the humerus. Then, strip the muscle off the bone by epi- periosteal dissection. After reduction of fracture a 3.5 mm D.C.P is used to fix it using the standard AO principles.

Postoperative protocol

Patients will be allowed for flexion and extension of elbow from the first day post-operative with the arm in broad arm sling and they were warned against vigorous activities until evidences of union were seen by radiographs. Active assisted range of motion exercises for shoulder was encouraged from the first day post-operative.

Results

Mean age in years for patients in posterior group is 30.35year , Mean age in years for modified posterior group is 27 and Mean age in years for both groups is 28.57 years ; there was a male preponderance in our patients. A male to female ratio in all patients was about 2.75:1. Most common mode of injury in adolescent patients, are Road traffic accidents and falling from height. Majority of patients in our study series were operated either in the same day or the second day to hospital admission (24 / 30) with delay only in 6 patients due to different cases. And there is shorter duration of healing time in cases operated more early than the delayed operated cases. In our study among the 14 cases operated in posterior group two patients had Hypertension, one patient with H.C.V and three patients had D.M while among the 16 cases operated with the modified posterior approach one patient had H.C.V and three patients had Hypertension all the 10 patients had controlled Blood pressure, controlled blood glucose level and normal liver functions before operation. Superficial wound infection was seen in one case operated with the modified posterior approach, treated with antibiotic and regular dressing and improved two weeks later. No cases with rotational malalignment have been seen in our study in both approaches. No cases in both groups developed compartment syndrome, revision surgery, metal failure or fracture nonunion.

Discussion

As regarding results of posterior approach according to Arch Orthop Trauma Surg (2016)

Journal	Number of patients (n)	Time to union	Rate of nonunion	Postoperative radial nerve palsy
Yin P, Zhang L et al 2014	26 patients	12.96 weeks	Not reported	3/26– (11.5 %)
Singh AK, Narsaria N et al 2014	220 patients (102 patients-LCDCP; 110 patients-LCP)	LCDCP 17.2 weeks;; LCP: 15.8 weeks	15/220 delayed Union (6.8 %) 5/220 nonunion (2.8 %)	3/102 – LCDCP (2.9 %) 4/110 – LCP(3.6 %)/7/220 (3.3 % overall)
Wang C, Li J, et al 2015	53 patients (27 patients-ORIF; 26 patients MIPO)	Not reported	3/45 (6.7 %)	3/27- ORIF (11 %) 1/26- MIPO (3.8 %) 4/53(7.5%overall)
Claessen FM, Peters RM et al 2015	259 patients compared by approach)	Not reported	Not reported	2/9- lateral (22 %) 9/85-Posterior (11 %)
Esmailieh AA et al 2015	65 patients 33 ORIF; 32 MIPO	Median time to union 4 months MIPO; 5 months in conventional ORIF	4/65 (6.2 %)	1/32–MIPO (3 %); 4/33 ORIF (12 %) 65(7.7 % overall)

When combined, these studies collectively report a 5.3 % rate of iatrogenic radial nerve palsy (3.8–7.5 %)

Comparing the modified posterior approach results in this study with study done by Elizabeth B. Gausden, Alexander B. Christ et al in 2016 which show mean time to

union was 15.6 ± 11.1 weeks with one case of delayed union Seventeen of 66 (25.8 %) patients presented with a primary radial nerve palsy following injury, and 14 of the 17 (82 %) of the preoperative radial nerve palsies fully resolved at an average of 31 weeks following injury. Two additional patients developed radial nerve palsies postoperatively (3.0 %).

We demonstrated favorable rates of bone union, rate of non-union, and iatrogenic radial nerve palsy in both approaches .

On comparing results of both approaches in our study: (A) Time of union: There was no statistical significance between them (P. value =0.915). Range in both approaches was (8 – 16) weeks. (B) Average time of return of full range of motion of elbow joint: Average time in posterior group is 5.55 weeks. Average time in modified posterior group is 2.13 weeks The P value between them is less than 0.0001(significant). (C) Risk of complications namely radial nerve palsy: 3 cases developed post-operative radial nerve palsy in the posterior group (21.42 %) in comparing with one case in the modified posterior group (6.25 %). The P value between them is 0.19(insignificant). It is important to note that all the secondary radial nerve palsies reported are transient; likely the manifestations of traction neuropraxia and show complete return of radial nerve functions within two weeks post-operative. After Grading of cases according to Functional scoring in posterior approach group is 9 excellent and 5 good while in group modified posterior approach group is 14cases excellent and 2 cases good.

Conclusion

We recommend that both approaches could be used in the management of humeral diaphyseal middle or distal third fractures, And the modified posterior approach confirmed by our results minimizes the complication rate, allow early return of full range of elbow motion and full triceps muscle power and facilitates early return to normal activities of the patient with excellent functional out comes.

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