Comparative Study of Results of Anterior Vs Posterior Plating for Shaft Humerus Fractures

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Abstract: Background: Diaphyseal humeral injuries account for 3–5% of all injuries. Treatment option varies from conservative cast and brace to internal fixation with plate and screws and intramedullary nailing. Among all options, plate osteosynthesis remains the gold standard for the operative fixation of humeral shaft fractures. In present series we have studied operative result of two different techniques in terms of operative difficulties, functional outcome and complications. Methods: Study was conducted over a period of three years on thirty patients with closed acute humeral shaft fracture requiring operative interventions. In all patients, an AO 4.5 mm dynamic compression plate or Locking Compression Plate was used through anterior approach in 15 patients and posterior approach in 15 patients. Post-operatively regular follow up done and during each follow up radiological and functional outcome evaluated. Result: In all patients fracture united in mean weeks of 13.5. Mean shoulder flexion 159^0 , extension 48.5^0 ,abduction 162.5^0,external rotation 76.5^0 and internal rotation 59^0. Mean range of motion of elbow 0^0-139^0. Out of 15 patients of posterior plate group complications were: Infection- 1 (6.6%); iatrogenic radial nerve palsy – 4(26.6%). Out of 15 patients of anterior plate group no complications were observed. Conclusion: For patients requiring surgical treatment of shaft humeral fractures by plating, anterior and posterior approach both provide statistically comparable results but anterior humerus plating provides less complication rate and convenient operative position (for anesthesia) which makes it preferred approach. [Bhavik D NJIRM 2017; 8(4):1-5]

Key Words: Shaft humerus fracture, plate osteosynthesis, anterior vs posterior approach

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Introduction: Diaphyseal humeral injuries account for 3–5% of all injuries [1] and usually are high velocity injuries including road traffic accidents, assaults, fall from height and throwing injuries [2].Treatment of diaphyseal humeral fracture has evolved from the conservative cast and brace to internal fixation with plate and screws and intramedullary nailing [3] each of these techniques has its own complications and there is no definite data that shows the superiority of one over the other. The conflict between the need for absolute anatomical reduction and, at the same time, the desire for soft tissue preservation has been going on for a long time. Not just solid healing, but immediate and continuous function of the limb is now a leading goal. However, precise reduction and absolute stable fixation has its biological price [4].

Plate Osteosynthesis remains the gold standard for the operative fixation of humeral shaft fractures, despite advances in implant technology. It is associated with a high union rate, low complication rate, and rapid return to function [5-7].

It is generally accepted that the best surface of a long bone for plate placement is the tension surface; theoretically, this is the posterior surface of the humerus [8]. However, some authors have reported excellent results for plate osteosynthesis when using an anterolateral approach and placement of the plate on the antero-lateral surface of the humeral shaft [9].

In present series we have studied operative result of humerus platting by two different approaches and compared both techniques in terms of operative difficulties, shoulder and elbow joint functions, outcome in terms of period of fracture consolidation, union rates and functional result and complication. Study aimed to suggest proper management techniques for better functional outcome and minimum complications.

Methods: In our study 30 cases of fracture of the shaft humerus were treated by open reduction internal fixation with plating from July 2013 to Jun 2016. Fifteen patients with shaft of humerus fractures were treated with plating through anterior approach and other fifteen were treated with posterior approach. Before starting study informed consent taken from all patients. Patients were selected on bases of inclusion and exclusion criteria. Patients age group between 20-60 years with shaft humerus fracture treated with open reduction and internal fixation by platting were included in study while patients with life threatening infection ,patient having age <15 years and > 60 years,

humeral shaft fractures that extend into the articular surface, vascular injury requiring repair and pathological fracture were excluded from study.

Surgical Technique: Anterior approach: Patients were placed in supine position, with the operated arm on a radiolucent table. Most of patients underwent regional block, and general anesthesia supplemented if required. Longitudinal incision is made over lateral border of the biceps starting about10-12 cm proximal to the flexion crease of the elbow. The deep fascia of the arm was incised in line with skin incision, the biceps muscle was identified and retracted laterally and muscular interval between the brachioradialis and the brachialis muscle was identified and brachialis muscle fibers split to expose the periosteum of the anterior humerus. During procedure musculo-cutaneous nerve and radial nerve carefully identified and retracted to avoid injury.

Posterior approach: Patients were placed in lateral position with arm over top of body. Most of patients underwent regional block, and general anesthesia supplemented if required. Longitudinal incision made over posterior aspect of the arm, from 8-10 cm below the acromion to the olecranon fossa. The deep fascia of the arm was incised in line with skin incision, the plane between the lateral and long head of triceps was identified and lateral head was retracted laterally and long head was retracted medially. Radial nerve was identified in spiral groove and carefully retracted and medial head of tricep split to expose humerus.

The fracture ends were exposed and haematoma drained and soft tissue interposing between fragments was removed. The fractures were reduced and a 4.5-mm dynamic compression plate or 4.5 locking compression plate used to fix the fractures with at least eight cortices in each end of the plate. The stability of the bone plate construction was examined by passive motion of the shoulder and the elbow.

Postoperatively, patients were advised functional arm brace for 4 weeks. Postoperative IV antibiotics were given as per protocol. Stitches were removed on 12 to 14th postoperative day. Passive and active range of motion exercises of the shoulder and the elbow were initiated on the first postoperative day, avoiding

external shoulder rotation movements. Patients were followed monthly for 3 months and then every 3 months for one year. Patients were assessed clinically and radiologically for movements at the elbow & shoulder joint, pain, any angular or rotational deformity or any other complaints.

Data analyzed in regard to fracture union time, perioperative complications, late complications, and shoulder and elbow function. Shoulder and elbow function were quantitatively assessed by American

shoulder and elbow society score. The score further divided in excellent (>=90),good(80-89),fair(70-79),poor(<70) [13].

Result:

Approach		Anterior[9-10]	Posterior[11-12]
Age (Year)		**37.1 (20-60)**	**38.1 (21-55)**
Fracture Location	Upper 1/3	1	0
	Middle 1/3	14	11
	Lower 1/3	0	4
AO-OTA Classification	12A.1	1	0
	12A.2	11	10
	12A.3	3	5
Gustilo-Anderson Classification	Open Grade 1	2	1
	Open Grade 2	1	1

There were 22 male and 8 female(11 male and 4 female in each group).Mean age of the anterior humerus plating group and posterior humerus platting group was 37.1 and 38.1 years respectively. Most patients sustained injuries in road traffic accidents (56.6%) followed by domestic fall (23.3%) and fall from height (20%). 25 patients had Middle one-third shaft fracture, 4 patients had lower one-third fracture and 1 patient had upper one third fracture. According to the Gustilo-Anderson classification 25 cases (83.3%) had closed fracture. There were 3 grade -I open fractures (10%) and two grade-II (6.7%) fractures. Preoperatively, there were two patients with radial nerve palsy. An average time interval from injury to operation was 2 days.

An average time to bone union was 13.5 weeks anterior platting and 13.2 in posterior platting. An average time to return to work was 13 weeks (range 10 to 16 weeks).

Shoulder joint average flexion was 160^{o} and 158^{o} ,average extension was 50^{o} and 47^{o}, average abduction, external rotation and internal rotation were 163^{o} and $162^{o,}$$77^{o}$ and 76^{o}, 60^{o} and 58^{o}respectively for anterior plating and posterior plating patients. Elbow range of motion average was $0\text{-}140^{o}$ and $0\text{-}138^{o}$ respectively in anterior plating and posterior plating.

Joint (Movements)		Anterior approach	Posterior approach
Shoulder	Flexion	160°	158°
	Extension	50°	47°
	Abduction	163°	162°
	External Rotation	77°	76°
	Internal Rotation	60°	58°
Elbow	Flexion Extension	0°-140°	0°-138°

In anterior plating ASES score was 96.8 and in posterior plating it was 94.3. No complication were reported in anterior humerus platting group where as in posterior platting group 1 patient had infection and 4 patients had post-operative radial nerve palsy.

Approach		Anterior	Posterior
Patients		15	15
Anesthesia	Block	12	5
	GA Supplement	3	10 (P value <0.02)
	Union (Weeks)	13.5	13.2
ASES Score	Excellent	13	06 (P value <0.05)
	Good	2	9
	Fair	0	0
	Poor	0	0
Complications	Infection	0	1
	Post-Operative Radial Nerve Palsy	0	4

Discussion: Humeral shaft fractures have a bimodal distribution [2]. In the elderly, the predominant cause include simple fall or rotational injury, whereas high velocity injury are usually seen in younger patients, including motor vehicle accidents, assaults (direct blows or gun shots), fall from a height, and throwing injury [2]. The choice of operative treatment depends on many factors. McKee[14] divided the indications into three categories: (1) fracture indications, (2) associated injuries, and (3) patient indications. While some indications are absolute, such as an associated vascular injury or an associated high grade open wound injury, some indications are relative and both patient and fracture pattern must be considered before deciding on treatment.

Operative treatment involves ORIF using plates and screws, external fixation, or minimally invasive methods, such as intramedullary nailing or

MIPO[8,10,15,16]. However, plate osteosynthesis remains the gold standard for the fixation of humeral shaft fractures[5-7]. As established classically, osteosynthesis with plates and screws should follow the tension band principles. It is generally accepted that the plate is placed on the tension surface of a long bone for the humerus, this is theoretically the posterior surface[17].

Although the entire humeral shaft can be exposed through the anterolateral approach described by Henry[18], without the need to visualize the radial nerve, the placement of a plate on the lateral surface involves a potential risk to the nerve during the retraction of the soft tissues or by the implant itself, especially when it is placed over the middle to distal thirds of the shaft, where the radial nerve is in intimate contact with the bone. The reported global incidence of iatrogenic radial nerve injury is 12% when plates are placed on the lateral or posterior surface of the humerus[19].

As far as we know, Jupiter's [20] is the only report in the English literature in which the plate was placed on the anterior surface of the humerus via a medial approach. Although this approach is appropriate when a vascularized bone graft is used, we believe that it places the humeral vasculature at risk, because the nutrient artery enters the humerus medially, as described by Laing[21] and when there is no need for a vascularized bone graft, a simpler, easier, and safer approach is advised.

In our study all of our cases healed in about the same time as approach methods classically used (posterior) for treating humeral shaft fracture, which leads us to believe that placing a plate over the tension face of the humerus is of little clinical significance. The biological benefits of less damage to the soft tissues via an approach that uses a plane between nerves certainly contributed to our good results. There was no infection and all cases achieved fracture union. We believe, advantages of anterior plating over posterior plating are supine position of the patient which makes anesthesia easier, no handling of radial nerve, less soft tissue dissection, proximal extension possible via delto-pectoral interval.

The advantages of this technique are safety and convenience, no need to have special tools and demanding implants or excessive radiographic control. The plate stability allows a fast rehabilitation with superior functional results comparing with the conservative techniques. Humeral shaft fractures could be effectively treated with the anterolateral approach and plate is placed on the anterior surface of the humeral shaft, with advantage of shorter fracture union time and lower incidence of iatrogenic radial nerve palsies but with similar functional outcomes to the conventional open plating technique. The anterior plating is provides satisfactory clinical and radiological outcomes.

Conclusion: The results obtained in this study have shown that humerus platting by anterior approach is safe, convenient and effective, relatively safe since there was no obvious damage, nor major complications. There was no difference in union time and functional outcome compare to platting by posterior approach.

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