International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

To analyze the Functional Outcome of Humeral Shaft Fractures Treated by Open Reduction Internal Fixation

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ABSTRACT

Background: Fractures of the humeral shaft are common. The advantages of operative management are early mobilization and patient comfort but, operative management carries the risk of technical errors and post-operative complications like infections and nerve injuries. Non-operative management of humeral shaft fractures is the mainstay of treatment with some drawbacks. The surgical options for a closed humerus diaphyseal fracture are plate osteosynthesis and intramedullary nailing, the previous being gold standard for last four decades.

Aim: The aim of this study is To analyze the "Functional Outcome Of Humeral Shaft Fractures Treated By Open Reduction Internal Fixation".

Materials and method: A prospective study of fifty (50) patients in the age group above 18 years with diaphyseal fractures of humerus admitted in orthopedic department in Guru Govind Singh hospital and Shri. M. P. Shah Government Medical College, Jamnagar during the period of 18 month, meeting the inclusion criterion are the subjects for the present study. The complete data was collected by taking the history of illness and by doing detailed clinical examinations and relevant investigations.

Result: The shoulder function was assessed by UCLA shoulder score in the 50 patients operated 6 (12%) patients had excellent outcome 41 (82%) had good results and 3 (6%) patients had fair result. The elbow function post operatively was assessed by using Mayo elbow performance score by which 18 (36%) patients had excellent score and 31 (62%) patients had good result and 1 (2%) patient had fair result. 3 patients had post op radial nerve palsy that eventually recovered with physiotherapy. Only 1 patient had postoperative infection at operative site.

Conclusion: There is no universally superior technique or implant for surgically treating humeral shaft fractures. Optimal outcomes rely on the meticulous execution of surgical techniques, adherence to sound biomechanical principles, careful handling of surrounding soft tissues, and the use of appropriate fixation methods. When these elements are properly addressed, open reduction and internal fixation using a suitable plate can yield favorable results.

KEY WORDS: Humeral shaft fracture, Open reduction internal fixation (ORIF), Functional outcome,

Plate osteosynthesis, Diaphyseal fracture, UCLA shoulder score, Mayo elbow performance score, Radial nerve palsy, Postoperative complications, Orthopaedic trauma.

INTRODUCTION:

Mid-shaft fractures of the humerus are relatively common, accounting for approximately 1% of all fractures. Traditionally considered benign, these fractures have shown a high rate of primary healing with conservative treatment methods, such as hanging arm casts or functional bracing. However, loss of reduction with casting can frequently result in malunion.

Surgical intervention has typically been reserved for specific situations, including nonunion, associated forearm fractures, polytrauma cases, and the presence of neurovascular complications. While operative management offers benefits such as early mobilization and improved patient comfort, it also presents risks, including technical challenges and postoperative complications like infection and nerve injury.

Most studies evaluating treatment outcomes have focused primarily on fracture union, with limited emphasis on functional outcomes at the shoulder and elbow. The optimal fixation method for humeral shaft fractures remains a topic of ongoing debate. Plating has demonstrated reliable outcomes but requires extensive soft tissue dissection and careful handling of the radial nerve. Moreover, in osteoporotic bone, plate fixation may be less effective.

Inspired by the successful use of intramedullary fixation in femoral and tibial fractures, some have proposed intramedullary nailing as a potentially superior method for humeral shaft fractures. Nonetheless, recent studies suggest that dynamic compression plating remains the preferred technique.

The aim of this study is to evaluate the outcomes of mid-shaft humeral fracture fixation using dynamic compression plating and to statistically compare its results with those of alternative fixation methods.

MATERIALS AND METHOD: A prospective study of fifty (50) patients in the age group above 18 years with diaphyseal fractures of humerus admitted in orthopedic department in Guru Govind Singh hospital and Shri. M. P. Shah Government Medical College, Jamnagar during the period of 18 month, meeting the inclusion criterion are the subjects for the present study. The complete data was collected by taking the history of illness and by doing detailed clinical examinations and relevant investigations.

Inclusion Criteria:

- Age 18 years or older
- Both male and female patients
- Closed fractures
- Fractures with significant displacement despite closed reduction attempts
- Diaphyseal transverse fractures
- Shaft fractures requiring surgical intervention
- Intact vascular supply

Exclusion Criteria:

- Skeletally immature patients
- Patients unfit for surgery
- Patients managed conservatively
- Pathological fractures

IMPLANTS:

- 4.5 mm Long Narrow Dynamic Compression Plate (DCP) with 10 to 12 holes
- Locking Compression Plates
- Extra-Articular Distal Metaphyseal Humerus Plate
- 4.5 mm Cortical Screws
- Locking Screws

SUMMERY OF THE PATIENT:

number of patients	**50**
Sex (male :female)	**35:15**
Fracture site(right:left)	**27:23**
Mode of injury	
Road traffic accidents	**32**
Fall	**18**
AO classification	
A1	**4**
A2	**9**
A3	**31**
B1	**3**
B2	**3**

Table 2: summery of patients

PREOPERATIVE EVALUATION:

- Detailed history to rule out head or other system injuries.
- X-rays of the humeral shaft, including the shoulder and elbow joints in both AP and lateral views.
- Assessment of distal neurovascular status.
- Informed consent obtained in the patient's own language, explaining the procedure and study.
- Clearance from the physician and anesthetist (regional block or general anesthesia if necessary).
- Administration of systemic antibiotics one hour before the skin incision

OPERATIVE TECHNIQUE

APPROACH: Modified Posterior Approach

POSITION: the patient in the lateral decubitus position. Prepare and drape the area widely to facilitate the use of a sterile tourniquet.

Procedure:

- Make an incision from the tourniquet site to the tip of the olecranon, aligning it with the humerus.
- Dissect down to the triceps fascia, make an incision in the fascia, and continue dissection laterally to the intermuscular septum .
- Locate the lower lateral brachial cutaneous nerve and trace it proximally to where it joins the radial nerve at the septum .This junction typically aligns with the tourniquet level. Release the tourniquet.
- Identify the radial nerve.
- Carefully dissect the triceps muscle proximally away from the intermuscular septum.

- Mobilize the radial nerve by dissecting it proximally, distally, anteriorly, and posteriorly, including a 3 cm incision of the lateral intermuscular septum to allow for nerve movement .
- Incise the triceps from the periosteum to expose the humerus, taking care to preserve as much periosteum as possible.
- If necessary, reflect the posterior border of the deltoid muscle anteriorly to enhance exposure.
- Place a single bone clamp on both the proximal and distal fragments, positioning them away from the fracture site to control the fragments and reflect the triceps. Ensure not to strip the soft tissues circumferentially with the clamp.
- After debriding the fracture site, insert a lag screw for provisional fixation. For transverse fractures where lag screw fixation is challenging, consider using a compression plating technique or a mini-fragment plate (Eglseder technique) for provisional fixation, followed by definitive plate fixation.
- Apply a large-fragment plate using either a neutralization, compression, or bridge-plating technique .
- Verify the alignment of the humerus and the reduction of the fragments using fluoroscopy.
- Close the skin routinely and place a drain if necessary.

POSTOPERATIVE PROTOCOL:

- Monitor neurovascular status immediately after the procedure.
- Support the operated limb with a broad arm sling.
- Inspect the wound on the second postoperative day.
- Initiate passive motion exercises up to 45 degrees two days post-op.
- Increase passive flexion to 60 degrees one week post-op.
- Remove sutures on postoperative day 12.
- Achieve passive flexion up to 90 degrees one month post-op.
- Begin active mobilization six weeks post-op.
- Allow weight lifting as tolerated.
- Perform check x-rays at monthly intervals to monitor for union.

Preoperative radiograph

postoperative radiograph

OBSERVATIONS:

Complications	
Radial nerve palsy	3
Non union	4

Infection	1
Duration of union	
12-16 weeks	4
16-24 weeks	24
>24 weeks	18
Non union	4

Table 3: statistical observations

RESULT:

- The shoulder function was assessed by UCLA shoulder score in the 50 patients operated 6 (12%) patients had excellent outcome 41 (82%) had good results and 3 (6%) patients had fair result.
- The elbow function post operatively was assessed by using Mayo elbow performance score by which 18 (36%) patients had excellent score and 31 (62%) patients had good result and 1 (2%) patient had fair result.
- 3 patients had post op radial nerve palsy that eventually recovered with physiotherapy. Only 1 patient had postoperative infection at operative site.

	UCLA Score	MEPS Score
EXCELLENT	6	18
GOOD	41	31
FAIR	3	1
POOR	0	0
Total	50	50

Table 4: final outcome with MEPS and UCLA score

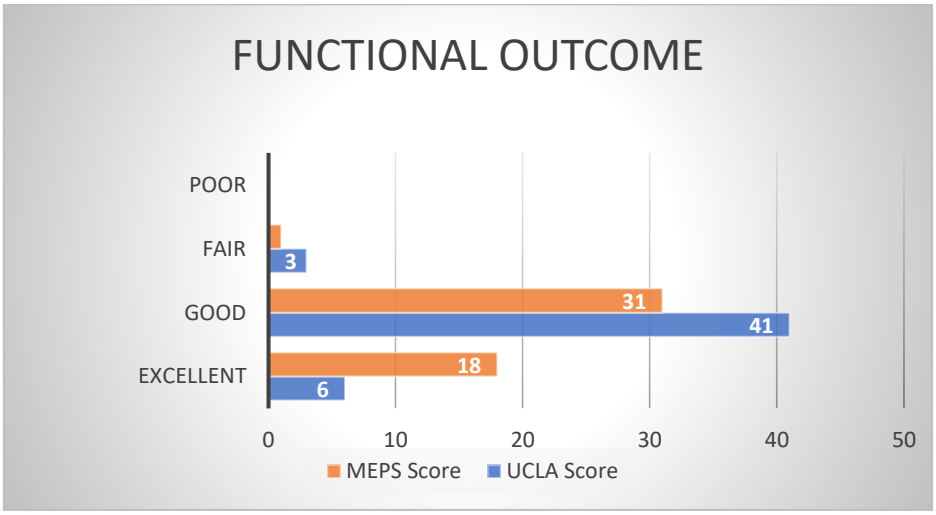

Chart 1: final outcome with MEPS and UCLA score

DISCUSSION

The optimal management of humeral shaft fractures continues to be a subject of debate among orthopedic surgeons. With a range of available implants and surgical techniques, multiple treatment options exist, yet

no single approach has emerged as definitively superior. Non-operative treatment can yield excellent results for certain fracture patterns when appropriate principles are applied. However, surgical intervention is often preferred in cases of displaced fractures, as it allows for early mobilization, reduces the risk of joint stiffness, and avoids prolonged immobilization.

Among surgical techniques, both plating and intramedullary nailing are commonly used. While intramedullary nailing offers some benefits, it also has notable limitations. Variability in humeral canal diameter and the bone's natural curvature can lead to complications such as adhesive capsulitis, implant migration, and shoulder stiffness, making some surgeons hesitant to adopt this method. Plating, on the other hand, is generally regarded as more predictable, with fewer shoulder-related complications and better functional outcomes compared to nailing.

In our study, we evaluated the clinical and radiological outcomes of humeral shaft fractures managed with open reduction and internal fixation (ORIF) via a posterior approach. We assessed fracture healing, recovery from primary radial nerve palsy, incidence of iatrogenic nerve injuries, and other postoperative complications. Our findings revealed high rates of fracture union and minimal complications, with all patients achieving satisfactory outcomes.

CONCLUSION:

- There is no universally superior technique or implant for surgically treating humeral shaft fractures. Optimal outcomes rely on the meticulous execution of surgical techniques, adherence to sound biomechanical principles, careful handling of surrounding soft tissues, and the use of appropriate fixation methods. When these elements are properly addressed.
- open reduction and internal fixation using a suitable plate can yield favorable results.

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