e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(6); 1473-1481

Original Research Article

A Comparative Study of Management of Fracture Shaft of Humerus by Dynamic Compression Plate and Interlocking Nailing

Sunny Kumar[1], Om Prakash Kumar[2]

[1]Senior Resident, Department of Orthopaedics, NMCH, Patna
[2]Professor, Department of Orthopaedics, NMCH, Patna

Received: 17-04-2024 / Revised: 13-05-2024 / Accepted: 04-06-2024
Corresponding Author: Dr. Om Prakash Kumar
Conflict of interest: Nil

Abstract:

Introduction: Fractures of the humeral shaft are common and accounts for 1-3% of all fractures and have bimodal distribution.

Objective: To compare functional out-comes, union and complication rates in patients treated with locked intramedullary nailing or dynamic compression plating for humeral shaft fractures.

Material and Methods: This study was conducted in the Department of Orthopedic Surgery at Nalanda Medical College and Hospital, Patna, Bihar, between may 2022 to May 2023. Total 20 patients were surgically treated with either DCP or interlocking nailing between the above-mentioned study periods.

Results: Out of 20 cases, there were 15 men and 5 women. 13 (76%) cases were admitted due to Road Traffic Accident and 3(15%) Due to physical assault and 4 due to fall at home. Out Of 20 cases, 5 cases (25%) were proximal third, 10 (50%) were middle third, and 5 (25%) were distal third. The fractures united in 18 (90%) patients, with 2 (10%) cases showed delayed union due to infection.

Conclusion: Open reduction and Internal fixation of the humerus shaft fractures treated with dynamic compression plate provides higher union rates as compared to other modes of treatment available.

Keywords: orif, interlocking nail, dynamic compression plate, diaphyseal humerus fracture, humerus

Introduction

Fractures of the humeral shaft are common and accounts for 1-3% of all fractures and havebimodal distribution. One group consists of mostly young males of 21 to 30 years age group and the other of older females of 60 to 80 years. *The* predominant causes of humeral shaft fractures in young age group are high energy traumas and in case of second group mainly simple fall or rotational injuries. [6,4] Fractures of humeral shaft have traditionally been regarded benign, with high percentage of primary healing with conservative methods, using either a hanging arm cast or a functional brace. Operative treatment for humerus fractures has usually been reserved for the treatment of non-union, unacceptable reduction of fractures, compound fractures, associated with forearm fractures, for polytrauma patients, fractures with neurovascular complications and patients with obesity who are at risk of developing varus angulations. 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, nerve injuries etc.[5,7] Two techniques under study include intramedullary nailing and dynamic compression plate fixation. Open reduction and internal fixation (ORIF) with plates and screws continues to be considered the gold standard for surgical treatment. It is associated with a high union rate, low complication rate, and rapid return to function. It provides satisfactory results but requires extensive soft tissue dissection, and meticulous radial nerve protection. The plate may fail in osteoporotic bone.[4,7] Due to concerns about soft tissue dissection required for ORIF, a less invasive technique that allows indirect reduction and percutaneous plating of the anterior humerus has been developed. With this background current study was planned to compare the outcomes of each method of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus.

Material and Method

This study was conducted in the Department of Orthopaedic Surgery at Nalanda Medical College and Hospital, Patna, Bihar, between May 2022 to May 2023.Total 20 patients were surgically treated with either DCP or interlocking nailing between the above-mentioned study periods. The patients were followed up every second week till radiological union was seen. Patients were also assessed clinically

Inclusion Criteria

1. Age 20yr-45yr
2. Segmental fractures
3. Diaphyseal fractures

Exclusion Criteria

1. Age less than 20 yr.
2. Severe comorbidity.
3. Associated with head injury.
4. Non-union

Pre Operative preparation

Each patient will be subjected to thorough clinical and radiological examinations along with routine pathological investigations to rule out associated injuries and other comorbid conditions. Prophylactic administration of cephalosporins along with aminoglycosides and tetanus toxoid will be given. Stable Patients will be subjected to all relevant preoperative investigations and will betaken up for surgery as soon as they are fit for anaesthesia.

Technique

Antero lateral approach of middle shaft of Humerus

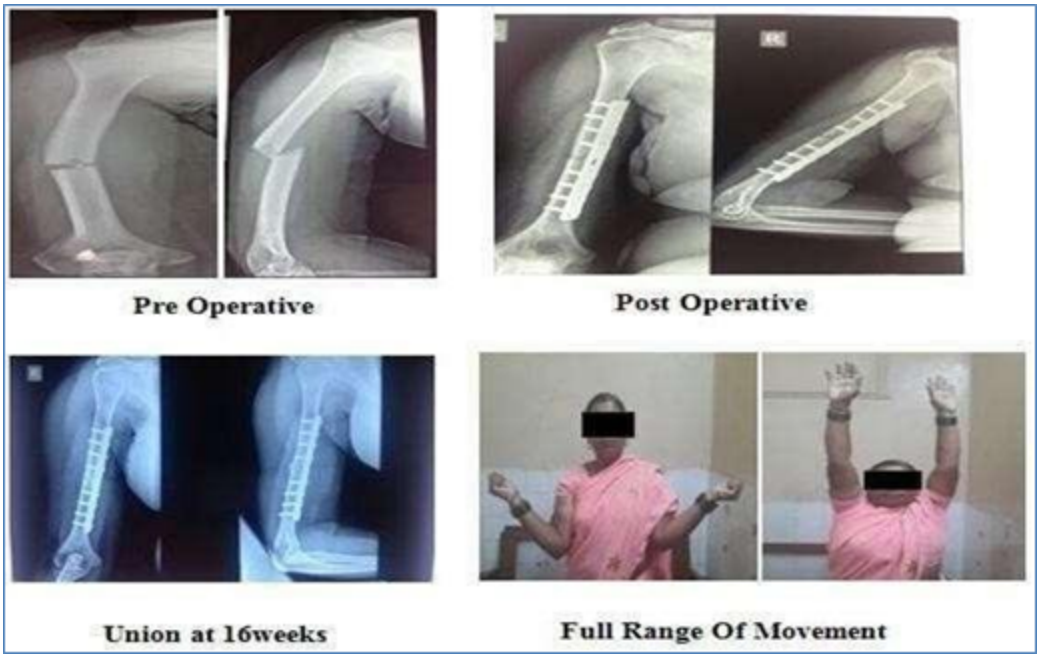
Position of the patient will be supine on operating table with affected limb on arm board, abducted 60^0 and C-Arm on contra lateral side. All patients will be operated under Brachial block or Genernal Anaesthesia . After Proper scrubbing and painting with antiseptic solution draping done.

Step

Incision made longitudinal from tip of coracoids process of scapula then along line of deltopectoral groove. And continue incision Lateral border of bicep. Incision should be stopped 5 cm above the flexion crease. Separate soft tissues, incise the deep fascia of arm along the line of incision and retract the biceps medially. Split the brachialis muscle to reach periosteum of bone and opening of medullary canal and cleaning of both end of fracture and reduction of fracture with help of reduction clamp. Selection of plate (DCP 8hole) and fixation of fracture with plate and screw (4Proximaland 4distal) Secure hemostasis and drain applied and wound closed in layers with suture and dressing applied.

Postoperative Care

Post-operative rehabilitation following stable osteosynthesis by plate is straight forward. We start the patient with finger and wrist movements on the 1st post-operative day. Mobilization begins on post-operative day 2 with active-assisted elbow flexion-extension and forearm Pronation-Supination exercises taking into consideration pain tolerated by the patient. After that if patient is able to tolerate the pain then we start the patient on pendulum exercises of shoulder from post op day 5. Then as the tolerance increases we start the patient with shoulder shrugs and shoulder circling exercises followed up by shoulder abduction stretching exercises. Resistive exercises and load bearing are started only after evidence of bridging callus on radiograph. Thus, a good functional range of motion is achieved within 4-5 weeks.



Operative Technique - Patient Positioning

Patient is placed on radiolucent orthopedic table in contralateral lateral decubitus position with 10–15-degree posterior sag of ipsilateral shoulder (Figure 1). Patient's body is secured with well-padded side supports over the sacrum and pubis, soft cushioning at all bony prominences and appropriate head-neck elevation for adequate airway access. Positioning of the patient, Surgeon, assistant, image intensifier and the anesthetist with his machine at a predefined place is the key in execution of the surgery. The surgeon stands at the headend of the patient's shoulder and assistant stands opposite to the surgeon at posterior aspect of the patient holding the arm at forearm and elbow. The assistant has a pivotal role in achieving and maintaining reduction with traction and manipulation of the arm with viewing im- ages in all planes during the procedure. Image intensifier is placed in transverse plane giving unobstructed anteroposterior view from shoulder to elbow at all times. Viewing in different planes is usually achieved by rotating the image intensifier or changing of position of shoulder by arm and elbow rotation (**Figure 2**).

Figure 1. Lateral position. 2. A arm image of proximal humerus; (d) B Arm image of distal humerus.

Procedure

Patient is placed in the lateral position. A small 2 cm skin incision from the an- terolateral edge of the acromion is given and subcutaneous tissue sharply incised (**Figure 3**). Deltoid muscle is split along the raphe followed by incising and/or partially resecting

Figure 3. Anterolateral incision.

the subdeltoid bursa. The supraspinatus tendon is incised in line with its fibers with a pointed scalpel blade and both borders of the tendon are retracted with sutures. Expose the superior humeral head cartilage medial to the greater tuberosity.

Figure 4. (a) X ray showing fracture humerus; (b) Entry point.

The entry point is enlarged with bone awl and a 2.5 mm guide wire is passed through the correct entry point, and guide wire is passed across the fracture site (**Figure 5**).

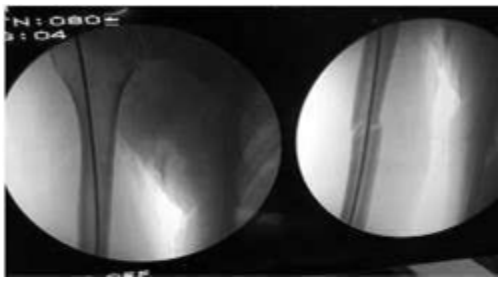


Figure 5. Reduction and guide wire insertion.

Reaming of the Canal

Reaming of the canal is carried out sequentially through the fracture site into the distal medullary canal up to one cm proximal to olecranon fossa (**Figure6**

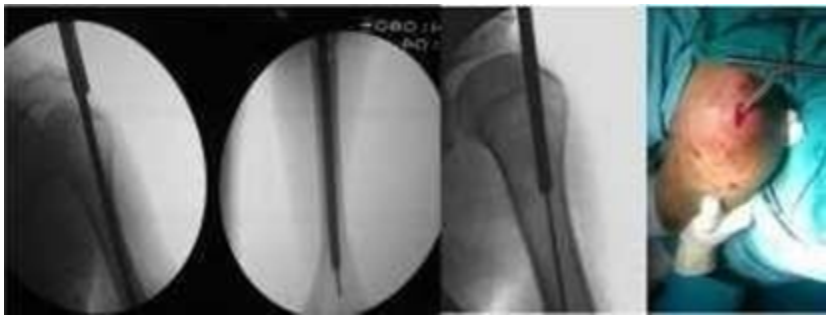


Figure 6. Sequential reaming of canal over guide wire.

Insertion of Nail

The appropriate size and the length of the humerus nail are inserted with slightly rotating movements down to the fracture line. The fracture site is firmly held by the assist to avoid movements at the fracture site which helps in the prevention of injury to the radial nerve. The nail is passed across the fracture site and final seating of the nail is done in distal metaphysis with gentle blows after accurate control of rotation. Care is taken to avoid distraction at the fracture site. Appropriate size of the nail means a nail which is embedded in the distal metaphysis and is buried at least 5 mm beneath the articular surface and has no distraction at fracture site (**Figure 7**).

Figure 7. (a) Insertion of nail.

Proximal locking

Proximal locking is done with help of jig. Number of locking screws and their position depends on the fracture configuration and location. At least two proximal bolts are considered sufficient for shaft fractures and multiple angled locking with maximum bolts are required for proximal and metaphyseal fracture. If gapping is evident at fracture site elbow is stroked gently to achieve compression or first distal locking and extraction blows shall achieve compression at fracture site. Check the nail is sub articular and then do proximal locking (**Figure 8**).

Figure 8. (a) Proximal locking.

Distal Locking

During freehand distal locking, the patient's arm rests on his or her body and the forearm is rested on the anterior pelvic support on sterile padding. By changing the amount of padding, arm rotation can be adjusted to give a perfect view of the distal locking hole. Once distal interlock holes appear as perfect circles in AP

Postoperative Care:

Every patient was put in an arm sling immediately post-operatively. Every patient was examined for vascular and neurological status. Check X-rays were obtained to assess the reduction and the position of nails. Analgesic (parenteral 50 mg of diclofenac sodium) twice daily and anti-oedematous (alpha chymotrypsin i.m. twice daily) measures were

prescribed according to the clinical condition. One gram of third-generation cephalosporin was administered every twelve hours for 48 hours postoperatively. The postoperative dressing changed after 2 days.

Follow up:

Stitches were removed after two weeks. Rotational stresses were avoided until callus formation was visible. After two to three days the patient was instructed to remove the sling several times per day and start a passive range of motion exercises of the elbow and shoulder as tolerated by pain. The arm sling was removed after three to six weeks and active shoulder exercises were allowed. Heavy weight loading not allowed till complete and solid radiological bone union was achieved. Check X- rays (anteroposterior and lateral views) were obtained after two, six, and twelve weeks, then monthly till radiological union, then at the end of follow up. The mean follows up period was twenty-four weeks (range: from twenty to thirty-two).

Complications

Nail protrusion: Nail protrusion into the shoulder was a technical error due to incomplete insertion of the nail as it should be a 2mm subchondral. It occurred in one patient but the patient refused any operative procedure to remove the nail after the union.

Nerve injury:

Shoulder impingement: Shoulder impingement was seen in three patients' nail protrusion was the cause in one of them.

Infection:

Results:

Out of 20 cases, there were 15 men and 5 women. 13 (76%) cases were admitted due to Road Traffic Accident and 3(15%) physical assault Due to and 4 due to fall at home. Of 20 cases, 5 cases (25%) were proximal third, 10 (50%) were middle third, and 5 (25%) were distal third. The fractures united in 18 (90%) patients, with 2 (10%) cases showed delayed union due to infection.

Table No.1

Variable	ILN (n:20)	DCP (n:18)
Age (mean±SD)	35.05±11.44	37.28±11.18
Male:Female	7:3	8:2
Side Left: Right	2: 8	3:7

Table2: AO type of patients in Groups:

AO Type	Group (ILN)		Group (DCP)	
	No	Percentage	No	Percentage
12A1.1	6	60.00%	7	70.00%
12A1.2	2	20.00%	2	20.00%
12A1.3	2	20.00%	1	20.00%
Total	10	100%	20	100%

Table3: Anatomical level of fracture:

Anatomical level	No. of patients	Percentage
Upper third	5	50%
Middle third	10	25%
Lower third	5	25.0%
Total	20	100%

Table4:Mode of Injury patients in Groups:

Mode of Injury	(ILN) A		(DCP) B	
	No	Percentage	No	Percentage
Physical assault	2	20.00%	1	10.00%
Fall	1	10.00%	3	30.00%
RTA	7	70.00%	6	60.00%
Total	10	100%	10	100%

Table5: Functional out come of Patients in Groups:

Functional out come	[Intramedullary Nailing]		[Dynamic Compression Plating]	
	No	Percentage	No	Percentage
Excellent	6	60.0%	7	70.0%
Good	2	20.0%	1	10.0%
Poor	1	10	7	10.0%
Fair	1	10%	2	10.0%
Total	10	100%	10	100%

Table6: Functional assessment of whole upper limbs function:

ASES Score	[Intramedullary Nailing]		[Dynamic Compression Plating]	
	No	Percent age	No	Percentage
42- 52	7	70%	6	60%
42- 46	2	20%	2	20%
36- 41	1	10%	2	20%
31- 35	00	00	00	00%
<30	00	00	00	00
Total	10	100%	10	100%

Table7: Complications:

Complications	(n=10)		(n=10)	
	Number	Percentage	Number	Percentage
Radial nerve palsy	0	0	2	20%
Shoulder stiffness	1	10%	0	0
Superficial infection	1	10%	1	10%
Absent	8	80%	7	70%
Total	10	100%	10	100%

Table8: Profile of approach used and duration of union

	ILN	DCP	
Duration of Fracture Union	17.4 week	18.4 week	

Union	Delayed Union
18	02

Discussion

Rathod et al (2017) [8] In the present study, out of 48 patients 8 were lost to follow up and 2 patients expired leaving us with 38 patients with the distribution being 18 in DCP and 20 in interlocking group. Average time taken for radiological healing was 15.05 weeks. The healing rate was relatively faster in the interlocking group as compared to the DCP group. Complications were more in the interlocking group, which was statistically significant (p=0.009). In our study we achieved a mean healing 17.4 week in patients treated with humereus nailing and 18.05 weeks in patients treated with DCP plating.

Radial Nerve Palsy

Naga and Somesula [10] the study subjects consisted of n = 28 adult patients of fracture shaft of humerus, in plating group, 12 (86.67%) patients recovered completely and n = 3 (20%) cases had complications. There was an incidence of postoperative radial nerve palsy and fully recovered following the use of neurotrophic drugs for 3 and 6 weeks after surgery., The incidence of post op radial nerve palsy with fracture shaft humerus varies from 6% to 15%. [1] Dabezies EJ et al in his study found that in the DCP group the incidence of post-operative radial nerve palsy is 2% to5% [3] and there were 2 cases in our study. The incidence of post-operative radial nerve palsy in various studies varies from 2.6% to 14.3%in the interlockin group. [7, 2] In our study there is no such cash of nerve palsy in interlocking group. And 2 out of 20have radial nerve palsy with DCP plating UNION

Abdallah et all. [11] Forty patients with humeral shaft fractures were selected [9] randomly for treatment by either an antegrade interlocking nail or by a DCP plate and screws; after obtaining consent, 20 patients were included in each group three patients from the nail group had delayed union, the healing was delayed after 5 months in contrast to plate group, only one case had delayed union. followed up and their fractures eventually united the two groups had no cases non-union.

Infection

Abdallah et al. [11] Forty patients with humeral shaft fractures were selected randomly for treatment by either an ante grade interlocking nail or by a DCP plate and screws two cases in the plate group had a superficial infection in the early postoperative period; in Nonunion was recorded in three cases in the nail group that needed further active intervention; the incidence was 15%. In contrast to the plate group, in only two cases there was nonunion and needed revision, Shobha et al. included 20 patients operated with open reduction and internal fixation with locking compression plates and 20 patients operated with closed reduction and internal fixation with intramedullary nails.1 patient in each group were found to have delayed union. They were closely one of them, the fracture was an open grade two and in the second case, it was a closed type. Both cases after debridement infection subsided early incidence was 10%. In contrast, in the nail group, no postoperative infection cases were recorded, 0%. Naga and Somesula [10] the study subjects consisted of N = 28 adult patients of fracture shaft of the humerus with indications for surgical management In plating group, 1 (6.67%) patient had wound infection and recovered with antibiotics and resulted in a good result, in the interlocking nailing group, 1 (7.69%) subject had a superficial infection at the fracture site and later the wound healed well. In our study there were 2 case of superficial infection and treated with debridement and antibiotic Iv. In cases of humerus fractures treated operatively by IM nailing the most common problem in post-operative period is restricted abduction movement at shoulder. In our study we found that following the rehabilitation/mobilization plan our patients were able to achieve a good functional range of motion at elbow in 2-4 weeks where as we had 70˚ abduction at shoulder by 4-5 weeks and 90˚ abduction by 5-6 weeks. In cases of patients treated with DCP we achieved a good functional range of motion at elbow in 2-4 weeks and shoulder in 4-5 weeks. The overall functional outcome in our study is better for the DCP group as compared to Interlocking Nailing group.

Conclusion

There were fairer and poor results in the interlocking nailing group compared to DCPgroup. The complications were more in the interlocking nailing group with most of them pertaining to poor shoulder function or pain and this difference in the complications was significant. Though interlocking intramedullary nailing is good for specific conditions like pathological fractures, segmental fractures or with associated lower limb fractures which require early weight bearing with crutch walking, we still consider DCP fixation is better than interlocking nailing in treating fractures of the diaphysis of the humerus.

References

1. Garcia AJ, Maeck BH. Radial nerve injuries in the fractures of the shaft of the humerus. Am **J** Surg. 1960: 99: 625 - 627.
2. Muller ME, Algower M, Schneider R, Willenegger H. Manual of internal fixation. Springer- Verlag. 3rd Edition; 1991.
3. Dabezies EJ, Banta CJ, Murphy CP, d'Ambrosia RD. Plate fixation of the humeral shat for acute fractures with or without radial nerve injuries. **J** Orthop Trauma: 1992: 6: 10-13.
4. Singisetti K, Ambedkar M. Nailing versus plating in humerus shaft fractures: A prospective comparative study. Int Orthop. 2010; 34:571–6.
5. Denies E, Nijs S, Sermon A, Broos P. Operative treatment of humeral shaft fractures.Comparison of plating and intramedullary nailing. Acta Orthop Belg. 2010; 76:735–42.
6. Chaudhuri A, Dasgupta S, Datta S, Ghosh S, Halder T, Mitra U. Comparative study of operative treatment of mid shaft fracture of humerus by locking plate versus intramedullary interlocking nail. Med **J** Dr DY Patil Univ. 2013; 6:390.
7. Hwang Y-S, Kim K-Y, Kim H-C, Ahn S-H, Lee D-E. Polarus Intramedullary Nail for Proximal Humeral and Humeral Shaft Fractures in Elderly Patients with Osteoporosis. **J** Korean Fract Soc. 2013; 26:14.
8. Jay Rathod, PravinPatil, Vijay Kanake, Umesh Kawalkar. Comparison between interlocknailing andplatting for fracture sh humerus. International Journal of Contemporary Medical Research 2017; 4(3):587-59
9. Shobha H, Kumar PS, Jolly A *et al.* (2017): Middle third humerus fractures in adults: Intramedullary nails vs. locking compression plates. International Journal of Orthopaedics Sciences,3(4):7 42-5.
10. Naga V, Somesula J (2018): A comparative study on the fixation of fracture shaft of the humerus in adults by compression plate and intramedullary interlocking nail. International Journal of Orthopaedics, 4(1):31622.
11. Abdallah H, El din M, Rizk A *et al.* (2018): Results of compression plating versus lockedintramedullary nailing fixation in the treatment of humeral shaft fractures in adults. Journal of Medicine in Scientific Research,1(3):214-18.
12. Juan M. Patino, MD, Juan C.

Ramella, MD, Alejandro E. Michelini, MD, Ignacio M. Abdon, MD, Emanuel Fedum Rodriguez, MD, Alejandro F. RullanCorna, MD https://doi.org/10.1016/j.jseint.2021.01.012

13. Dr Himanshu Hemant[1], Dr Rajesh Kumar Comparative Study of Functional Outcome of Dynamic Compression Plating With Interlocking Nailing For Fracture Shaft of Humerus in A.2022.