

Intramedullary Interlocking Nail Versus Narrow Dynamic Compression Plate For Treatment Of Diaphyseal Humerus Fracture In Adults: Comparative Prospective Study

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Abstract:

Background:The purpose of this prospective study is to compare the functional outcomes of method of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus and to analyze the difference in the results of these two methods.

Materials and Methods: A prospective comparative study of 26 patients with diaphyseal fracture of humerus (age range 18-60), half of the patients (group A) treated with Intramedullary Interlocking Nailing and another half group of patients (group B) treated with Narrow DCP in the Department of Orthopaedics, Jhalawar Medical College, Jhalawar between January 2018 to June 2019.

Results:The functional outcome and range of motion of shoulder and elbow were assessed by RODRIGUEZ MERCHAN CRITERIA. In Group A (Interlocking Nail), range of movement of shoulder and elbow joints were excellent in 61.54%(8), good in 23.07%(3) and fair in 15.39%(2) of cases whereas in Group B (Narrow DCP), range of movement of shoulder and elbow joint were excellent in 84.62%(11), good in 7.69%(1) and fair in only 7.69%(1) of cases.

Conclusion:Though both modalities of treatment provide comparable union rates, narrow DCP is an effective and safe alternative for treatment of diaphyseal fractures of humerus.

Keywords:Humerus fracture, IMIL nail, narrow DCP

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I. Introduction

Fractures of the humeral shaft account for 20 % of the humeral fractures¹and about 3-5 % of all fractures².They are caused by high energy trauma and most commonly seen in Middle third of shaft. Humerus shaft fractures are unique among all long bone fractures in having very good results with non-operative methods like hanging cast, functional brace, Velpeau dressing, coaptation splint and abduction cast.

Non-operative treatment requires a long period of immobilization, which carries a risk of prolonged shoulder joint stiffness and inconvenience for the patient^{6,7}. There is a growing interest in treating even simple humeral shaft fractures by surgical modalities in order to avoid these problems and to allow earlier mobilization and rapid return to work^{8,9}.

Closed intramedullary interlocking (IMIL) nailing is widely accepted for the stabilization of femur and tibia. Nowadays it is also being applied to the fractures of the humerus. Plate fixation gives high rates of union, but requires extensive open operation with stripping of soft tissues and complicated by proximity of radial nerve¹⁰.It also provides less "secure" fixation, especially in osteoporotic bone and if crutch walking is required. Closed IMIL nailing avoids all these problems. IMIL nailing is a less invasive procedure with improved biomechanics and load-sharing feature of the implant. Fractures managed with IMIL nail have better chances of union, as the surgery does not involve periosteal stripping and reaming produces act as an autograft. This benefit, however, comes at the cost of shoulder problems.

The purpose of this prospective study is to compare the functional outcomes of methods of fixation (dynamic compression plating and interlocking nailing) for the fracture shaft of humerus and to analyze the difference in the results of these two methods.

II. Materials And Methods

This is a prospective comparative study of 26 patients with diaphyseal fracture of humerus, half of the patients (group A) treated with IMIL nail and another half of patients (group B) treated with narrow DCP in the Department of Orthopaedics, Jhalawar medical college, Jhalawar, Rajasthan between January 2018 to June 2019. All cases were randomly divided in 2 groups, Group A - Patients treated with IMIL humerus nail and Group B - Patients treated with narrow DCP.

Inclusion Criteria: Acute fractures of humeral shaft, patients aged 18 years to 60 years, Gustilo-Anderson open fracture type 1 (patient who attend the hospital within 24hr of injury) and patient who have given their consent for the procedure.

Exclusion Criteria: Age less than 18 years and more than 60 years, patient with pre-existing shoulder and elbow problem, patients not willing for surgery, patients medically unfit for surgery, fractures associated with neurovascular injury, Gustilo-Anderson open fractures type 2 and type 3, segmental fractures and pathological fractures.

Methods: In group A (Fig. 1), reamed antegrade interlocking nails are used. The nails have a 5-degree bend in the proximal part. The nail size is measured with the full-length x-ray from tip of greater tuberosity to 3cms above the proximal tip of olecranon fossa. Clinically it is measured by subtracting 5cms from the tip of acromion to the lateral epicondyle of humerus. A 4–5 cm incision, lateral to the acromion, made to facilitate the splitting of the deltoid muscle. The posterior margin of the greater tuberosity exposed by retracting the supraspinatus tendon. The entry hole made with an awl. The canal gradually enlarged by reaming after insertion of a guide pin. During reaming, cortical contact at fracture site ensured to prevent radial nerve injury. After passing the nail in the canal, fracture site inspected under image intensifier to avoid distraction at the fracture site. The distal screws fixed by the freehand technique. To prevent damage to the neurovascular structures, the entry holes visualized by image intensifier followed by stab incision and blunt dissection to the bone. The proximal screws fixed by the target device.

In group B (Fig. 2), fixation done with 4.5-mm narrow dynamic compression plates using appropriate surgical techniques, depending on the fracture configuration. Transverse or short oblique fractures stabilized by axial compression, while in the spiral or oblique fractures interfragmentary lag screw fixation done, followed by application of plate in the neutralization mode. Anterolateral or posterior approach is used, depending upon the fracture configuration and the surgeon preference. Fixation of at least six cortices, preferably eight cortices, both proximal and distal to the fracture obtained in every patient.

Post-operative protocol: Immediately after surgery the limb was supported with U slab and an arm sling. Wound inspection was done on 2nd-3rd post-operative day. Suture removal after 10 days of operation. Passive elbow and shoulder exercises started on 3rd day under the supervision of the physiotherapist.

Follow up: The patients followed up clinically and radiologically at regular intervals, maximum period of 12 months. All patients (both groups) were followed up 2nd week, later at 6th week and 12th week and in 24th week till the completion of study. On each follow-up, the patients examined clinically to check for signs of infection, pain, range of motion of elbow and shoulder, neurovascular status and any other complication (Fig. 1,2).

Radiological assessment using plain radiographs done to know the status of union of the fracture, alignment, hardware problems and any malunion special stress was laid on shoulder and elbow range of movement and subjective complains. X-rays were obtained in anteroposterior and lateral view and sign of union were looked. Patients who did not show any sign of union up to 4 months they categorized as delayed union and bone marrow infiltration was done.

Union (clinical healing of the fracture) was defined by absence of functional pain and local tenderness at the previous fracture site and the presence of bridging callus in 3 of the 4 cortices seen on AP and LAT views.

Functional Outcome: The functional outcome and range of motion of shoulder and elbow assessed by RODRIGUEZ MERCHAN CRITERIA. It is based on elbow and shoulder range of motion, pain and disability as described in below Table 1.

Table 1: RODRIGUEZ MERCHAN CRITERIA

RATING	ELBOW ROM	SHOLDER ROM	PAIN	DISABILITY
EXCELLENT	EXTENSION 5* FLEXION 130*	FULL ROM	NONE	NONE
GOOD	EXTENSION 15* FLEXION 120*	<10% LOSS OF TOTAL ROM	OCCASSINAL	MILD
FAIR	EXTENSION 30* FLEXION 110*	10% TO 30% LOSS	WITH ACTIVITY	MODERATE
POOR	EXTENSION 40* FLEXION 90*	>30% LOSS ROM	VARIABLE	SEVERE

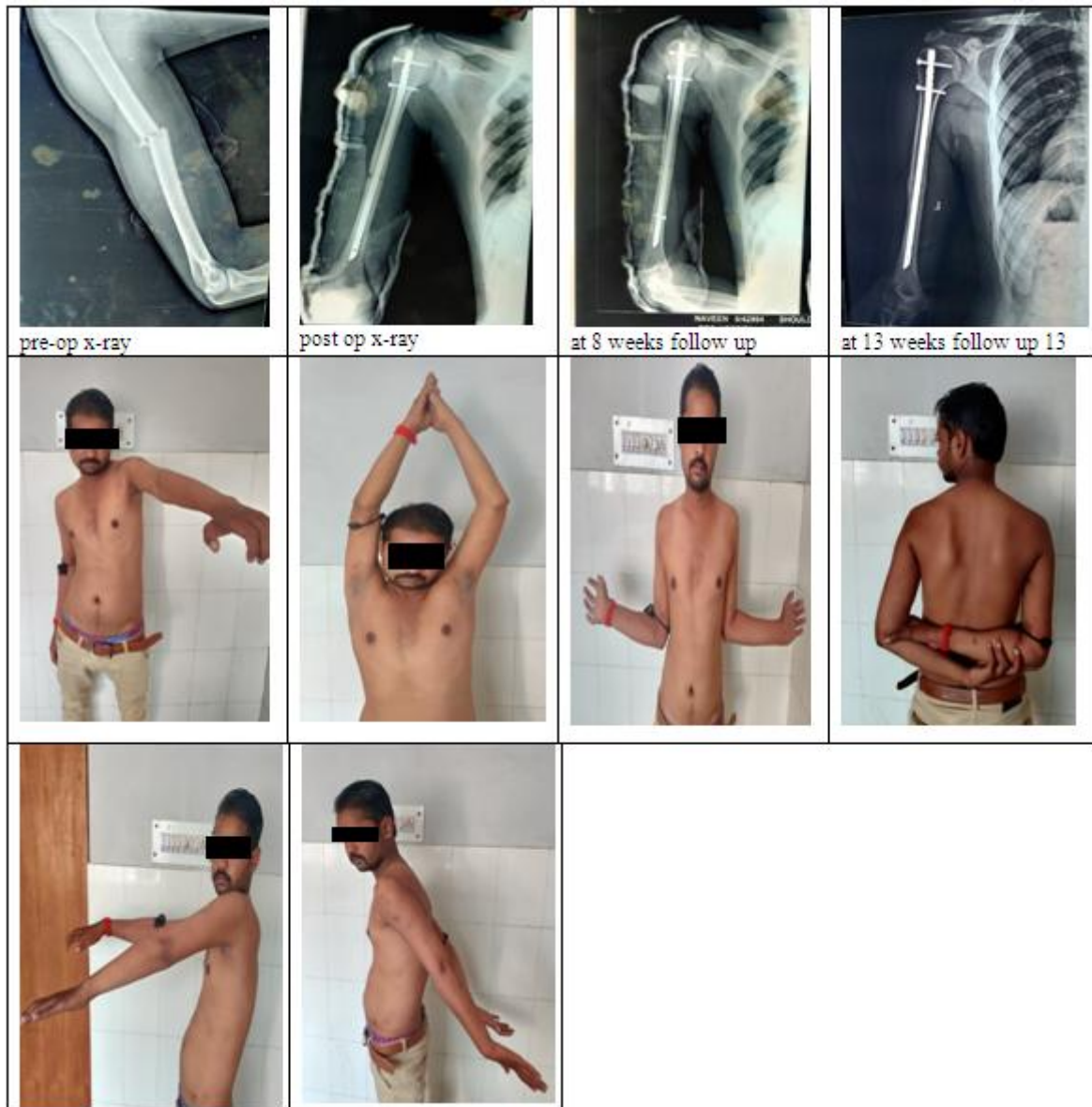


Figure 1: Group A patient treated with IMIL nail, follow up and functional outcome.

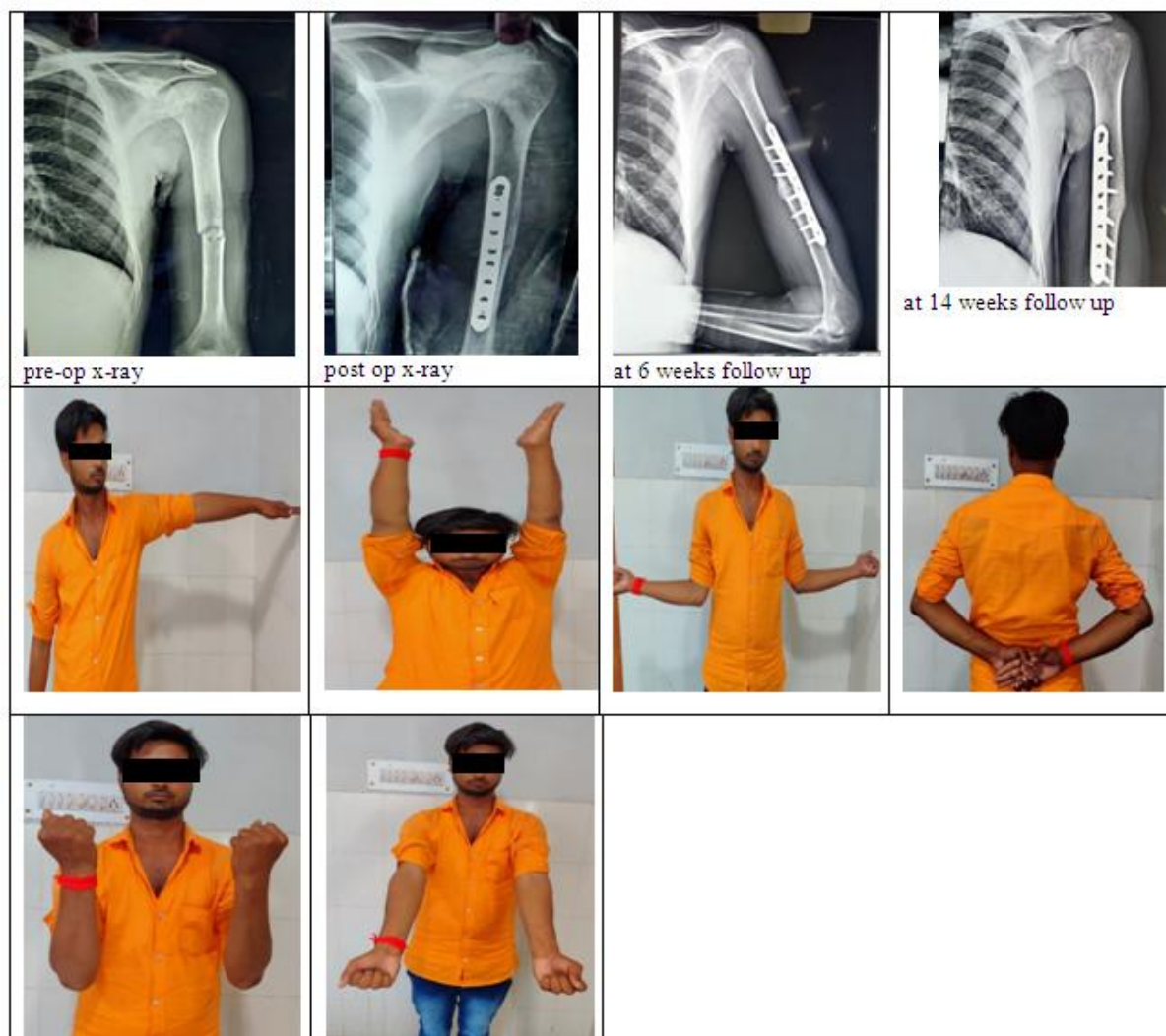


Figure 2:Group B patient treated with narrow DCP, follow up and functional outcome.

III. Results

Study sample of twenty-six (26) cases of diaphyseal fracture humerus 13 (50%) were treated with IMIL nailing and rest 13(50%) were treated with narrow DCP. All patients were evaluated periodically, clinically and radiologically prior to and after surgery. The age group of patients ranged from 20 to 60 years. Majority of patients were male 16 (61.54%) and rest were females 10 (38.46%).

- IMIL Nail group - male 9 (69.23%), female 4 (31.77%).
- Narrow DCP group - male 7 (53.85%), female 6 (46.15%)

The majority of the cases in both groups were found due to road traffic accidents (73.09%). There were 22(84.62%) cases had closed fracture and 4 (15.38%) had open fracture (Gustilo - Anderson type 1).

In interlocking nail group found that 3 patients had delayed union and 1 patient had non-union, 69.23% cases union occurred in 17 weeks whereas in narrow DCP group, only 1 patient had non-union and 92.31% cases union occurred within 17 weeks.

Our study shows no significant difference between the time of union with an average of 15 weeks in the Interlocking Nailing group and an average of 13 weeks in the narrow DCP group. There were 3 cases of infection in narrow DCP group but two cases had superficial infection which subsided with antibiotics. One case had deep infection which caused infected non-union. No infection was noted in interlock nailing group (Fig. 3).

In this study the group A (IMIL Nail) took more operative time while blood loss was less as compared to other group B (narrow DCP) which had average operative time less but blood loss was more (approx. 150-200ml).

Interlocking group was found that range of movement of shoulder and elbow joints were excellent and good in 77.93% of cases and it was found to be fair in only 23.07% of cases whereas in narrow DCP group was

found that range of movement of shoulder and elbow joint were excellent and good in 92.3% of cases and it was found to be fair in only 7.7% of cases.

According to RODRIGUEZ MERCHAN CRITERIA in IMIL nailing group 85.62% of the patients had good or excellent functional outcome and in narrow DCP group 92.31% of the patients had good or excellent functional outcome (Table 2).

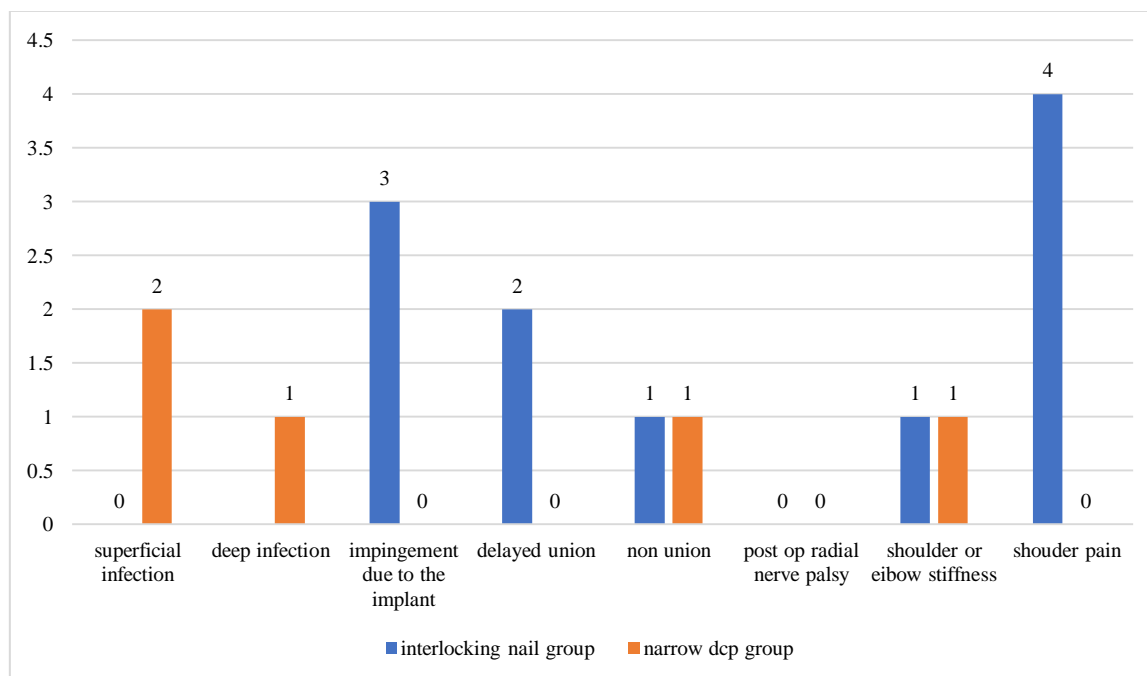


Figure 3: Post-operative complications

Table 2: RODRIGUEZ MERCHAN CRITERIA

RESULTS	INTERLOCKING NAILING GROUP		NARROW DCP GROUP	
	No. of patients	percentage	No. of patients	Percentage
EXCELLENT	8	61.54%	11	84.62%
GOOD	3	23.07%	1	7.69%
FAIR	2	15.39%	1	7.69%
POOR	0	0	0	0
TOTAL	13	100%	13	100%

IV. Discussion

Diaphyseal fracture of humerus are commonly seen in young and middle-aged individual. The average in this study was 36.15 years with most patients belonging to 3rd decade. The age group of patients ranged from 20 to 60 years. There is male preponderance in our study with males 16 (61.54%) and females 10 (38.46%). Maximum number of cases were associated with RTA as the mode of injury. These observations were similar to the studies of Griend RV, Tomasin J, Ward EF¹¹, Changulani M et al¹², Rodriguez-Merchan EC¹³ and McCormack RG et al¹⁴.

Our study shows no significant difference between the time of union with an average of 15 weeks in the IMIL Nail group and an average of 13 weeks in the narrow DCP group. This is comparable with Ragavendra S et al¹⁵ in their study found no significant difference in bony union between plating group and nailing group in a series of 31 cases. Incidence of non-union in Bell MJ et al¹⁶ and Griend RV, Tomasin J, Ward EF¹¹ after plating ranged from 2% to 4% and after interlocking nail was found to be 0 to 8%. In our study the incidence of non-union both in narrow DCP group and IMIL group are 7.69%. In our study shoulder pain occurred in 4 out of 13 patients due to impingement of nail (30.46%). This is comparable to the study by James P. Stannard et al¹⁷ where they showed an occurrence of mild to moderate shoulder pain in about 20% of the patients and also in a study made by Chapman et al¹⁸ there is significant reduction in shoulder movement in the Nailing group.

The data collected in our study was assessed and analysed on RODRIGUEZ MERCHAN CRITERIA, in IMIL nailing group 85.61% of the patients had good or excellent functional outcome. Results of IMIL nail group are comparable to Rommens et al¹⁹ (85% patients had excellent outcome). In narrow DCP group 92.31% of the patients had good or excellent functional outcome, results of this group comparable with Bell MJ et al¹⁶ with 91.2%, Rodriguez-Merchan EC¹³ with 95%, Tingstad EM et al²⁰ with 94%.

V. Conclusion

Though both modalities of treatment provide comparable union rates, the complications in our study were more in the interlocking nail group with most of them pertaining to poor shoulder function associated with pain. Narrow dynamic compression plating is an effective and safe alternative for treatment of diaphyseal fractures of humerus.

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