

Treatment of Humeral Shaft Fractures in adults by Intramedullary Nailing Versus Plating

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Abstract

Background:Fractures of the shaft of the humerus is about 3%-5% of all fractures in adults. The plate may fail in osteoporotic bone and the intramedullary nailing included less invasive surgery and use of a load sharing device support.This study is aimed to compare the interlocking intramedullary nailingoutcome versus plating of diaphyseal humeral shaft fractureoutcome in adults. **Patients and Methods:**A prospective clinical trial was carried in Orthopedic Department, Zagazig University in Egypt Hospitals and Alwahda Hospital in Libya, on 36 cases with Humeral shaft fractures in adult with age between 21year to 54year.Patients were followed post operatively for union, and clinical assessment was done using ASES scoring system including; shoulder function, elbow function, union and pain.**Results:**Operation time was distributed as 134.44 ± 23.52 and 155.54 ± 22.85 respectively between nail and plate groups and nail group was significantly shorterUnion time was shorter in plate group but not significantly as it was distributed as 14.64 ± 3.99 and 13.26 ± 3.97 respect, nonunion and mail union was higher in nail group compared to plate group with no significant difference $P > 0.05$. There was no significant difference between group as regard pain.Comparison between outcomes of different management in both groups showedwith no significant difference $P > 0.05$. **Conclusion:** Midshaft fractures humerus in adults could be fixed by either intramedullary nailing or plating. However plating associated with more blood loss and higher infection rate and intramedullary nail fixation for humerus associated with more higher incidence of shoulder discomfort, and more malunion and non unuon rate.

Keywords:InterlockingNailing; Intramedullary Plating; Humeral Fracture.

Introduction:

There is considerable debate regarding the best method of treating humeral shaft fractures. There are many methods for treatment either conservative or operative. The goal of management is to establish union with an acceptable humeral alignment and restore the patients to their pre traumatic level of function (1).

Trials of non-operative treatment, may lead to malunion that may affect the limb function. The acceptable alignment for the humerus is up to 20 degrees of anterior angulation, up to 30 degrees of varus angulation and up to 3 cm shortening (2). Therefore, it is best managed by internal fixation or external fixator before vascular repair depending on the viability of the limb (3). Percutaneous plate fixation of segmental fractures of the humeral shaft is an alternative to standard open surgery and intramedullary fixation, reducing surgical impact and yielding an excellent functional result (4).

The intramedullary nail is load sharing device used to reduce and fix the fractures is closer to the normal mechanical axis. Intramedullary fixation has gained popularity over the last several years. The initial reports revealed a higher non-union rate than that associated with conservative treatment or open reduction and internal fixation (ORIF) with plates and screws. However, several reports have demonstrated that newer implant and improved technique; locked intramedullary nailing can have a success rate as high as other methods (5).

Interlocking intramedullary nailing of the humerus for the pathological fractures provides immediate stability which can be accomplished with closed technique, brief operative time and minimum morbidity, with a resultant early return of function to the extremity (6).

Hence, this study is aimed to compare the interlocking intramedullary nailing outcome versus plating of diaphyseal humeral shaft fracture outcome in adults.

Patients and Methods:

A prospective clinical trial was carried on 36 cases with Humeral shaft fractures in adult with age between 21 year to 54 year. Patients were admitted to Orthopedic Department, Zagazig University in Egypt Hospitals and Alwahda Hospital in Libya during the period from March 2020 to December 2020.

Patients were divided into two groups: Group (1): included 18 patients managed by Intramedullary Nailing, Group (2): included 18 patients managed by plating.

Inclusion criteria:

Patients above 18 years of both sexes with humeral shaft fractures.

Exclusion criteria:

Patients with Fracture dislocation, Associated neurovascular injuries, Neglected cases, Presence of infection, Pathological fractures or Open fracture Gustilo III.

Clinical investigations:

All patients were undergo For radiographic views were obtained: Anteroposterior and Lateral views. X ray requested for any other suspected injuries including the skull, neck, chest, pelvis, spine and any other limb injuries. After examination and resuscitation of patient in ER the patient received early primary management in ER as the fractured limb was splinted by U-shaped slab.

Surgical technique:**1-Antegrade nailing in group(1):**

The technique was performed through long curved incision ventral to the medial epicondyle over the nerve at sulcus level. After carpi ulnaris muscle incision, the reduction of fracture was usually achieved by adducting the arm with gentle traction. The guide rod was inserted until its bent tip was seen at the fracture site by the image intensifier. The guide rod measured the outside part after its insertion and subtracted this part from the whole length of the guide to know the nail length. The selected nail was attached to the T handle of the target device, and then the nail was driven gently over the guide rod by screwing. Proximal locking screw and Distal interlocking screw was typically performed.

2-Plate in group (2):

There are two approaches for plating: (i) anterolateral approach for proximal and mid-third shaft fractures, (ii) posterior approach for distal one third.

In Posterior approach, Lateral head was retracted laterally and long head retracted medially, then incision of the medial head in the midline down to the periosteum. The posterior aspect of the humerus was exposed. Fracture was manipulated in a trial reduction of the fracture with applied of at least 6 holes DCP and insertion of at least 3 cortical screws distal and another 3 proximal to the fracture site to achieve rigid fixation was done(7).

In Anterolateral approach, the brachialis and biceps were retracted medially and the brachioradialis laterally. Sub periosteal elevation of the brachialis revealed the humeral shaft underneath. DCP plate applied with 4 screw proximal to fractures and 3 screw below(7)

Follow up:

Patients were followed post operatively for union, and clinical assessment was done using ASES scoring system including; shoulder function, elbow function, union and pain. intensity assessed by Visual Analogue Scale (VAS) (8,9).

Statistical analysis

Data analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0). According to the type of data

qualitative represent as number and percentage, quantitative continues group represent by mean $\pm$ SD, the following tests were used to test differences for significance; difference and association of qualitative variable by Chi square test (X^2). Differences between quantitative independent multiple by ANOVA, correlation by Pearson's correlation. P value was set at <0.05 for significant results & <0.001 for high significant result.

Results:

The present study showed that, operation time was distributed as 134.44 ± 23.52 and 155.54 ± 22.85 respectively between nail and plate groups and nail group was significantly shorter (**Figure 1**). Union time was shorter in plate group but not significantly as it was distributed as 14.64 ± 3.99 and 13.26 ± 3.97 respect, nonunion and mail union was higher in nail group compared to plate group with no significant difference $P > 0.05$ (**Figure 2**). There was no significant difference between group as regard pain (**Figure 3**).

Comparison between outcomes of different management in both groups showed with no significant difference $P > 0.05$ as regard time of follow up postoperative, shoulder and elbow movement, postoperative complications and satisfaction degree (**Table 1**).

A Case of A 34 year Female patient (Group 1) had road traffic accident presented with right arm deformity and swelling humerus. Arm was edematous, bruising on skin with limitation of movement in the arm with no neurovascular injury. Diagnosis showed anteroposterior radiography right arm was done show transvers fracture right humerus (12 type A1 according to AO classification) and no associated injury. Preoperative: U shape slap applied with analgesia. Fracture was fixed using plates. After 6 months follow up, ASES showed score with No associated complications (**Figure 4**).

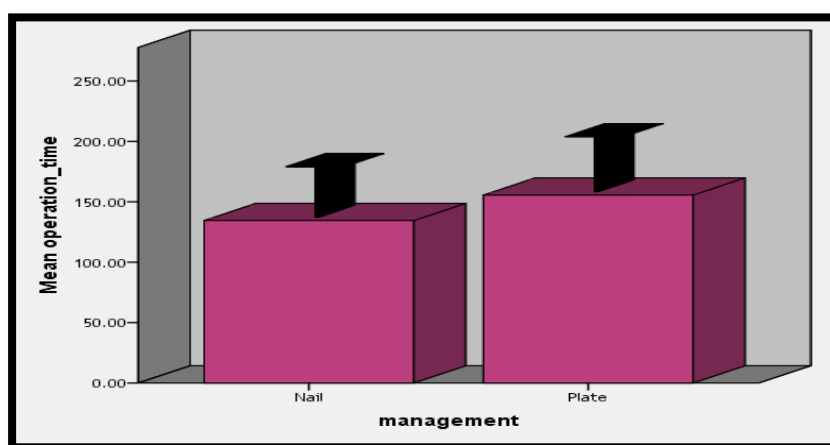


Figure (1): Mean operative time among the studied groups.

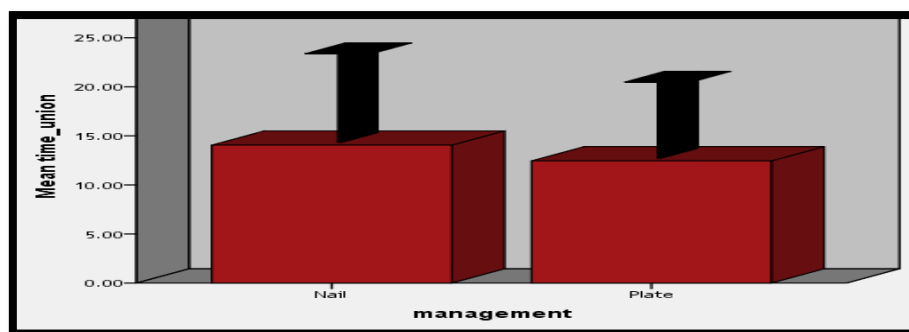


Figure (2): Mean union time (weeks)among the studied groups.

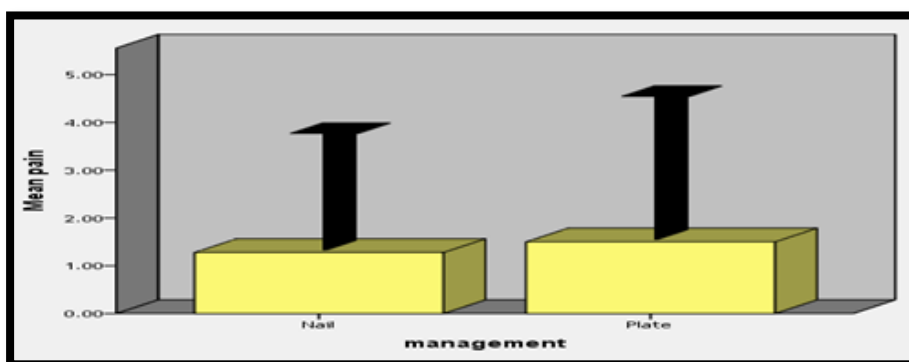


Figure (3): Pain outcome among the studied groups.

Table (1): Comparison between outcomes of different management

			Nail group	Plate group	t/ X2	P
Time union			2.94±0.46	3.5±0.93	-1.59	0.13
Time follow up per months		N	5.16±1.76 (3-10)	5.11±1.23 (4-8)	0.28	0.779
Shoulder movement	Fair	N	5	1	6.2	0.16
		%	27.8%	5.6%		
	Good	N	8	5		
		%	44.4%	27.8%		
	Full	N	5	12		
		%	27.8%	66.7%		
Elbow movement	Fair	N	2	1	3.6	0.16
		%	11.1%	5.6%		
	Good	N	2	5		
		%	11.1%	27.2%		
	Full	N	14	12		
		%	77.8	66.7%		
Infection	No	N	16	14	0.8	0.37
		%	88.9%	77.8%		
	Yes	N	2	4		
		%	11.1%	22.2%		
complication	Radial nerve palsy	N	0	4	4.52	0.035
		%	0%	22.2%		

	Delayed union	N	3	1	1.12	0.28
		%	16.7%	5.6%		
	Non union	N	1	0	0.18	0.54
		%	5.6%	0%		
Satisfaction	Satisfactory	N	18	14	2.25	0.13
		%	100.0%	77.8%		
	Unsatisfactory	N	0	2		
		%	0.0%	22.2%		
Total		N	9	9		
		%	100.0%	100.0%		

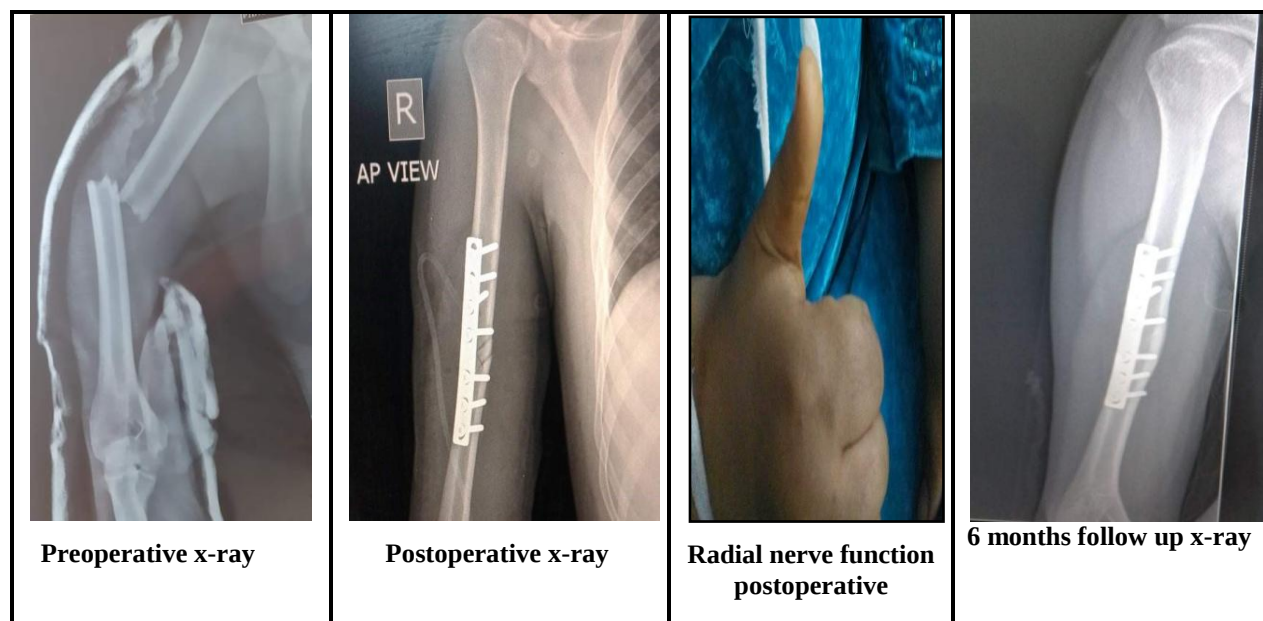


Figure (4): 34year Female patient had road traffic accident presented with right arm deformity and swelling humerus. Arm was edematous, bruising on skin with limitation of movement in the arm with no neurovascular injury. Antro-posterirradiography right arm was done show transvers fracture right humerus. Fracturewere fixed using plates. After 6months follow up, ASES showed score with No associated complications.

Discussion

Surgical fixation of a fracture of the shaft of humerus can be achieved by plating or nailing. Plating provides satisfactory results but requires radial nerve protection. The theoretical advantage of intramedullary nailing included less invasive surgery, an undisturbed fracture hematoma and use of a load sharing device support. There is always a tug of war with certain advantages and disadvantages of both procedure between advocates of nails and plates more so in fracture shaft of humerus (6).

The current study was done on 36 patients with diaphyseal fractures of humerus, Among the 18 patients in the plating group with average age being 35years. Posterior approach was used in 8 patients and an anterolateral approach was used for 9patients and

anterior approach was used for 1 patients (MIPO). Among the 18 patients in the interlocking nail group with average age being 38 years. A 7 mm nail was used in 14 patients, whereas 6mm nail was used for 4 patients. Only antegrade nailing was done in nailing group. The current study aimed to compare the outcome of mid shaft humerus fracture fixation by intramedullary nailing with that of plating to achieve which better for fixation.

Our study showed that the Operation time was distributed as 134.44 ± 23.52 minutes and 155.54 ± 22.85 minutes respectively between nail and plate groups and nail group was significantly shorter. These agree with **Saroj et al. 2020(10)**, who reported that average time taken for surgery was 70 minutes interlocking nailing group and 82 minutes for plating with a significant difference between both groups. **Kulkarni et al., 2012 (11)** found that respectively in the nailing and plating groups, mean operating times were 65 and 112 minutes with a high significant difference between both groups ($p < 0.001$). In contrary **Sena et al., 2019(12)** reported that the mean Operative time was 2.53 ± 0.52 hours in nailing group and 2.47 ± 0.52 hours in plating group with no significant difference between studied groups ($P = 0.634$).

Our study showed that in nail group there was infection in 2 patients (11.1%), while in plate group there was infection in 4 patients (22.2%) with no significance between studied group ($P = 0.37$). These agree with **Sena et al., 2019(12)** who reported that in nail group there was no infection, while in plate group there was 2 patients (10%) with infection with no significance between studied group ($P = 0.146$). In contrast to our study, **Kurup et al., 2011(13)** found that there was no difference in incidence of post-operative radial nerve palsy identified in their patients ($P > 0.05$), although their study underpowered to detect differences in this complication rate and others.

Our outcomes are in agreement with the study of **Akalin et al., (2020) (14)** who found no significant differences were observed regarding the union time, where it was 4 months (rang 3–8) and in plate group it was 4 months (rang 3–7) with no significant difference between studied groups ($P = 0.189$).

Regarding satisfaction in our study was reported in 18 patients (100%) in Nail group, while in plate group satisfaction was reported in 14 patients (77.8%) and 4 patients (22.2%) were unsatisfied and Nail group was significantly associated with satisfaction ($P = 0.034$). These agree with **Sahni et al., 2015(15)** who found that 25 patients (96%) in Nail group were satisfied while in plate group 27 patients (93.3 %) were satisfied with no significant difference between both groups. In contrary to our results the study of **Kelany et**

al., 2020(12) who reported that satisfaction was reported in 9 patients (100%) in Nail group, while in plate group satisfaction was reported in 7 patients (77.8%) and 2 patients (22.2%) were unsatisfied with no significant difference between both groups.

Conclusion:

Mid-shaft humerus fractures in adults could be fixed by either intramedullary nailing or plating. However, plating associated with more blood loss and higher infection rate and intramedullary nail fixation for humerus associated with higher incidence of shoulder discomfort, and more malunion and non union rate.

No conflict of interest.

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