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RESEARCH ARTICLE

NAILING AND PLATING AS FIXATION OF HUMERAL SHAFT FRACTURES

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Abstract

Both the modalities of treatment i.e. dynamic compression plating and interlocking nailing are good as far as union of the fracture is concerned, but considering the functional outcome and rate of complications, we are of the opinion that plating offers better result than interlocking nailing with respect to pain and function of the shoulder joint. Cases where both plating and interlocking nailing can be done, plating should be preferred as plating offers better result with respect to pain and function.

Introduction:-

Fractures of the humeral shaft are commonly encountered by orthopedic surgeons, accounting for approximately 3% of all fractures [20]. Typically, they are the result of direct trauma but also occur in sports where rotational forces are greater, for example, baseball or arm wrestling, Fractures of the middle or distal third of the shaft put the radial nerve at risk. In a small percentage of cases, humeral shaft fractures are associated with a vascular injury. Open fractures are uncommon but can represent serious injuries particularly if associated with crushing in industrial injuries

Treatment methods for these injuries continue to evolve as advances are made in both non-operative and operative management. It is generally agreed that most fractures of humeral shaft are treated best non-operatively, although there are indications for primary or secondary operative treatment in some situations [8, 18, 19**]**.

AOI ASIF classification humerus fractures are divided into three types with further subdivisions, A - simple fracture, Al - spiral fracture, A2 - oblique fracture, A3 - transverse fracture, B - wedge fractures, B 1 - spiral wedge, B2 -bending wedge, 83 - fragmented wedge, C- complex fractures, C I-complex spiral, C2 complex segmental fractures, C3 -complex irregular fractures**.**

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 polytraumapatients, fractures with neurovascular complications and patients with obesity who are at risk of developing Varus angulations (3).

Methods:-

This study will be conducted in Orthopedic Surgery department in Misurata medical Centre (Misurata- Libya)

A prospective, comparative study of management of acute humeral shaft fractures by ante grade interlocking nail fixation and dynamic compression plating was undertaken at our institution over a period of three years (Nove1nber

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2016 to November 2019). The average follow-up period was one year (range 10-24 months). An informed consent from patients and departmental permission were obtained according to local hospital regulations.

The inclusion criteria were:
(1) humeral shaft fractures which required operative intervention and were treated with interlocking or plating procedures, and (2) patients of age of 18 years or more.

The exclusion criteria were:
(1) the patient was aged less than 18 years, (2) pathological fractures, (3) segmental fractures, (iv) fractures within 4cm of proximal and distal end of humerus, and (5) patients who were lost to follow-up or at early stages of follow-up at the time of completion of the study (minimum follow up of six months required).

Forty-five patients with closed acute humeral shaft fracture reqUinng operative intervention were treated with either interlocking nailing or plating procedures. A randomization attempt was made by allocating each patient to either of the groups depending on the criteria of odd or even hospital number.

All patients had appropriate clinical and radiological assessment before a decision to offer surgical intervention was made. All fractures were classified according to the AO classification. Of the 25 patients treated by interlocking nail, three were at earlystage follow-up and two were lost to follow-up at completion of the study. Of the 20 patients treated by plating, two were in early follow-up and two lost to follow-up.

A thorough history and clinical examination was done. The status of radial nerve injury was recorded . Roentgenogram of the arm with shoulder and elbow was taken in both antero-posterior and lateral views. Additional roentgenogra1ns were taken if any other injury was suspected. The humeral shaft fracture was temporarily immobilized with aU-slab and arm pouch.

An antegrade interlocking technique was used with an intramedullary nail (Russell- Taylor type) and care was taken to minimize damage of the rotator cuff during nail insertion. A 3.5-mm or 4.5-mm dynamic compression plate was used in the plating group depending on the width of the bone with appropriate AO principles. The choice of surgical approach (antero-lateral or posterior) for the plating group was left to the discretion of the operating surgeon.

All patients were advised on immediate postoperative shoulder and elbow exercises and radiographs were taken at regular intervals during follow-up.

The functional outcome was measured by the "Disabilities of Ann, Shoulder and Hand" (DASH) Questionnaire at nine months or at full recovery which ever was earlier.

Result:-

There were 65 fractures shaft of humerus in adults, presented to our hospital during the course of the study of the 60 fractures, 45 were operated and the rest 20 treated conservatively, of the 45 patients, 4 were lost to follow up and 1 patients expired leaving us with 38 patients with the distribution being 22 in plating and 18 in interlocking group.

In the plating group there were 13 males and 7 females. In the interlocking group, there were 14 males and 4 females. ($p<0.05$) The age of the patients in the plating group ranged from 20 to 62 years with a mean of 41 years. The age in the interlocking group ranged from 20 to 65 years with a mean age of 42.5 years. ($p>0.05$).

The most common mode of injury in both groups is RTA, with fall being the second most common cause. Right side was the most commonly involved side in both the plating and interlocking group with no statistically significant difference.

22fractures occurred in the middle third of the diaphysis, 10 in the interlocking group and 12 in the plating group. 9 fractures were there in lower third 3 fracture in the middle third and lower third junction . 3 fractures in the upper third. 1 fracture between upper third and middle third junction. 2 segmental fracture extending between upper third and lower third.

Pre-operative radial nerve palsy was present in 3 patients . All the 3 of them in the plating group of which 2 recovered completely. The mean duration between trauma and surgery in plating group was 4.15 days and in ILN group was 2.95 days**.**

In plating anterolateral approach was used in 14 patients and posterior approach was used in 4 patients. Among the interlocking group only antegrade nailing was done. Average time taken for surgery was 82 minutes for plating and 70 minutes interlocking nailing group. The average duration of follow up in our study was 11.4 months. Range (6 to 17 months).

Average time taken for radiological healing was 15.05 weeks (14.05 in interlocking group and I 6.06 in plating group). So the healing rate was relatively faster in the interlocking group as compared to the plating group. There was no statistically significant difference in the time taken for radiological union. (P=0.065). Two fractures treated with plating remained ununited**.**

Result	Group		
	IMN	Plate	Total
Excellent	4	8	12
Good	6	8	14
Fair	6	4	10
Poor	4	2	6

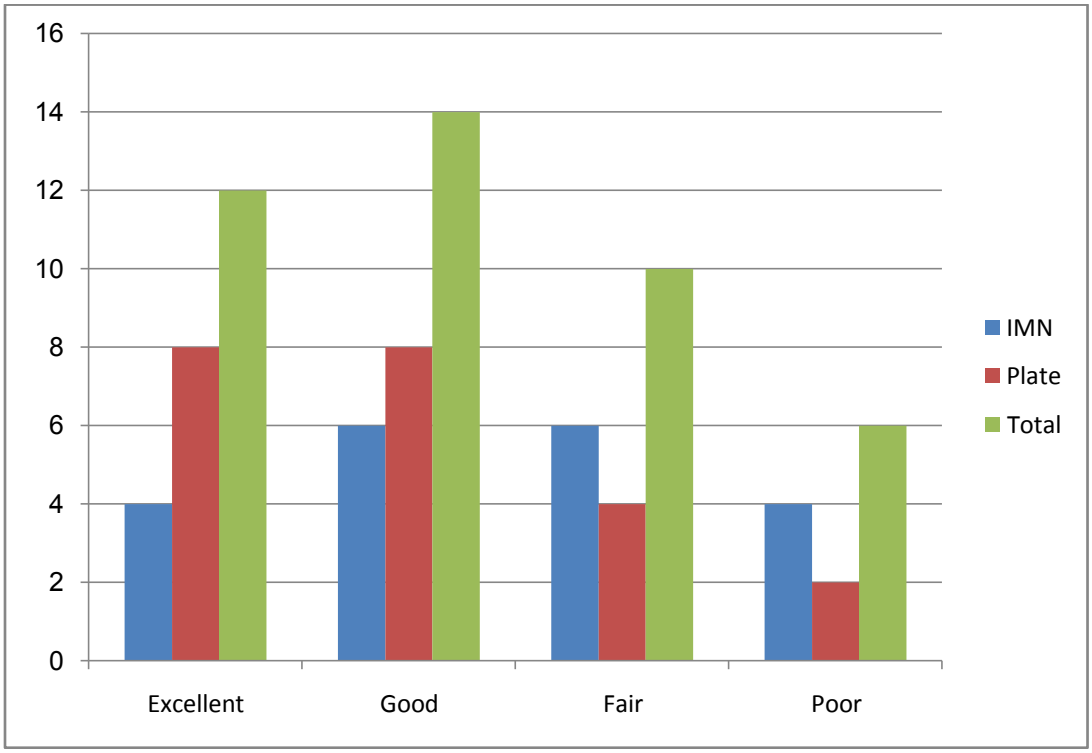
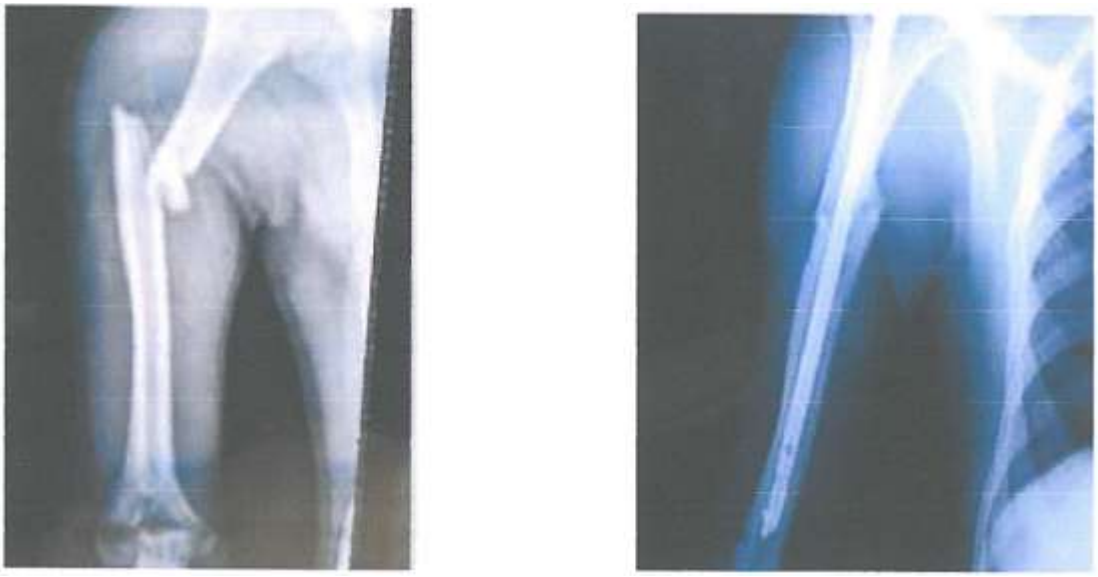


Plate versus IMN FIXATION OF HUMEROU

Intraoperative the interlocking group had 4 complications and the plating group had only 2 complications



Imn Fixation

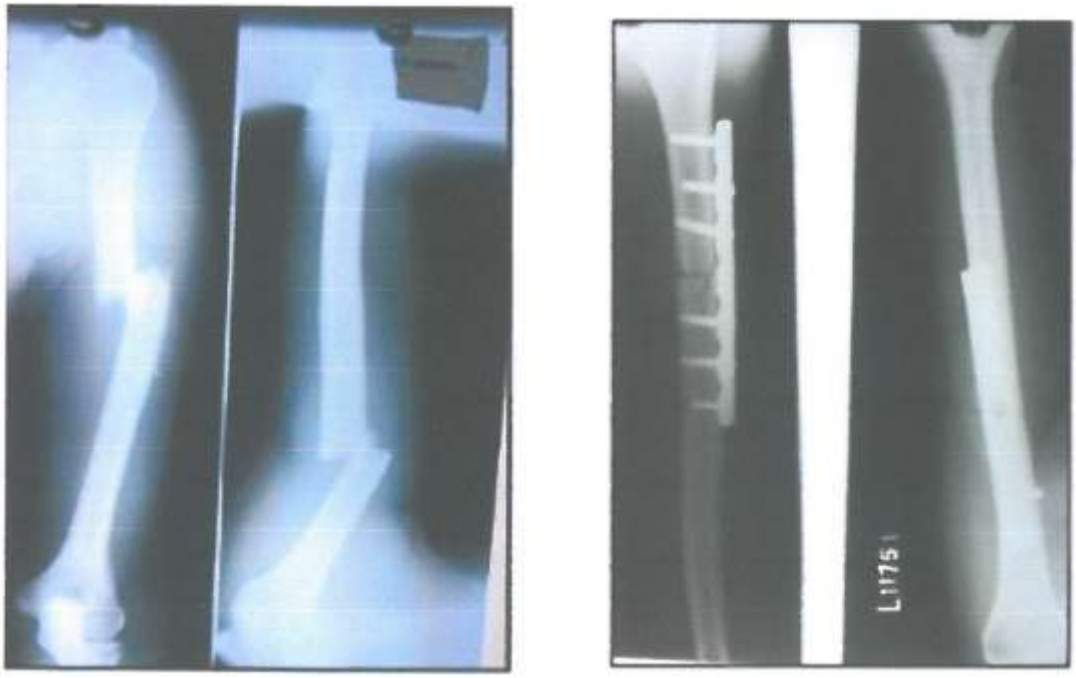


Plate Fixation

Discussion:-

Most surgeons agree that intramedullary nailing is the best internal fixation for femoral and tibial shaft fractures, but there is no agreement about the ideal procedure for fractures of the humeral shaft. Plate osteosynthesis requires extensive soft tissue dissection with the risk of radial nerve damage [5**].**

The indications for open reduction and internal fixation of acute fractures of the humeral shaft have been described as: fractures in patients with multiple injuries, open fractures, fractures associated with vascular or neural injuries or with lesions of the shoulder, elbow or forearm in the same limb; bilateral upper extremity injuries, fractures for which closed methods of treatment have failed and pathological fractures [6, 7**].**

In several reported series, the presence of associated multiple injuries was the most frequent indication for internal fixation of the humeral shaft [8, 9]. In our study failed closed reduction and associated injuries were the most common indications.

This study is having a short term follow up of minimum of 6 months and maximum of I 7 months (mean 1 1.44 months) and therefore discussion is essentially a preliminary assessment.

In previous reports the incidence of non-union after plating has ranged from 2% to 4% [10, 11]. In our plating group the incidence of non-union was 11.I 1%. Retrospective studies of locked intramedullary nail fixation quote incidences of non-union ranging from 0% to 8%[12-13]. In our series the incidence of non-union in the interlocking nail group is 0%.

The incidence of radial nerve palsy with fracture shaft humerus varies from 6% to 15% [15, 16]. In our series the incidence was 7.9%. Out of the 3cases, 2 cases recovered (66.6%), which tallied with Seddon's and Pollock's series of 70% and 68% respectively.

In the plating group the incidence of post-operative radial nerve palsy is 2% to 5% [10, 11], but there were no such cases in our study. The incidence of post-operative radial nerve palsy in various studies varies from 2.6% to 14.3%in the interlocking group [16, 17].

There was no problem with infection in our patients with only 1 patient having superficialinfection (2.63%) among 38 patients, which responded well to debridement and intravenous antibiotics for 3 weeks.

The failure of fixation in a case of plating was due to poor technique due to inadequate hold. When this fracture was replated with the addition of 2 extra holes and bone graft, the fracture united at 6 months without complications. The patient with implant failure in interlocking group went on to unite uneventfully despite the screw breakage at one of the two distal interlocking sites.

The rate of intra operative comminution during interlocking nail insertion with various studies varied from 7.7% to 10%. 17, 18In our series there were 2 (10%) intra operative comminutionout of 20 patients treated with interlocking nailing. One occurred at fracture site due to hoop stress and the other at the greater tuberosity during nail insertion.

Persistent pain after antegrade nailing is common [29-21] Habemek and Orthner [22] reported good results with Seidel's interlocking nail but later withdrew their support in 1998, as they had not assessed the shoulder functions of their patients properly. The cause of pain could be disruption of the rotator cuff in its avascular zone within 1 cm of its insertion to the greater tuberosity that may lead to poor healing [21]

Three patients had developed shoulder pain/stiffness and 11 of our 20 patients in the interlocking nailing group reported some or the other shoulder pain. Our study confirms that antegrade insertion of nail can lead to problems with shoulder function and range of 1novement probably because of damage to the rotator cuff.

The sample size of our study is small with only 38 patients included in the final study. The union rates are comparable in both the groups with the results in excellent and good category are similar {p value insignificant). There were more fair and poor results in the interlocking nailing group compared to plating group. 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 statistically significant.

Though interlocking intra1nedullary nailing is good for specific conditions likepathological fractures , segmental fractures or with associated lower limb fractureswhich require early weight bearing with crutch walking, we still consider plate fixation is better than interlocking nailing in treating fractures of the diaphysis of the humerus.

Conclusion:-

Both the modalities of treatment i.e. dynamic compression plating and interlocking nailing are good as far as union of the fracture is concerned, but considering the functional outcome and rate of complications, we are of the opinion that plating offers better result than interlocking nailing with respect to pain and function of the shoulder joint.

Cases where both plating and interlocking nailing can be done, plating should be preferred as plating offers better result with respect to pain and function

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