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Pervaiz Hashmi

Aga Khan University, pervaiz.hashmi@aku.edu

Yasir Mohib

Aga Khan University, yasir.mohib@aku.edu

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Functional and radiological outcome of Intramedullary nailing vs. plate fixation for humeral shaft fractures. Does treatment method bring any difference?

Pervaiz Mehmood Hashmi, Yasir Mohib, Kashif Abbas

Abstract

Background: Operative Management of Humeral shaft fractures may be accomplished with the help of Plate fixation or IM Nails. Controversy exists as to which modality is superior to the other in terms of fewer complications and better functional and radiological outcome.

Objective: To compare the differences in radiological and functional outcome of humeral shaft fractures managed by platefixation and antegrade intramedullary nails.

Methods: The retrospective study was conducted at Aga Khan University Hospital, Karachi, and comprised records of Patients managed surgically for uncomplicated humeral shaft fractures between 2007 and 2012. The patients were followed up for one year at clinic, and radiographs and clinical assessment were used to complete the Quick Disabilities of the Arm, Shoulder and Hand Questionnaire. SPSS 19 was used for statistical analysis.

Results: Of the total 61 patients, 39(64%) underwent plating and 22(36%) had intramedullary nailing. There was no significant difference in terms of mean age and mean duration of surgery in the two groups ($p > 0.05$ each). Also, no significant difference was noted in the duration of healing with either of the two methods ($p > 0.05$). Mean Questionnaire score for plating was 23.9 ± 17.7 , while for intramedullary nailing it was 21.7 ± 19.8 ($p > 0.05$).

Conclusion: There was no significant difference in the radiological and functional outcome of patients in the two groups.

Keywords: Humerus shaft fracture, Plate fixation, ORIF, IM Nailing, Functional outcome, QuickDASH. (JPMA 64: S-135 (Suppl. 2); 2014)

Introduction

Humeral shaft fractures represent 3% of all fractures, and mostly it affects the middle-third of the shaft. Majority of these fractures are minimally displaced and successfully managed non-operatively with over 90% rate of union, while certain amount of malalignment is well tolerated by the patients.¹ Complications may include non-union, mal-union, persistent nerve paralysis and shoulder and elbow stiffness secondary to prolonged immobilisation with other compliance issues.² Operative treatment is indicated for open injuries, segmental fractures, pathological fractures, vascular injuries, worsening nerve palsy or poly-trauma patients and failure to achieve adequate reduction with conservative measures.³

There is no universally accepted operative indications and thus the choice of operative procedure remains with the operating surgeon.⁴ Intramedullary (IM) nailing and plating are the two most common fixation methods.⁵ IM nailing preserves periosteal blood supply and fracture hematoma which is thought to minimise healing problems. It also includes the risk of postoperative

shoulder pain and stiffness, probability of impingement of hardware and risk of further fracture comminution during reaming or nail insertion. On the other hand, plating provides accuracy of fracture reduction under direct vision, but requires extensive dissection which may risk iatrogenic injury to the radial nerve.⁶

The ideal management of fractures of the humeral shaft continues to be debatable. Published data comparing the efficacy of IM nails and plating fail to show any superiority of one over the other.⁵

The current study was planned to compare the functional and radiological outcome of plate osteosynthesis and IM nailing for humeral shaft fracture. However, the risks of any musculoskeletal procedure cannot be overlooked and in the case of compression, plating includes extensive dissection, iatrogenic radial nerve injury, an increased risk of infection and non-union.⁷

Material and Methods

The retrospective review of record of patient managed surgically from January 2007 to December 2012 by IM nailing or plate fixation for uncomplicated humeral shaft fractures was conducted, at Aga Khan University Hospital (AKUH), Karachi. All fractures were at least 3cm distal to the surgical neck and at least 5cm proximal to the

Department of Surgery, Aga Khan University Hospital, Karachi.

Correspondence: Yasir Mohib. Email: yasirmohib@hotmail.com

olecranon fossa. Patients with traumatic humeral shaft fractures over 18 years of age and a minimum follow-up of 12 months were included. Patients with insufficient follow-up data, pathological fractures, non-cooperative patients with head injury or cognitive impairment were excluded.

All patients were operated upon by consultant orthopaedic surgeons. The choice of the operative technique was based on the general recommendations at the time of treatment. All open fractures were stabilised primarily after debridement and further re-evaluation was done after 3 to 5 days for delayed primary closure according to the condition of the wound. No cast or brace was used postoperatively in either of the two groups. Follow-up with X-rays and clinical examination were done at 2, 8, 14 and 20 weeks. Further radiographs were obtained according to the fracture healing. All the patients were asked to return at 12 months for final clinical examination.

All radiographs were assessed by the senior author, and healing was considered as bone bridging the fracture in two planes.

Quick Disabilities of the Arm, Shoulder and Hand Questionnaire (QuickDASH) score was used to assess the functional outcome at 12-month follow-up visit. QuickDASH score is a reliable and validated tool that can evaluate disability and symptoms in single or multiple disorders of the upper limb.⁸ It is the assessment of arm function in terms of limitation faced by patients in regular activities, performance of daily activities, including opening a tight jar, carrying out heavy household tasks, carrying a shopping bag, washing the back, cutting with knife, recreational activities, pain, tingling and sleep disturbances faced by the patient. All these parameters were scored 1 to 5; 1 being no difficulty in performance of activities and 5 being inability to perform the task. Minimum score would be 11 and maximum 55. We stratified the scores, 0-20 as Excellent, 21-40 as good, and over 40 as poor.

Surgical complications were categorised as wound infection, loss of fixation, and nerve injury. Delayed union was defined as failure of fracture union to occur by four months. Non-union was defined as failure of fracture union by six months or evidence of fixation failure.

SPSS 19 was used for data analysis. Chi square test was used to compare descriptive variables, like gender, mechanism of injury, radiological healing and functional outcome. Student t-test was used to compare continuous variables, like age.

Results

A total of 90 files were located, but 29(32%) did not meet the inclusion criteria and had to be excluded. The remaining 61(68%) patients represented the study sample. Of them, 39(64%) underwent plate fixation (Figure-1) and 22(36%) had IM nailing (Figure-2). Among the plate fixation group, 26(67%) were males and 13(33%) were females with a mean age of 43.8±18.2 years (range: 23-68 years). In the other group, there were 16(72%) males and 6(28%) females with a mean age of 45.8±14.6 SD years (range: 21-66 years) (Table-1).

The overall mechanism of injury in both groups was Road Traffic Accident (RTA) in 34(56%), Fall 16(26%), Firearm

Table-1: Comparison of patient data.

| | Plate Fixation | | IM Nailing | | Total | Significance Statistical test |
|-----------------------|----------------|-----|----------------|-----|----------------|-------------------------------|
| Number | 39 | | 22 | | 61 | |
| Gender | | | | | | P=0.624 Chi-square |
| Male | 26 | 67% | 16 | 72% | 42 | |
| Female | 13 | 33% | 6 | 28% | 19 | |
| Age | | | | | | |
| Mean | 43.8 years | | 45.8 years | | | |
| Range | 23 to 68 years | | 21 to 66 years | | 21 to 68 years | P = 0.593 Student T-test |
| Mechanism of injury | | | | | | P = 0.900 Chi-square |
| Road traffic accident | 21 | 54% | 13 | 59% | 34 | |
| Fall | 11 | 28% | 5 | 23% | 16 | |
| Fire Arm Injury | 3 | 8% | 1 | 5% | 4 | |
| Other | 4 | 10% | 3 | 13% | 7 | |

IM: Intramedullary.

Table-2: Comparison of radiological and functional outcome and complications.

| | Plate Fixation | | IM Nailing | | Total | Significance Statistical test |
|--------------------------|----------------|-----|------------|-----|-------|-------------------------------|
| Fracture Union | | | | | | P = 0.848 Chi-square |
| <22 weeks | 36 | 92% | 20 | 91% | | |
| >22 weeks | 3 | 8% | 2 | 9% | | |
| Quick DASH Score | 23.9±17.7 | | 21.7±19.8 | | | P = 0.697 Chi-square |
| Excellent | 29 | 74% | 17 | 77% | | |
| Good | 8 | 20% | 3 | 14% | | |
| Poor | 2 | 6% | 2 | 9% | | |
| Complications | | | | | | |
| Surgical site infection | 2 | | 1 | | | |
| Radial nerve neurapraxia | 1 | | 2 | | | |
| Non-union | 0 | | 0 | | | |

DASH: Disabilities of Arms, Shoulders and Hands.

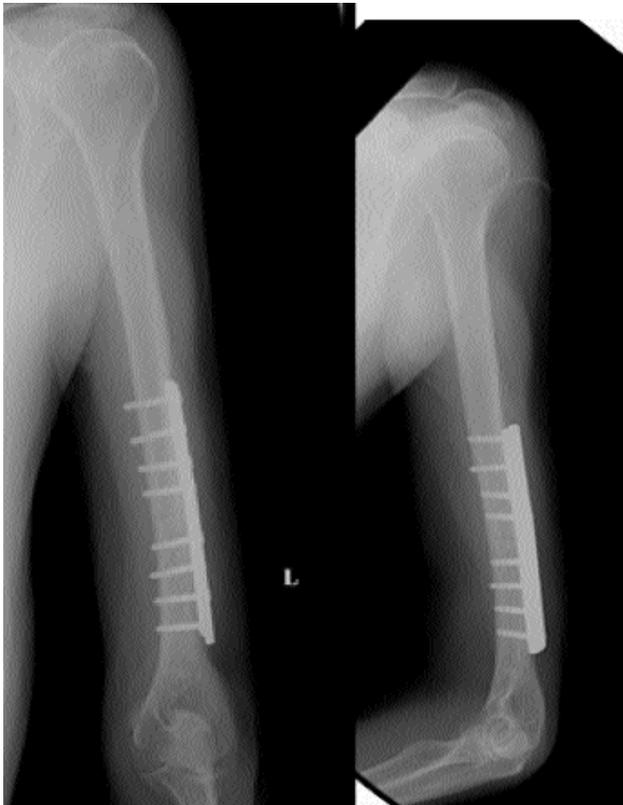


Figure-1: Case example after Humerus plate fixation.

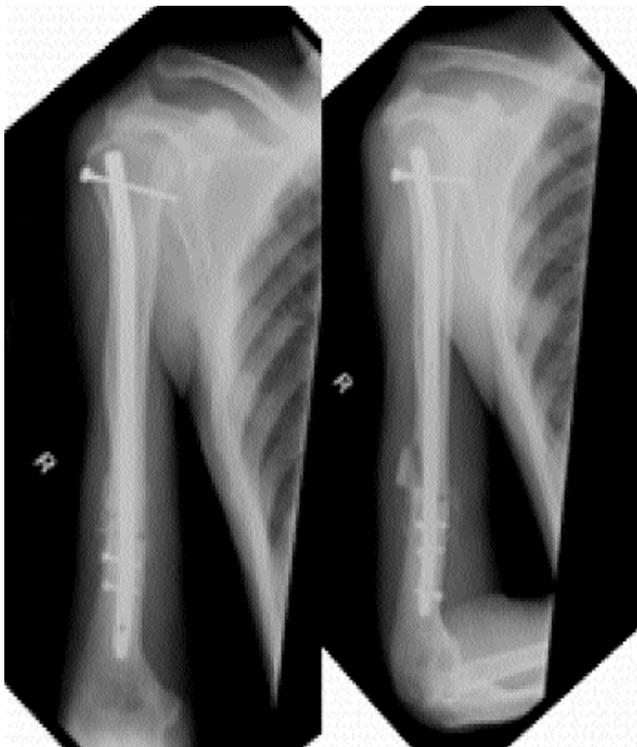


Figure-2: Case example after Humerus Intramedullary nailing.

4(6.5%) and other causes, including industrial injury, assault and explosions, 7(11.5%). Mean duration of surgery was 104 ± 38 minutes in plate fixation group and 121 ± 32 minutes in the IM nailing group.

The mean duration from injury to surgery was 7.5 ± 3 days in the plate fixation group and 6.9 ± 3.4 in the other group. Besides, 14(36%) patients had open fractures in plate fixation group and 5(23%) in IM nailing group. There was no statistically significant difference in time to union in the two groups ($P>0.05$). Union was achieved in 36(92%) patients in plate fixation group and 22(91%) in IM nailing group at 22 weeks, while delayed union was noted 3(8%) and 2(9%) patients respectively. No fixation failure and no re-operation was observed.

Mean QuickDASH score was 23.9 ± 17.7 in the plate fixation group and 21.7 ± 19.8 in the IM nailing group. Further, 29(74%) patients had excellent scores, 8(21%) had good scores and 2(9%) had poor score with plate fixation, while corresponding numbers in the other group were 17(77%), 3(14%) and 2(5%) (Table-2).

Overall, 3(4.9%) patients had superficial surgical site infection (SSI) which were managed by antibiotics; and 3(4.9%) had transient radial nerve palsy.

Discussion

The results of both treatment modalities in our study were comparable in terms of functional outcome and radiological union. Both methods provided reliable reproducible results, but our sample size was not sufficient to demonstrate any statistically significant conclusions.

Several biomechanical considerations have shown disagreement with the use of nail in the humerus. Mechanical stresses in weight-bearing bones, femur and tibia are found to be bending stress, whereas in humerus, torsional or rotation forces contribute the major stress. These are thought to be more relevant in transverse or oblique fractures. Reaming of humeral fractures poses the risk of segmentation or separating butterfly fragments increases the vulnerability of radial nerve injury.⁹

Chapman et al. also compared antegrade IM nailing with plate fixation and observed good rate of union with both of these modalities. Nailing was shown to be associated with increased shoulder impingement. They also concluded that plate fixation was the safer of the two modalities.¹⁰

Whereas Risti? V et al. in 2011 concluded that IM fixation was superior to plate fixation.¹¹ Our study showed similar outcomes with both treatment modalities with high

union rates and good functional outcome in terms of QuickDASH score.

The majority of humeral shaft fractures can be treated safely and effectively by either plate fixation or IM nailing with similar outcomes.

Conclusion

There was no significant difference in radiological union or in the long-term functional outcome of patients in those treated by plates or IM nails for humeral shaft fractures. No delay was observed in time to union.

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