Original Article

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Percutaneous Intramedullary Nailing in Adult Diaphyseal Humeral Fractures.

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Abstract

Aims and Objectives: *Fractures of Humerus can be treated conservatively, but often present problems of compliance. malunion, delayed/ nonunion needing intervention. One option for fixation of these fractures is closed fixation by multiple flexible intramedullary nails. A prospective study was undertaken to study this method of treatment.*

Materials and Methods: *In two private hospitals over a period of 7 years, 132 patients of fracture humerus shaft were fixed with multiple (3 to 5) slender flexible nails—71 by rush nails and 61 by ender nails and followed up from 5 months to 42 mths and assessed clinically for range of movements, pain and deformity and radiologically for union.*

Results: *Results were assessed at 6 months and again at the time of implant removal. Satisfactory results were seen in 87% cases at 6 months with primary union in 107 cases. There were 19 non/-delayed unions, which eventually healed after a second surgery- bone grafting in 12 and bone marrow injections in 7. 6 patients were lost to follow up before union and were included in the poor results. The commonest complication observed was shoulder stiffness the incidence of which reduced dramatically after the insertion site of the nails was revised during the study.*

Conclusions: *Closed intramedullary nailing for the humerus offers many advantages such as minimal tissue trauma, short surgical time, short hospital stay, economy and early union.*

Keywords *: Intramedularry nailing, Humerus shaft fractures, Percutaneous nailing of humeral fractures.*

Introduction

Majority of fractures of the shaft of Humerus are amenable to conservative management. A thorough understanding of humeral anatomy, the fracture pattern and the patient's activity level and expectations is required for selection of appropriate treatment. The goals of humeral shaft fracture management are to establish union with an acceptable humeral alignment and restore the patients to their prior level of function [1]. Various options exist for treatment of diaphyseal humeral fractures. The accepted methods being a hanging cast, U slab, and functional cast bracing. However, these seemingly easy to treat fractures often present problems of patient compliance, malunion, delayed/ nonunion needing intervention. Fixation of these fractures can be done by compression plating or by closed IM nailing. One option for fixation of these fractures is closed fixation by multiple flexible intramedullary nails. A prospective study was undertaken to assess this method of treatment.

Materials and Methods

In two private hospitals at two district headquarters, over a period of 5 years (2010 to 2015) 132 patients of fracture humerus shaft were fixed with multiple (3 to 5) slender flexible nails. All closed fractures in skeletally mature individuals that occurred not more than 7 days before the surgical procedure, in which the fracture displacement was more than 20 degrees in the sagittal or coronal plane, with shortening between the segments greater than 2 cm were included. Similarly simple or compound up to grade 3 a with or without radial nerve injury were included. Patient was operated in supine position on an operation table with radiolucent top. Skin incision of about 2.5 cms long was taken 5 cms. distal to the lateral margin of the Acromion. Deltoid was split and with a small curved awl entry hole made just distal to the insertion of the rotator cuff and checked under IITV. In case the fracture was in the proximal 1/3rd (below the surgical neck) the nails were put in retrograde through the lateral condyle or through a window just proximal to the olecranon fossa. Rush nail/ender nail of the proper length- (measured preoperatively on the other arm) 3 mm in diameter was selected and tip was bent to negotiate into the medullary canal and across the fracture. Under IITV control the fracture was crossed to engage the distal fragment. Further nails (at least a total of 3) were passed in to fill the medullary canal. Nails fan out in the lower end to provide rotational control. Fracture was impacted and final seating done under IITV .The choice of nails: Rush nails or Ender nails of 3 or 2.5 mm. diameter were used. 71 fractures were fixed by rush nails and 61 by ender nails.

Post operative protocol: U slab of POP and a pouch arm sling was given for 3 weeks. Slab was removed at 3 weeks and sling continued till clinical and radiological union.

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Table 1: Age distribution

16-20 yrs	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	61-70 yrs	>71 yrs	Total
13	31	25	19	22	15	7	132

Table 2: Result Grade

	Results	
Excellent	84	63.60%
Good	37	28%
Fair	5	3.80%
Poor	6	4.60%
Total	132	100%

Finger and pendulum exercises along with wrist and forearm static and gentle active exercises were begun immediately. Shoulder and elbow mobilization was begun at three weeks but patients were not permitted full use of arm till union.

Check x-rays were taken at 6-week intervals till union.

Results were assessed for Union, Deformity, and Shoulder function (Constant and Murley Score) 2 or elbow range of movements and pain for retrograde nails. Results were classified into

Excellent: Primary union, no deformity , Full and painless shoulder and elbow movements (Constant and Murley score more than 80)

Good: Primary union, Deformity less than 100 angulation and 2 mm shortening, Shoulder and elbow with good range of movements and no pain at rest or with ADL (Constant and Murley score 60 to 80)

Fair: Primary union or delayed union healing after bone grafting or BM injection, Deformity less than 300 angulation and less than 5 mm shortening, Shoulder and elbow with fair range of movements and no pain at rest (Constant and Murley score 30 to 60)

Table 3: Review of Literature

Study and Year	Method of Treatment	Number of Cases	Average Time to Union	Percentage Satisfactory Results
Chen C M, Chin F Y 2000 8	Ender nailing	118	10.5 wks	0.87
QidwaiSA 2000 5	Multiple K wires	29	--	0.93
Chapman JR Henley 2000 2	IL nailing Plating	38 46	--	87% 93%
Cox MA DolamM 2000 9	Russel Taylor nail	37	--	0.84
Hall R f Pankovich1987 10	Unreamed IM nail	85	7.3 wks	0.95
Ajmal M O'sullivan 2001 11	Russel taylor nail	23	--	0.7
Present study	Multiple IM nails	132	9.2	0.92

Poor: Nonunion, Deformity more than 300 angulation and more than 5 mm shortening, Shoulder and elbow with fair range of movements and pain at rest (Constant score 30 to 60)

Results

One hundred and thirty two patients underwent this surgery—36 Females (27.3%) and 98 males (72.7%). Results were assessed at union and again at the time of implant removal.

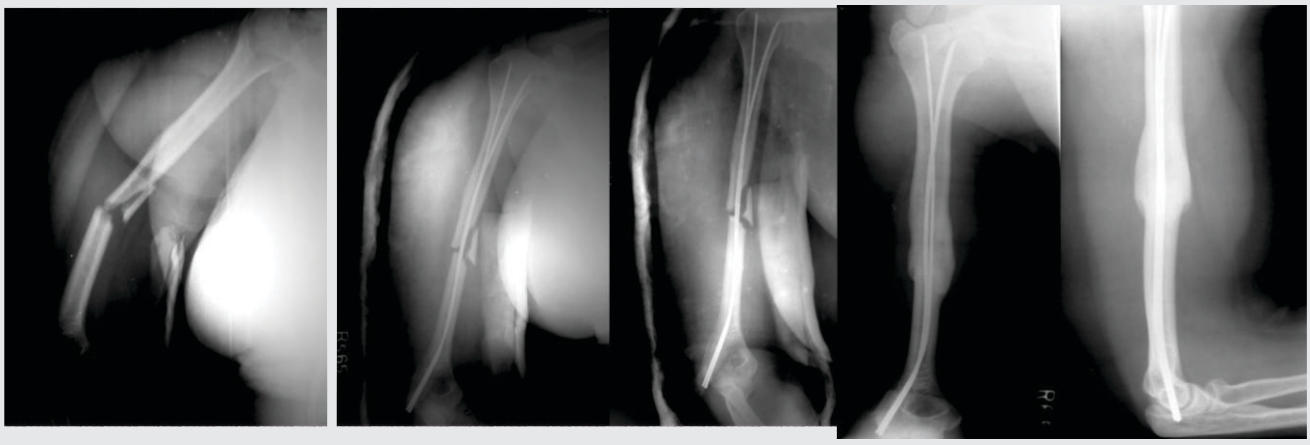

Figure 1: Fracture Middshaft Humerus treated with enders nail with folluw up till fracture union

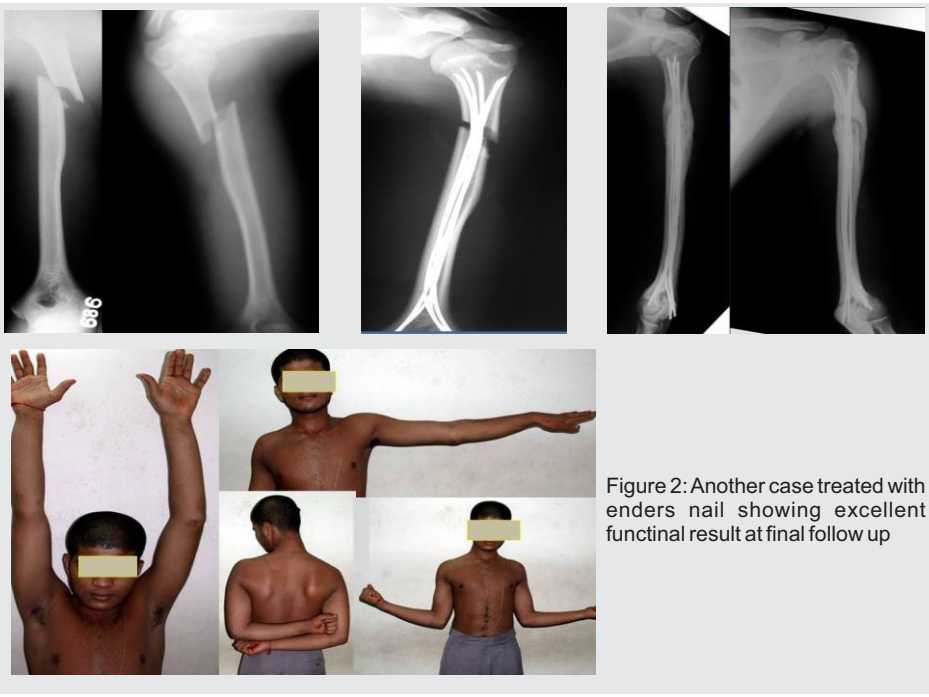

Figure 2: Another case treated with enders nail showing excellent functinal result at final follow up

The right humerus was fractured in 78 cases (59%) and the left in 54 cases (41%). There were no bilateral fractures in this study. Maximum numbers of patients were in age group 21-30 years (Table 1). Out of 132 patients, 27 (20.4%) had compound fractures.

Radial nerve palsy was seen in 14 of the cases (10.6%) but typical Holstein Lewis Type of injuries (radial nerve palsy developing after reduction of a spiral fracture at the junction of lower and middle third), were not fixed by IM nails – these fractures were opened and Plated with a DCP. Patients were followed up from 5 months to 42 mths (average 19.2 mths)

Four cases had superficial at nail insertion site which healed with oral antibiotics. Deep in 3 compound fractures developed deep infection. All cases were treated aggresively with wound exploration curettage and lavage and IV antibiotics and all healed. There were no chronic/ late infections in this series. Backing out of nail was seen in 7 cases (5%). Only one of the many nails backed out was impacted under a short GA and had further uneventful recovery. There were 19 non/-delayed unions, which required a second surgery- bone grafting in 12 (where gap was seen at fracture site) and bone marrow injections in 7 (where there was only insufficient callus) Second intervention was done at 3 mths to 8 mths interval. All the fractures healed eventually. Shoulder stiffness and pain can occur because of rotator cuff injury or impingement. This was experienced by 28 patients, most of them early on in the series. They were treated with physiotherapy and analgesics. Three patients needed manipulation under GA. The incidence decreased after the insertion site of the nail was revised to a more distal position.

Time to Union: The average time to radiological union in this series was 9.4 weeks (range 7 weeks to 18 week). It was easy to assess union on X-rays as all cases healed with callus formation.

In this study six cases were lost to follow up before union and were included in poor results.

Discussion

Fractures of the humeral shaft can be treated by many different techniques. A large number can be treated conservatively with a hanging cast, U slab and sling or functional cast bracing and in spite of some mal-union the patient still has a functionally perfect arm. However, some of these fractures do need intervention and both Compression plating and Intramedullary nailing have their advocates. Plating has the advantage of accurate reduction and rigid fixation with no insult to shoulder or elbow joint. However, Plating is not without its problems- soft tissue stripping, prolonged surgery and poor surgical technique and infection can result in a disaster that becomes extremely difficult to manage.

With the widespread popularity of interlocking nailing in lower limb fractures, this technique also was tried in the humerus. Russel Taylor, AO Unreamed Humeral nails and Sirus nails are still widely used with good success. Prospective studies have shown results of plating and IL nailing to be comparable [3,4]. However even this technique is not without its problems. Intra-operative complications like fragmentation and splitting of the fracture ends, missed interlocking, jamming and distraction of the fracture site may occur. Also, shoulder and elbow stiffness (for retrograde nails) are a problem.

Closed Intramedullary nailing with multiple stacked flexible nails (Ender, Rush, and Marchetti bundle nails) has been studied by a number of workers,[5,6,7]. Being a percutaneous technique, it minimizes the soft tissue trauma, blood loss, operative time and hospital stay. Rotational control can also be achieved by fanning out of the tips. Economical- implant cost is a fraction of the cost of interlocking nail or a LCDCP

Our study shows that results of the method are comparable to those of locking IM nails and plates.

Though this method cannot be used for all fractures of the humerus but with proper selection, a large number of patients can be managed by this simple technique. In fact, this method of fixing the fracture is nothing but assisted conservative treatment where natural healing of

the fracture is helped by a relatively trivial intervention.

Conclusions

Closed intramedullary nailing for the humerus with multiple flexible nails offers many advantages such as minimal tissue trauma, short surgical time, short hospital stay, economy and early union. We recommend this method of treatment for fractures of the shaft of the humerus bearing in mind the specific indications and limitations.

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