FUNCTIONAL EVALUATION OF FRACTURE SHAFT OF HUMERUS TREATED BY ANTEGRADE CLOSED INTERLOCKING NAIL

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ABSTRACT

Introduction

Management of fractures shaft of humerus is always a challenging problem to deal with as they are very frequently associated with complex multiple injuries. Interlocking nails have gained popularity now a days for stabilization of humeral shaft fractures due to load sharing nature of implant, preservation of fracture hematoma, minimal exposures and rigid fixation with early mobilization.

Objective

The objective of the study was to assess the outcome of the fracture shaft of humerus stabilized with interlocking nail.

Methodology

A Prospective clinical study was done on fifty patients of fractures shaft of humerus stabilized using antegrade interlocking nail.

Results

The most common causes of fractures shaft of humerus was road traffic accident (66%). The average union time was 12.7± 1.3 weeks. About 8% had delayed union and 10% had non-union which were treated with bone graft. There was no deep infection but two (4%)had superficial infection in open Gustilo grade IIfracture. Four cases (8%) had radial nerve injury, mostly neuropraxias, which recovered in three months. There were 12 cases of significant restriction of shoulder movements which was resolved in six weeks after guarded physiotherapy.

Conclusion

Closed interlocking nailing is a least invasive surgical option available to manage complex humeral shaft fractures.

KEY WORDS

Antegrade closed interlocking nail, fractures, shaft of humerus.

INTRODUCTION

Fractures of humeral shaft are commonly encountered by orthopedic surgeons, accounting for approximately 3-5% of all fractures.[1-3] Conservative treatment of humeral shaft fractures is well established, but has limitations in cases of extensive soft tissue injury and nerve injury, multiple fractures, non -compliance or obesity. Open reduction with internal fixation is gold standard of surgical treatment, but problems such as excessive soft tissue stripping, radial nerve injury, difficulty with complex fracture patterns, risk of infection and nonunion are well recognized. Consequently, a wide variety of fixation devices have become available for treating these fractures, but to date there is no consensus as to the optimal method of reduction and fixation. Humeral interlocking nail were introduced to reproduce the success seen with similar devices used in the lower extremities. For this reason, interlocking nail fixation has become increasingly popular, offering load sharing biomechanics rotational control and length stability.[4,5] There is considerable debate regarding the best method of treating humerus fractures. A method closely approaching this perfection is interlocking nails.

The objective of the study was to assess the various post-operative outcome of the interlocking nail of fracture shaft of humerus stabilized with interlocking nail.

METHODOLOGY

In a prospective study a total of fifty patients of age group (18-55) years, of either sex, having fractures shaft of humerus were treated by antegrade closed interlocking nail. Pre-operative evaluation was done which included the history regarding the mode of injury. Clinical and radiological assessment of fracture pattern were assessed with antero-posterior and lateral radiographic view of the humerus including shoulder and elbow joint and classified according to the AO classification system. The clinical study was conducted on patients admitted in Birat Medical College Teaching Hospital Biratnagar from May 2016 to April 2018.

The work was approved by institutional medical ethics committee. A written informed consent was obtained from all patients. They were explained about treatment plan, hospital stay after surgery, complication of operation and anesthesia.

Inclusion criteria-Patients with fracture shaft of humerus with age more than 18 years and had presented within a week of injury and did not have any previous surgical treatment for a fracture in same limb.

Exclusion criteria-Patients with age more than 60 with open grade III fracture, arterial injury and pathological fractures.

Examination of the patients was done thoroughly at the time of admission to exclude other injuries. Antegrade Closed interlocking nailing of the fracture humerus was performed within 7th to 10 days after the injury. Check x-ray was taken of the full humeral length. The patients were discharged on 5th post-operative day. The postoperative sutures were removed on the 12th postoperative day. Passive range of motion exercise at shoulder and elbow started on 5th postoperative day when pain and swelling subsided. Thereafter active ranges of motion exercise were started. Patients were followed-up every 6 weeks until 9 months, check x-ray were taken to see the progress of fracture healing.

Radiological assessment was done to assess; union, time of union (weeks), delayed union, and non-union. Union was said to have occurred when a mature callus formed bridging across the fracture on AP and lateral radiographic views. Delayed union as that occurring between 4 to 6 months. Nonunion was said to have occurred when fractures did not achieved union by end of 9 months. All radiologically united fractures were finally assessed at the end of 9 months clinically and functionally. Clinical assessment was based on severity of pain in operated limb and active range of motion of shoulder and elbow. Functional assessment was done as per system of American Shoulder and Elbow Surgeons shoulder score as adopted by McCormack et al[6].

Statistical data were analyseds and results were expressed as descriptive measures for continuous variables (mean and standard deviation [SD]) and as % frequency distribution for categorical variables.

RESULTS

The average age of patients was 34.5 ± 10.2 years with range 18 to 57 years. The male patients (76%) were more frequent than females. The most common causes of fracturs shaft of humerus in this study was road traffic accident (66%). Table 1 shows the frequency distribution on mode of injury encountered in this study.

Table 1: Mode of injury (n=50)

Mode	Number	Percent
Road Traffic Accident	33	66
Fall on Ground	10	20
Hit by Lathi	2	4
Gunshot Injury	5	10
Total	50	100

The most common types and radiological types of fractures were shown in table 2 and 3 respectively.

Table 2: Types of fractures (n=50)

Type	Number of Patients	Percent
Closed	44	88
Open grade I	4	8
Open grade II	2	4
Total	**50**	**100**

Table 3: Radiological types (n=50)

Radiological Types	Number of Patients	percent
Transverse	14	28
Oblique	12	24
Spiral	10	20
Comminuted	8	16
Segmental	6	12
Total	**50**	**100**

Table 4: Site of Humeral fractures (n=50)

Humeral site	Number of Patients	Percent
Proximal One-third	8	16
Middle One-Third	26	52
Distal One-Third	16	32
Total	**50**	**100**

The primary outcomes measured were function and pain. To assess function, we used the American Shoulder and Elbow Surgeons' (ASES) shoulder score for 13 activities of daily living requiring full shoulder and elbow movement table 5. The maximum possible score is 52 points.

Table 5: Details of the American Shoulder and Elbow Surgeons' (ASES) score (4=normal; 3=mild compromise; 2=difficulty; 1=with aid; 0=unable; NA=not available)

Back pocket	Perineal care
Wash opposite axilla	Eat with utensil
Comb hair	Use arm at shoulder level
Carry 10lb at side	Dress
Sleep on affected side	Pull
Use hand overhead	Throw
Lift	

The average union time in our study was 12.7± 1.3 weeks. All of our patients had full range of motion of their shoulders and elbows. Twelve (24%) patients had a significant restriction of shoulder movements, which resolved in 6 weeks after guarded physiotherapy. There were four (8%) delayed unions that were treated by bone graft. In our study, five (10%) of our patients was labeled as nonunion and was treated by bone graft. There was wound infection in two (4%) cases superficial infection in open grade II but no deep infection. Four cases (8%) had Radial nerve palsy which all were neuropraxias secondary to manipulation of fracturing during surgery. All the patients recovered completely within three months with splinting and physiotherapy. No cases of axillary nerves injury were recorded in our study.

Postoperative complications are mentioned in table 5

Table 6: Results of series reporting treated by closed antegrade nailing of fractures shaft of humerus.

Authors	No. of Patients	Time to union Weeks	Infection	Delayed union	Non union	Radial nerve palsy	Restriction ROM of Shoulder
Crats et al[7]	71	13.7		2		2	2
Arun K N et al[8]	25	13.6			1		1
Kroptl et al[9]	109	12.3		5			5
Sahu RL et al[10]	78	15.8		5	4		
Wali MGR et al[11]	25	13.6	1	3	2	2	4
GosawamiSet al[12]	22	12.2					3
Hashib G[13]	13	6.2	1				
Jolly A et al[14]	30	14.6	2	2	2	4	9
Jinn Lin[15]	48	8.6					
Present study	50	12.7± 1.3		4	5	4	12

DISCUSSION

After reviewing the articles, Table 5, these techniques have been largely abandoned because of a considerable complication profile the success of closed intramedullary nailing in the treatment of humeral shaft fractures. An acceptable functional result can be achieved in fractures shaft of humerus even if 3 cm shortening, 30 degree of rotation and 20 degree of angulation exists after fracture union making many of these fractures amenable to conservative treatment[16]. Despite this, an increasing trend towards operative management is being seen nowadays to allow patients to returnearly in their daily activities and occupation. Plate osteosynthesis has yielded high success rate but it needs extensive dissection with the risk of radial nerve injury and re-fracture after implant removal. Closed intramedullary interlocking nailing has the advantages of less soft tissue trauma, less chance of radial nerve injury and most frequent criticism has been its potentially deleterious effect on shoulder function. This can be due to impingement of proximal nail tip or proximal locking screw, due to adhesive capsulitis or due to rotator cuff tears. In the most of the studies with antegrade nailing, 85% to 100% of patients regained their normal shoulder functions.

On the average, the time to union in our series was 12.7± 1.3 weeks which is comparable with Crates et al[7] 13.7 weeks, Arun KN et al[8] 13.6 weeks, Wali MGR et al[11] 13.6 weeks, Kroptl et al[9] 12.3 weeks and Gosawami et al[12] 12.2 weeks. We have considered delayed union to be present if clinical union of fracture did not occur within 24 weeks of the operation. In our series, there were 4(8%) of delayed union which is comparable with Wali MGR et al[11] 12%,Sahu RL et al[10] 6.4% and Jolly A et al[14] 6.6%. We have considered non-union to be present if clinical union of fracture did not occur by end of 9 months post-operatively. Sahu RL et al[10] 5.1%, Wali MGR et al[11] 8% and Jolly A et al[14] 6.6% reported nonunion. In our series there were 5(10%) of nonunion, which we attribute to distraction at the fracture site. We believe that the distraction at the fracture site may be prevented during antegrade nailing by thumping at elbow

after proximal locking. Once the distraction and rotations are corrected by thumping distal locking should be done.

There was no deep infection in our series, but there were 2(4%) cases of superficial infection in open Gustilo Grade II fracture. All the cases had use antibiotics second generation cephalosporin that is continued for intravenous 72 hours post-operatively and oral antibiotics for 12 days. Rommens et al (1995), Heim and Linn reported no infection. Brumback et al (1986) reported an infection rate of 1.7%, Jolly A et al [14] reported 6.6% and Hasib G et al[13] reported 7.6%.

In our series 4 (8%) cases had radial nerve palsy, mostly neuropraxia, secondary to manipulation of fracture during surgery which recovered in three months with splinting and physiotherapy. McCormack et al [6] 14.2%, Hems and Bhullar[17] 9.5%, Jolly A et al[14]13.3% and Wali MGR et al[11] 8% reported radial nerve palsy during manipulative reduction and claimed full recovery in his patients.

The functional outcome of patients with humeral shaft fracture is probably the most important consideration when deciding on the best mode of treatment for a particular fracture pattern. Twelve (24%) of our patients had stiffness at the final follow-up. Shoulder stiffness was a significant problem in antegrade nailing, which could be minimized if care were taken to prevent the proximal protrusion of the nail and repair the rotator cuff properly.

Closed interlocking nail is a safe and reliable method of treating humeral shaft fractures. Among available surgical modalities, closed nailing is the least invasive among surgical techniques and has the least chance of post-operative infection. It reduces the duration of the hospital stay. Complications like nonunion can be avoided by intraoperative compression and avoiding distraction at fracture site. Certain technical aspects like burying the proximal nail end at the entry portal are essential in avoiding impingement and to gain better shoulder function.

CONCLUSION

An overall analysis of the results table 5, shows that in comparisons to previous studies results of our study were similar. We conclude that closed interlocking nailing is a least invasive surgical option available to manage complex humeral shaft fractures.

LIMITATION OF THE STUDY

None

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CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None

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