ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Operative management of humeral shaft fractures with closed reduction and intra medullary nailing at a tertiary care centre, a prospective study.

Dr. Vijay Vikas Sharma[1*], Dr. Mohammad Azhar ud din Darokhan[2], Dr. Omeshwar Singh[3], Dr. Naveen Pandita[4], Dr. Surinder Sharma[5], Dr. Kanav Mahajan[6], Dr. Abdul Hai[7].

1. Senior resident Post graduate department of Orthopaedics G.M.C. Jammu
2. 3rd year post graduate student department of Orthopaedics G.M.C. Jammu
3. 3rd year post graduate student department of Orthopaedics G.M.C. Jammu
4. Senior resident Sharda university Noida
5. post graduate student department of Orthopaedics G.M.C. Jammu
6. post graduate student department of Orthopaedics G.M.C. Jammu
7. post graduate student department of Orthopaedics G.M.C. Jammu

Manuscript Info

Manuscript History:

Received: 15 July 2015
Final Accepted: 22 August 2015
Published Online: September 2015

Corresponding Author

Dr. Vijay Vikas Sharma

Abstract

18 patients with fracture shaft of humerus were admitted from december 2013 to may 2014 in post graduate department of orthopaedics G.M.C Jammu and were managed operatively by closed reduction with interlocking nail. Interlocking system of locking one at proximal shaft and one at distal shaft of humerus provides rotational stability which is lacking in conservative method, elbow and shoulder joint stiffness is reduced, also immobilization period is cut short. Middle 1/3 of shaft of humerus is the most commonly involved site for fracture, right limb is the more commonly involved side. In younger patients it is seen that bone union is early and in older cases union is a bit late relatively so fracture shaft of humerus can be managed with interlocking nail and closed reduction with good results.

INTRODUCTION

Humeral shaft fractures account for about 3% of all fractures. Mechanism of injury for causing this type of fracture is a fall, followed by motor vehicle accident. Fracture chances increases in older patient more than 60 years which include 80% women because of osteoporosis. Other causes that account for less than 10% include sporting activities working accidents, fall from height, violence and bone pathology. The fracture patterns can be of transverse, oblique, spiral or communited type. Fracture is also accompanied with truama to the soft tissues and in some cases to the neurovascular structures. The commonest associated injury to a closed diaphyseal humeral fracture is radial nerve injury (10-12% of all closed humeral shaft fractures). Several modalities exist for treatment of fracture shaft of humerus. Most diaphyseal humerus fractures can be treated by conservative methods like Velpeau bandage, U-slab/Coaptation splint, hanging arm cast, and functional braces. With improved implant design and surgical procedures the operative method including open reduction and internal fixation with plates (4.5mm LC-DCP or LCP) or open/close reduction and fixation with interlocking nail under C-arm are on the rise. The indications of surgery are inability to obtain and maintain adequate closed reduction, compound fractures, segmental fractures, fractures with intra articular extension, floating shoulder or floating elbow injuries, fractures with neurovascular injuries, pathologic fractures and non union. The disadvantages of conservative treatment are prolonged immobilization, loss of reduction within the pop cast leading to nonunion or delayed union. Plate osteosynthesis

gives rigid fixation and absolute stability but has the disadvantages of a wide surgical exposure with stripping and devitalization of bone fragments, it takes more amount of intra operative time thereby leading to more blood loss and transfusion requirement and potential to damage the neurovascular structures including radial nerve and musculocutaneous nerve. Minimally invasive plate osteosynthesis (MIPO) shares many of the pitfalls described for open reduction such as inadequate reduction, fixation, and intraoperative neurovascular injury. Intra medullary nails offers the advantage of being minimally invasive and maintains the biology avoiding extensive soft tissue dissection required for plating. Interlocking nails gives rotational stability, decrease the need for postoperative bracing and allowing early mobilization of the extremity. In cases of segmental fractures, pathological fractures, fractures with poor soft tissue cover, humeral fractures in extremely osteopenic bone and obese patients, intramedullary nailing gives better results than plating.

AIM of study:-
To evaluate the results of Interlocking nail by closed reduction in patients with fractures of shaft of humerus at a tertiary care institute; a referral hospital.

MATERIAL AND METHODS:-

This prospective study was conducted in the post graduate department of Orthopedics Government Medical College, Jammu during the period from December 2013 to May 2014. Both male and female patients were included in the study.

Inclusion criteria:
Shortening >3cm, Rotation >30 degrees, angulation > 20 degrees, segmental fractures, compound fractures, pathologic fractures, age between 18 to 70 years, fresh trauma less than 2 weeks.

Exclusion criteria:-
Patient below 18years of age and grossly comminuted fracture were not included in study

All the patients were initially assessed in the emergency section of GMC Jammu. They were given first aid in the form of analgesia, splint immobilization, and other resuscitation measures. After selection of the patients for surgery, patients were prepared for elective surgery to be conducted in the elective operation theatre.

Pre-operative evaluation:
Pre-operative evaluation included detailed patient history. Every patient was evaluated for swelling, bruising & ecchymosis at the fracture site and visible deformity. A careful neurological and vascular examination of the involved limb was done. All the routine investigations like ecg, complete blood count & biochemistry were done. Radiographic evaluation by X-ray of the chest, PA view Xray-AP and lateral views of the humerus including the shoulder and elbow joints was done in every patient. Informed and written consent was taken from the patients

Follow up initially done every week and later on every 2 week and final assessment done at 24 weeks. The patients were assessed by American Shoulder and Elbow Surgeons (ASES) score and radiologically by noticing evidenve of union.
Results were graded in to:-

1. **Excellent**- ASES score >40, bony union within 3 months, no complication, full range of movement at elbow and shoulder joint

2. **Good**- ASES score 30-39 with painless shoulder abduction of 120 degree, loss of elbow flexion or extension of not >20 degrees and union within 3-4months.

3. **Poor**- ASES score <30, painful arc of motion either shoulder or elbow and union more than 4 months, complications like infection ,wasting etc and restriction of movement more than 30 %

Operative Technique:-

Pre operatively length of nail determined by measuring from greater tubrosity to humeral condyle (cooney) or lateral condyle of humerus minus 2cm.

All surgeries were done under general anaesthesia.

Arm was shaved, arm and shoulder were cleaned with soap/savlon for 2 minutes and limb was drapped in strile sheet, prophylactic antibiotics were given half an hour prior to skin insicion.

The patient were positioned supine with a padded support under the ipsilateral shoulder, the whole arm supported on a radiolucent arm support with C-arm on the opposite side.

A 2-3 cm incision was made from the anterolateral edge of the acromion obliquely forward and the deltoid muscle cut longitudinally along its fibres to reveal the subacromial bursa and the rotator cuff. After giving 1 cm stab incision to the cuff entry point was made just medial to the tip of greater tuberosity and 0.5 cms posterior to the bicipetal groove with an awl under C-arm. Fracture was reduced under C arm, and a guidewire passed through the fracture site to the distal segment. Serial reaming was done with reamers and a nail of appropriate size was selected and introduced. Proximal locking was done with help of targeting device and distal locking by free hand technique.

Post operative managment -

Rehabilitation of the patient began immediately. On the 1st post -op day, the operated extermity was elevated. From the 2nd post-op day, active assisted and passive movenents were begun, including pendulum exercises and assisted full forward flexion within the limits of pain. From the 7th post-op day, overhead abduction, external rotation and internal rotation exercises were begun.

Follow up evaluation:-

The follow up in the post operative period was done at 2 weeks, 4 weeks 6 weeks, 8 weeks, 10 weeks, 12 weeks and 6 months. In each visit patient was assessed by clinical examination and radiological examination. Clinical examination included incision site (infection, dehiscence) severity of pain, swelling, tenderness, distal neurovascular status, and deep infection, range of motion, power of shoulder muscles and fracture healing. Radiological examination included position of fragments, amount of callous, status of locking plate and screws and any other complication.

OBSERVATION and RESULTS:-

1. Distribution as per age and sex

MALE	FEMALE
12 (66.66%)	6 (33.33%)
Age range 18 -70	40-60

2. LIMB INVOLVED -Out of 18 patients, Right Limb involved in 14 patient (77.77%) and left limb involved 4 patient(22.22%)

3. NATURE OF TRUMA

RTA	FALL	OTHER
10(55.55%)	4(22.22%)	4(22.22%)

4. SITE OF FRACTURE

Upper1/3	Middle1/3	Lower1/3
4(22.22%)	9(50%)	5(27.77%)
Total	18	

5. TYPE OF FRACTURE

TRANSVERSE	OBLIQUE	COMMINUTED
11(61.11%)	3(16.66%)	4(22.22%)
TOTAL	18	

6. DURATION OF UNION IN DAYS IN DIFFERENT AGE GPS

AGE RANGE IN YEARS	NO OF CASES	PERIOD OF UNION IN WEEKS
18-30	5 (27.77%)	8
31 -50	7 (38.88%)	9
50-70	6 (33.33%)	10

7. SHOULDER MOVEMENT (only abduction was the main movement restricted)

TIME INTERVEL	FULL FUNCTIONAL MOVEMENT	RESTRICTION UP TO 25% of normal	Restriction more than 25% of normal
At 1 week	0	9(50%	9(50%)
f/u 24 week	0	14(77.77%)	4(33.33%)

8. ELBOW MOVEMENT (only extension was the main movement restricted)

TIME INTERVEL	Full functional movement	Restriction up to 25% of normal movement	Restriction more than 25% of normal	Restriction more than 50%
At 1week	14(77.77%)	3(16.66%)	1(5.55%)	0
f/u after 24 week	15(83.33%)	2(11.11%)	1(5.55%)	0
Total	18			

9. FINAL ASSESSMENT BY ASES SCORE AT 24 WEEKS

EXCELENT >40	GOOD 30-39	POOR <30	
3(16.66%)	14(77.77%)	1(5.55%)	
TOTAL	18		

10. Complications : –

No case of delayed or non union was found in this study, one case of entry site infection was postoperatively managed with antibiotics and one case of neuropraxia of radial nerve was noted which recovered within 4 weeks after surgery

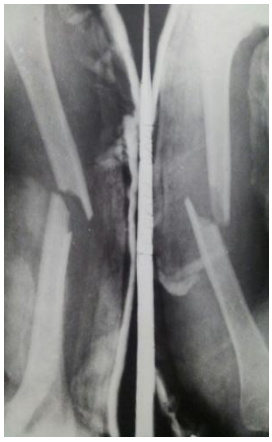

Fig.1 Pre op x ray of fracture shaft of humeru

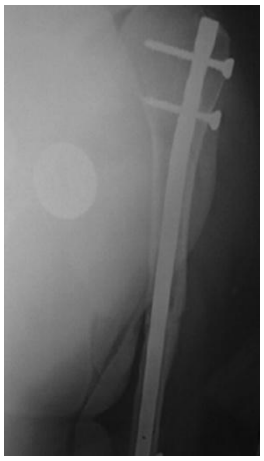

Fig.2 Post op X ray after interlocking nail

Fig. 3 post op internal rotation

Fig.4 post op abduction right side

SUMMARY -

18 cases of fracture shaft of humerus were managed by closed reduction with inter locking nail at post graduate department of orthopaedics G.M.C Jammu between December 2013 to May 2014

Around 72% cases occurred in patients 30 years or more in age. These fractures were common in people who were more involved in outdoor activities, sports and hence more prone to trauma.

It was observed that males (66.66%) who are more involved in outdoor activities and most of the vehicles are driven by males in our country had more fractures of shaft of humerus than females (33.33%).

Right limb (77.77%) was more involved than left limb (22.22%),

Road traffic accidents (55.55%) was the major cause of fracture shaft of humerus followed by falls (22.22%),

Middle third (50%) of shaft was mostly fractured followed by lower third (27.77%) then upper third (22.22%), transverse fracture was the most common pattern of fracture (61%) followed by communited (22.22%) and oblique type(16.66%).

Total period of union took from 8 to 10 weeks, average time of union was 9weeks. It was noted that union was earlier between the age group of 18 to 30 years(8 weeks) and more in age group above 50 years (10 weeks).

It was also seen that after 24 weeks 77.77% patients had restriction of shoulder movements less than 25% and 83.33% had no elbow restriction after interlocking nail humerus.

DISCUSSION:-

Fractures of the humeral shaft account for roughly 3% of all fractures; out of which most can be treated nonoperatively. Charnley stated, "It is perhaps the easiest of the major long bones to treat by conservative methods." Functional bracing has become the "gold standard" for nonoperative treatment. A nonrandomized study by Jawa et al. compared outcomes in 21 distal-third diaphyseal fractures treated with functional bracing to those of 19 treated with plate-and-screw fixation. Operative treatment resulted in more predictable alignment and faster healing but was associated with more complications, such as iatrogenic nerve injury, loss of fixation and infection. Complications associated with bracing included skin breakdown and malunionOperative management of humeral diaphyseal fractures is a hot topic of debate in the 21st century whether to plate or nail. In Rockwood and Green's fracture in adults 8th edition, the author's preferred treatment for closed or open diaphyseal fracture of humerus is an intra medullary nail. The indication of operative management of humerus fractures as given by McKee include absolute and others. Failure of conservative treatment, pathological fracture, displaced,
intraarticular extension, vascular injury, and brachial plexus injury almost always require surgery. Other conditions, such as minimally displaced segmental fractures and obesity, are only relative indications. Like interlocking nail is the treatment of choice in diaphyseal fractures of the lower limb its role in humerus diaphyseal fractures has to be fully explored and understood. According to our study on 18 patients of humeral diaphyseal fractures acceptable reduction and union with fair range of motion was achieved in 94.55% (17 out of 18 patients), results of other studies also have the same conclusion. Hall et al (1987) in his prospective study of 89 achieved excellent functional results with intra medullary nailing. It took 7.2 weeks for the fracture site to unite. They concluded that intra-medullary Enders nailing can be effectively and safely done. Jin Linn (1998) observed humeral locked nailing had shorter operative time, less blood loss and eventual union was achieved better in nail than in plate fixation. Kropfl et al (2000) conducted prospective study of 111 humeral fractures stabilized with unreamed antegrade nailing and stated that it is a safe technique with advantage of early mobilization. Vecsei et al (2001) compared seidel nail and unreamed humeral nail (UHN) and concluded that UHN can be inserted both antegradely as well as retrogradely and provides rotational stability. Karatagalis et al found a dependable solution in 39 patients treated by locked antegrade nailing particularly in segmental fractures and polytrauma patients. Park et al evaluated 34 fractures followed for average of 34 months who underwent antegrade humeral nailing through rotator cuff interval and concluded that the overall satisfaction rate was more than 90% according to ASES score and primary bone union was achieved in 32 cases. Changulani et al concluded that intra-medullary nailing can be considered a better surgical option as it offers short union time and lower incidence of serious infection, however there appears no difference in functional outcome between two groups..

Conclusion:-

The following conclusion can be drawn from the present study:
Antegrade intramedullary nailing is a rapid, safe and an effective method for treating fractures of the humeral shaft.

REFERENCES

Bhandari M, Devereaux PJ, McKee MD, et al: Compression plating versus intramedullary nailing of humeral shaft fractures—a meta-analysis, *Acta Orthop* 77:279, 2006.
Bishop J, Ring D: Management of radial nerve palsy associated with humeral shaft fracture: a decision analysis model, *J Hand Surg* 34A:991, 2009.
Bodner G, Buchberger W, Schoke M, et al: Radial nerve palsy associated with humeral shaft fracture: evaluation with US—initial experience, *Radiology* 219:811, 2001.
Bumbasirevic M, Lesic A, Bumbasirevic V, et al: The management of humeral shaft fractures with associated radial nerve palsy: a review of 117 cases, *Arch Orthop Trauma Surg* 130:519, 2010.
Chapman JR, Henley B, Agel J, et al: Randomized prospective study of humeral shaft fracture fixation: intramedullary nails versus plates, *J Orthop Trauma* 14:162, 2000.
Cox MA, Dolan M, Synnott K, et al: Closed interlocking nailing of humeral shaft fractures with the Russell-Taylor nail, *J Orthop Trauma* 14:349, 2000.
Ekholm R, Adami J, Tidermark J, et al: Fractures of the shaft of the humerus: an epidemiological study of 401 fractures, *J Bone Joint Surg* 88B:1469, 2006.

Ekholm R, Ponzer S, Törnkvist H, et al: Primary radial nerve palsy in patients with acute humeral shaft fractures, *J Orthop Trauma* 22:408, 2008.
Ekholm R, Tidermark J, Törnkvist H, et al: Outcome after closed functional ernandez FF, Matschke S, Hülsenbeck A, et al: Five years' clinical experience with the unreamed humeral nail in the treatment of humeral shaft fractures, *Injury* 35:264, 2004.
Fjalestad T, Stromsoe K, Salvesen P, et al: Functional results of braced humeral diaphyseal fractures: why do 38% lose external rotation of the shoulder? *Arch Orthop Trauma Surg* 120:281, 2000.
Flinkkilä T, Hyvönen P, Siira P, et al: Recovery of shoulder joint function after humeral shaft fracture: a comparative study between antegrade intramedullary nailing and plate fixation, *Arch Orthop Trauma Surg* 124:537, 2004.
Franck WM, Olivieri M, Jannasch O, et al: Expandable nail system for osteoporotic humeral shaft fractures: preliminary results, *J Trauma* 54:1152, 2003.
Gosler MW, Testroote M, Morrenhof JW, Janzing HM: Surgical versus nonsurgical interventions for treating humeral shaft fractures in adults, *Cochrane Database Syst Rev* (1):CD008832, 2012.
Hall RF, Pankovich AM. (1987): Ender nailing of acute fracture of humerus: A study of closed fixation by intra-medullary nails without reaming. J Bone Joint Surg ; 69: 558-67.
Heineman D, Poolman RW, Nork SE, et al: Plate fixation or intramedullary fixation of humeral shaft fractures: an updated meta-analysis, *Acta Orthop* 81:216, 2010.
Hollister AM, Saulsbery C, Odom JL, et al: New technique for humerus shaft fracture retrograde intramedullary nailing, *Tech Hand Up Extrem Surg* 15:138, 2011.
Idoine JD, French BG, Opalek JM, DeMott L: Plating of acute humeral diaphyseal fractures through an anterior approach in multiple trauma patients, *J Orthop Trauma* 26:9, 2012.
Jawa A, McCarty P, Doornberg J, et al: Extra-articular distal-third diaphyseal fractures of the humerus: a comparison of functional bracing and plate fixation, *J Bone Joint Surg* 88A:2343, 2006.
Kobayashi M, Watanabe Y, Matsushita T: Early full range of shoulder and elbow motion is possible after minimally invasive plate osteosynthesis for humeral shaft fractures, *J Orthop Trauma* 24:212, 2010.
Koch PP, Gross DFL, Gerber C: The results of functional (Sarmiento) bracing of humeral shaft fractures, *J Shoulder Elbow Surg* 11:143, 2002.
Kropfl A, Naglik H, Niederwieser B, Hertz H. (2000): Unreamed antegrade humeral nailing. Unfallchirug; 103(5):348-50.
Lin J, Shen PW, Hou SM: Complications of locked nailing in humeral shaft fractures, *J Trauma* 54:943, 2003.
Livani B, Belangero WD, Castro de Medeiros R: Fractures of the distal third of the humerus with palsy of the radial nerve: management using minimally-invasive percutaneous plate osteosynthesis, *J Bone Joint Surg* 88B:1625, 2006.
Lorich DG, Geller DS, Yacoubian SV, et al: Intramedullary fixation of humeral shaft fractures using an inflatable nail, *Orthopedics* 26:1011, 2003.
McCormack RG, Brien D, Buckley RE, et al: Fixation of fractures of the shaft of the humerus by dynamic compression plate or intramedullary nail: a prospective, randomized trial, *J Bone Joint Surg* 82B:336, 2000.
McKee MD: Fractures of the shaft of the humerus. In Bucholz RW, Heckman JD, Court-Brown CM, editors: *Rockwood and Green's fractures in adults*, Philadelphia, 2006, Lippincott Williams & Wilkins.
Mills WJ, Chapman JR, Robinson LR, et al: Somatosensory evoked potential monitoring during closed humeral nailing: a preliminary report, *J Orthop Trauma* 14:167, 2000.
Patel R, Neu CP, Curtiss S, et al: Crutch weightbearing on comminuted humeral shaft fractures: a biomechanical comparison of large versus small fragment fixation for humeral shaft fractures, *J Orthop Trauma* 25:300, 2011.
Pehlivan O: Functional treatment of the distal third humeral shaft fractures, *Arch Orthop Trauma Surg* 122:390, 2002.
Ring D, Chin K, Jupiter JB: Radial nerve palsy associated with high-energy humeral shaft fractures, *J Hand Surg* 29:144, 2004.
Rosenberg N, Soudry M: Shoulder impairment following treatment of diaphyseal fracture of humerus by functional brace, *Arch Orthop Trauma Surg* 126:437, 2006.
Ruland WO: Is there a place for external fixation in humeral shaft fractures? *Injury* 31:27, 2000.
Rutgers M, Ring D: Treatment of diaphyseal fractures of the humerus using a functional brace, *J Orthop Trauma* 20:597, 2006.
Sanzana ES, Dümmer RE, Castro JP, et al: Intramedullary nailing of humeral shaft fractures, *Int Orthop* 26:211, 2002.

Sarmiento A, Zagorski JB, Zych GA, et al: Functional bracing for the treatment of fractures of the humeral diaphysis, *J Bone Joint Surg* 82A:478, 2000.
Schoots IG, Simons MP, Nork SE, et al: Antegrade locked nailing of open humeral shaft fractures, *Orthopedics* 30:49, 2007.
Shao YC, Harwood P, Grotz MR, et al: Radial nerve palsy associated with fractures of the shaft of the humerus: a systematic review, *J Bone Joint Surg* 87B:1647, 2005.
Shin SJ, Sohn HS, Do NH: Minimally invasive plate osteosynthesis of humeral shaft fractures: a technique to aid fracture reduction and minimize complications, *J Orthop Trauma* 2012. [Epub ahead of print].
Stannard JP, Harris HW, McGwin G Jr, et al: Intramedullary nailing of humeral shaft fractures with a locking flexible nail, *J Bone Joint Surg* 85A:2103, 2003.
Strothman D, Templeman DC, Varecka T, et al: Retrograde nailing of humeral shaft fractures: a biomechanical study of its effects on the strength of the distal humerus, *J Orthop Trauma* 14:101, 2000.
Suzuki T, Hak DJ, Stahel PF, et al: Safety and efficiency of conversion from external fixation to plate fixation in humeral shaft fractures, *J Orthop Trauma* 24:414, 2010.
Tingstad EM, Wolinsky PR, Shyr Y, et al: Effect of immediate weightbearing on plated fractures of the humeral shaft, *J Trauma* 49:2778, 2000.
Toivanen JAK, Nieminen J, Laine HJ, et al: Functional treatment of closed humeral shaft fractures, *Int Orthop* 29:10, 2005.
Zhiquan A, Bingfang Z, Yeming W, et al: Minimally invasive plating osteosynthesis (MIPO) of middle and distal third humeral shaft fractures, *J Orthop Trauma* 21:628, 2007.
Zlotolow DA, Catalano LW 3rd, Barron OA, Glickel SZ: Surgical exposures of othe humerus, *J Am Acad Orthop Surg* 14:754, 2006.