

Management of Fractures of shaft of Humerus in Adults By Antegrade Closed Interlock Nailing and Evaluation of Clinical Results: A Prospective Study

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Abstract: Background: Fracture of shaft of humerus accounts for 3-5 % of all long bone fracture and 14 % of all fractures of humerus. There are several modalities for the management of diaphyseal humeral fractures. Most fracture can be treated by non-operatively Fracture shaft humerus is a major cause of morbidity in patients with upper extremity injuries Intramedullary nailing can be used to stabilize fractures that are 2 cm below the surgical neck to 3 cm proximal to the olecranon fossa. The aim of this study was to evaluate the outcome of interlocking nail in humeral shaft fractures.

Methods: This study was conducted in the Department of Orthopaedics of Govt. Medical College and Hospital, Latur, Maharashtra from November 2012 to June 2015. Forty six patients were followed prospectively admitted in department having a close fracture of humerus shaft. All patients were operated with closed reamed interlocking nailing. All patients were followed for 9 months.

Results: Out of 46 patients, 41 patients underwent union in 13 weeks –21.5 weeks with a mean of 15.8 weeks. Complications found in 02 patients who had non-union, and 03 patients had delayed union, which was treated with bone grafting. All the patients were assessed clinically And radiologically for fracture healing, joint movements and implant failure. The results were excellent in 88.46% and good in 6.41% patients. Complete subjective, functional, and clinical recovery had occurred in almost 100% of the patients.

Keywords: Humeral Shaft Fractures, rotational stability, Close Reamed Interlocking Nail, Union.

Thesis Question: What is the best modality of treatment of fracture of shaft of humerus in adults?

Thesis Answer: Locked intramedullary nailing is best treatment if basic surgical fixation principles and with proper implants & is sure way to achieve union and pre-trauma functional outcome.

THESIS SUMMARY

Introduction

Fracture of shaft of humerus accounts for 3-5 % of all long bone fracture .Most fracture can be treated by non-operatively. Conservative methods like Closed reduction and application of U-Slab, abduction cast and splint, Hanging arm cast, Arm-Brace.

Serminto et al reported use of plastic sleeve with early introduction of functional activity. In review of 51 fractures, there was no non-union in 49 non-pathological fractures with good restoration of joint motion [1].Traditionally fractures of shaft of humerus are treated conservatively with high union rate, but with significant rate of deformities; so also period of immobilisation required is 12 to 16 weeks. In Today's, modern era, both, deformities and longer period of

immobilisation are not accepted by patients.

Humerus is single bone in arm and surrounded by large muscle mass. With shoulder and elbow at risk of stiffness due to prolonged immobilization, there are certain clinical conditions and in these conditions primary or secondary operative treatment is indicated [2].

Following are indications for Surgery:-

1. Failure to Obtain Satisfactory reduction :

- LONG SPIRAL FRACTURES
- TRANSVERSE FRACTURES
- SHORT OBLIQUE FRACTURES.

2. Failure to Maintain Reduction (Unacceptable reduction) –

Shortening >3 cm, Rotation >30 degrees & angulation >20 degrees.

3. Injuries to Chest Wall.
4. Bilateral Humerus Fractures.
5. Multiple Injuries / Vascular Lesions / Neurological Lesions.
6. Fracture of Shaft with Intra articular Extensions / with intra articular Fractures.
7. Open Fractures/ Pathological Fractures of the Humerus.
8. Floating elbow lesions and
9. Patients with obesity (risk of developing varus angulation).

Open reduction and internal fixation (ORIF) with plates and screws and intramedullary nailing are advocated for treating humerus fractures .In accordance with AO Principle of anatomical reduction and stable internal fixation, Plate and screw osteosynthesis seemed appropriate choice [3].

But due to obvious disadvantages of

- Extensive soft tissue dissection,
- Periosteal stripping,
- Opening of fracture hematoma,
- Contamination of fracture site and
- Risk of infection and non-union
- Less secure fixation in osteoporotic bones.
- Scar over arm.
- Dissection of radial nerve in middle third fracture, which may endanger the nerve

Intramedullary nailing is favoured. Biomechanically intramedullary nails are better implants .Nails are subject to smaller bending load and less likely to fail due to fatigue[4]. Also cortical osteopenia that occur adjacent to plate ends is rarely seen in internal fixation with intramedullary nail, and risk of re-fracture after implant removal is less likely.

Locked Closed Intramedullary Nails are preferably to be used in the treatment of Segmental and Complex fractures of Shaft, which are difficult to stabilize with plates and screws because of fracture morphology.

Additionally;

- Being intramedullary, they act as load sharing and stress shielding device.
- Advantage of controlled impaction.
- Two screws in proximal and one distal fragment give better rotational stability.
- Shorter operative time, less soft tissue dissection, less blood loss & hence reduced rate of infection.
- Very useful in the treatment of Pathological fractures of humerus.
- Shaft fracture with severe comminution or bone loss and in osteoporotic bone.
- Early mobilization and Excellent functional outcome.

In view of these conditions, this study is taken up to evaluate clinical & radiological outcome of fractures of shaft of Humerus treated with closed interlocked intramedullary Nailing.

Material and Methods

We prospectively followed a series of 46 consecutive patients with

closed humeral shaft fracture treated at our Hospital between November 2012 and March 2015 with closed reduction and Locked intra medullary nail fixation.

Aims and Objectives

- 1) To study incidence of fractures of shaft of humerus in tertiary care centre.
- 2) To study incidence of associated complications with fracture shaft humerus.
- 3) To study difficulties encountered in management of fracture of shaft humerus treated with intra-medullary implant (locked intra-medullary nail) under IITV control.
- 4) To study clinical and radiological outcome of fracture of shaft humerus treated with intra-medullary implant (locked intra-medullary nail)

Inclusion criteria

Adult age groups patients of both sexes having fracture of humerus classified as according to AO classification.

Exclusion criteria

- i. Unstable proximal fracture of shaft humerus.
- ii. Fracture of distal part of humerus.
- iii. Fracture of shaft humerus – below 18 years of age.
- iv. Fracture dislocations of proximal humerus,
- v. Pathological fractures, patients affected by mental impairment,
- vi. Skeletally immature patients
- vii. Patients with open fractures and fractures in the same limb.
- viii. Patients with distal neurovascular deficit.
- ix. Patients with non-union, malunion or delay in surgery (>10 days)

Technique

- For patients requiring surgical intervention, anaesthesia fitness and written valid informed consent shall be obtained prior to surgery.
- Under anaesthesia, closed reduction and internal fixation by ante grade intra-medullary locked nailing was done.
- The surgery is performed in the supine position, sandbag under medial aspect of scapula with the head rotated to contra lateral side on a radiolucent table.
- A longitudinal skin incision 2–3 cm over the antero-lateral edge of the acromion obliquely forward near the tip of the greater tuberosity. Deltoid is split longitudinally along its fibres to reveal subacromial bursa and the rotator cuff.
- Incise rotator cuff in the direction of supraspinatus muscle; an awl was passed just medial to the tip of the greater tuberosity, 0.5 cm posterior to biceptal groove to make an entry point. The direction of awl should be slightly oblique, aiming towards medial cortex of humerus.
- The hand awl must penetrate for at least 4 to 5 cm to create pathway for guide wire.
- The correct alignment was obtained by closed reduction maneuver of Traction, Supination of forearm, and 90 Degrees elbow flexion applied

and maintained by assistant.

- Close reduction achieved and confirmed under C-arm guidance and guide wire was passed, the length of the nail was measured by subtracting exposed guide wire from the total length of the guide wire. In two cases, where closed reduction failed minimum open reduction was done.
- While maintaining the reduction, guide wire was removed, and the nail of proper length and diameter was passed till its proximal end was beneath the bone by 0.5 cm to avoid sub-acromial impingement, and its tip should lie 1.5-2.0cm proximal to olecranon fossa.
- Proximal and distal locking was done. The type of nailing is static ante grade interlocking nails. Before distal locking the fracture site is compressed by placing axial load on elbow (Gentle thumping on elbow) Dressing done and the limb was kept in collar and cuff support. Check X-ray was taken of the full humeral length.
- Three antibiotic shots, one pre operative, intra operative and post operative each, will be given and broad spectrum IV antibiotics for five days were administered.
- Patient treated with surgery will be discharged on 11th post operative day after suture removal.
- Rehabilitation Protocol.
- Patient were followed up at regular intervals at 4, 6 12 wks and 3, 6 12 months.
- Assessment was done based on clinical assessment and radiological examination with particular advices regarding active assisted shoulder and elbow exercises.
- Passive flexion abduction exercises of shoulder and flexion extension exercises of elbow was started on 3rd post op day after first check dressing and subsidence of local swelling and oedema.
- Active exercises were instructed after 2 weeks, and after visualisation of soft callus rotational exercises were advised.
- Union was defined as mature callus formation bridging across fracture visible in two radiographic views & Non union is defined as when fracture is not united at the end of 9 months of surgery.
- Clinical assessment was done based on severity of pain on operated limb and active range of motion of shoulder And elbow
- Functional assessment as per system of American Shoulder and Elbow Surgeons shoulder score.

The collected data was statistically analysed.

Results

Our study comprises of 46 patients of fracture of shaft of humerus.

There were 44 patients with 46 fractures (01 male and 01 female sustained bilateral fracture). and 32 males and 12 females.

04(8.69%) were upper third, 34(73.91%) were middle third and 08(17.39%) were lower third in location.

35 patients (76.08%) achieved union and 07(15.21%) had delayed union and 02 (4.34%) had malunion, So overall 44 patients (95.66 %) achieved union.

02(4.34%) went into nonunion and were treated by bone grafting.

Union was achieved between 91(13 wks) to 140(20 wks) days in 44

fractures out of which 07 were delayed union (which was diagnosed if a fracture had not united within four months [16 weeks] of injury (Stern et al. 1984).

Delayed union was treated with removal of distal locking screw (Bone grafting was not performed), and active movement was encouraged after operation.

In this study, 02 (4.34%) fractures went into non-union & were treated by bone-Grafting.

Functional outcome was Excellent in 39 fractures (84.78%) & Good in 5 fractures (10.86%) i.e Excellent to Good fracture union in 44 fractures (95.64%).

And by end of 9 month assessment of functional and clinical outcome was done and found to be satisfactory in all 100% patients.

Outcome of Result

39 patients (84.78%) had Excellent result and 05 patients (10.86%) had Good outcome on final assessment. 02 (4.34%) had Fair result. 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 [5]. They were followed-up after surgery, they were clinically and radiologically assessed for fracture healing, joint movements and implant failure.

According to the criteria the results are graded as excellent when the fractures unite within 16 weeks without any complication, good when union occur within 24 weeks with treatable complications like superficial infection and shoulder stiffness and poor when union occur before or after 24 weeks with one or more permanent complications like infection (osteomyelitis), implant failure, nonunion, limb shortening and permanent shoulder stiffness.

Follow-up was done according to these criteria. As part of a subjective assessment, patients were asked in the questionnaire if they were very satisfied, satisfied or not satisfied with the outcome of treatment.

Conclusion

Essentially all closed humerus shaft fractures extending between 2 cm from surgical neck to 3 cm proximal to olecranon fossa can be stabilized by ante grade closed intramedullary interlock nailing.

It is excellent method of managing comminuted and unstable humerus shaft fracture. Long butterfly fragment consolidate early at 4-6 weeks as closed nailing is done.

It is best surgical method available to fix humerus shaft fracture in patients with poly trauma and osteoporosis where reduction in operating time and early rehabilitation are the primary objectives

Interlocking nailing gives rotational stability; decreases need for post-op bracing and allow early mobilization of extremity.

In available surgical modalities, closed nailing is the least invasive surgical technique and has got the least chance of post-operative infection. It reduces hospital stay.

Since closed nailing preserves fracture hematoma, it appreciable decreases the time required for fracture to consolidate and achieves high

rate of fracture union.

Complications like delayed union can be effectively cured by dynamization (which is helpful to achieve compression at fracture site).

Non-union can be avoided by Intraoperative compression and avoiding distraction at fracture site. We believe that distraction can be prevented during ante grade nailing by pushing /thumping at flexed elbow after proximal locking. Technical aspect like, burying nail end in bone at the entry portal are essential in avoiding impingement and to gain better shoulder function.

Early intensive physiotherapy hastens the recovery of shoulder.

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