

Management of humeral shaft fractures with anterior bridge plating-A minimally invasive approach

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Abstract

Introduction: MIPO (Minimally Invasive Plate Osteosynthesis) of long bone fracture is a new concept which is gaining popularity as it is minimally invasive, requiring less dissection and also preserves fracture biology at the same time.

Aims and objectives: Our study aimed to evaluate the clinical, functional and radiological result of bridge plating of humeral shaft fractures using MIPO technique and comparing the results to the traditional and more extensive posterior approach of humerus plating.

Material and Methods: 20 patients with humeral shaft fractures that were treated by bridge plating using MIPO technique between Jan 2016 to Jan 2018 were included in this study. All cases were managed by closed reduction and application of a 4.5mm Locking Compression Plate (L.C.P) over the anterolateral surface of the humerus. The UCLA shoulder score was used to evaluate the outcome of this procedure.

Results: Out of 20 patients in this study 13 were male and 7 were female. The mean age was 31 years (range 20-60 years). The mean surgical time was 75 min (range 60-120 min). The mean fracture union time was 11 weeks (range 10-20 weeks). The shoulder function was excellent to good in 17 cases (85%) and fair in 3 cases (15%) on the UCLA SCORE.

Conclusion: Anterior bridge plating using MIPO technique is a safe and a reproducible option for managing humeral shaft fractures. It gives a high rate of union, good functional outcome, less time consuming and has minimal complications.

Keywords: MIPO (Minimally Invasive Plate Osteosynthesis), Bridge plating, Humeral shaft fractures.

Introduction

Diaphyseal fractures of the humerus occur frequently and represent three to five percent of the fractures of the human body.¹ The humerus can be considered the most versatile bone in the human body in view of the fact that it can be successfully approached by a variety of methods for fracture fixation including functional bracing, plating and intramedullary nailing.^{2,3} Compression plate fixation, which is a widely accepted operative method,⁴⁻⁶ gives a high union rate and allows early active motion of the joints. Compression plate fixation, however, is technically demanding and requires extensive surgical dissection with risk of injury to the radial nerve. Absolute anatomical reduction by compromising soft tissue and hence the vascularity is becoming older trend now. Stable mechanical fixation requires precise reduction and opening of the fracture site. It heals by primary intention which is biologically inferior to healing by secondary intention with the preservation of fracture haematoma causing minimal soft tissue injury. As a result of technical advancement, minimally invasive plate osteosynthesis (MIPO) has gained popularity in recent years with satisfactory clinical outcomes.^{7,8} Anterior bridge plating which utilizes the minimally invasive approach popularly known as the minimally invasive percutaneous plate osteosynthesis technique can be said to be the latest entrant in this list.^{9,10} Near normal acceptable reduction and rigid stable fixation

has its biological advantage as compare to absolute anatomical reduction with compromising soft tissue and vascularity.¹¹ In this study we have evaluated the clinical, radiological, and functional outcomes of this mini invasive technique for humerus fracture over a minimum follow-up of 2 years.

Material and Methods

Twenty patients with fractures of the humeral shaft were treated using anterior bridge plating by MIPO (Minimally Invasive Plate Osteosynthesis) Technique between January 2016 and January 2018.

All the patients had a minimum follow up of two years. The study was conducted with the approval of the ethics committee of the institution and prior consent of the patients was taken. The inclusion criteria included fractures involving the middle third of shaft of humerus in patients aged 20 to 60 years, who consented to the study. The operative procedure was performed within 2 days of the injury. Exclusion criteria included compound fractures, pathological fractures, bilateral humeral shaft fractures, fractures with vascular insufficiency and polytrauma patients. A preoperative clinical examination of the affected arm was done with respect to local area swelling, contusion, abrasions and neurovascular defect (mainly radial nerve injury). Preoperative Antero-Posterior (AP) and Lateral radiographs of the affected arm were taken [Fig. 1].

Surgical Technique

The patients were operated in supine position. 13 patients were given brachial block and 7 patients were given general anaesthesia. A 3cm proximal incision was taken between the lateral border of the proximal part of biceps and medial border of deltoid muscle. The dissection was carried out until the humeral shaft was visualised. Distally a 3cm incision was made along the lateral border of the biceps about 5cm proximal to the elbow crease. The lateral border of the biceps muscle is then identified, and the biceps is retracted medially. This exposes the musculocutaneous nerve lying over the brachialis muscle. The brachialis muscle is then split longitudinally to expose the distal humerus.

A sub brachialis tunnel is then created and a 4.5mm Locking Compression Plate is passed through the incision over the anterior surface of the humerus. Varus and valgus angulation, length and rotation are restored by traction. Two anterior to posterior cortical screws were inserted both proximal and distal to the fracture. Post operatively a shoulder immobilizer was applied.

The limb was kept immobilized with a shoulder immobilizer until stitches were removed (14th day). After this the patient was advised to perform gentle active range of motion exercises. The patients were called for follow up after two weeks for stitch removal, and then every monthly for 6 months and then once every six months until 2 years. The patients shoulder function was assessed using the UCLA shoulder score [Fig. 2]. The UCLA score was graded into excellent to good (>27 points) and fair to poor (<27 points).



Fig. 1: Pre-operative xray (a - ap view) (b - lateral view) & post-operative xray (c- ap view) (d - lateral view)

Results

Out of the 20 patients that were included in the study 13 (65 percent) were male and 7 (35 percent) were female [Fig. 3]. The age group of the patients ranged from 20 to 60 years with a mean age of 31 years [Fig. 4]. The most common mechanism of injury was road traffic accident followed by domestic fall and then fall from height [Fig. 5]. The mean surgical time was

75 min with a range of 60 to 120 min. The mean fracture union time was 11 weeks with a range of 10 to 30 weeks [Fig. 6]. The shoulder function was excellent to good in 17 cases (85 %) and fair in 3 cases (15 %) on the UCLA SCORE [Fig. 7].



Fig. 2: Clinical result (E, F, G, H, I)

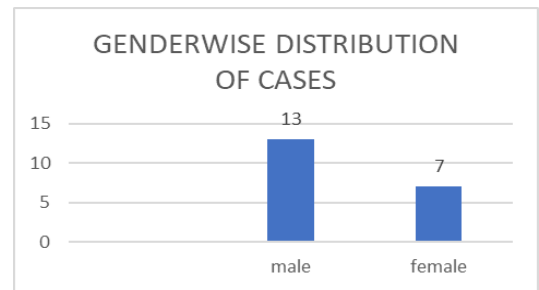


Fig. 3: Sex Wise distribution of cases

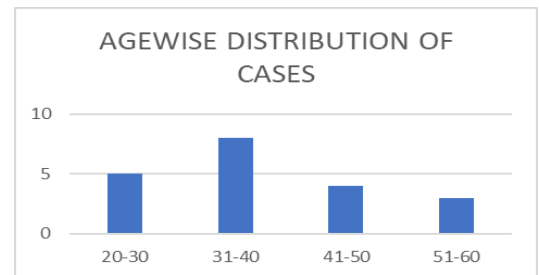


Fig. 4: Age wise distribution of cases

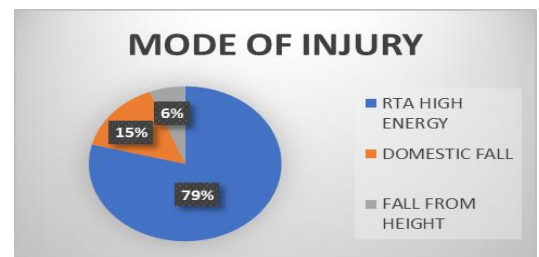


Fig. 5: Mode of Injury

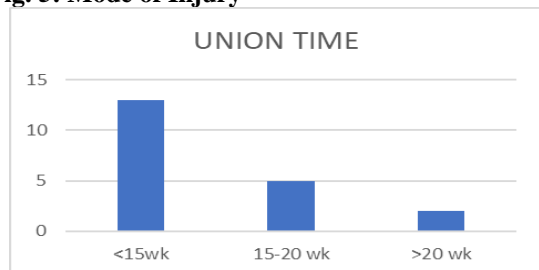


Fig. 6: Union Time

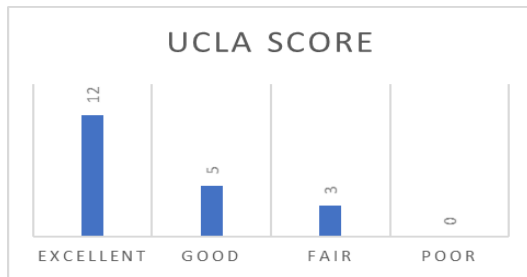


Fig. 7: UCLA Score

Discussion

The MIPO technique is used in managing various other fractures as well. It is now known from the literature that fixation of diaphyseal fractures of long bones should preferentially be done using the principle of relative stability, by means of minimally invasive techniques, thereby enabling formation of bone callus. The MIPO technique seems to be reproducible and applicable in almost all types of shaft humeral fractures. Anatomical reduction of the fracture is not necessary. Lower rates of iatrogenic nerve injury with minimal bone vascularity disruption, and soft tissue dissection are all the advantages over conventional plate technique. MIPO involves minimal blood loss, preservation of fracture biology and is a more cosmetic procedure. This technique uses the plate as an extramedullary splint, fixing the two main fragments while the intermediate zone is left untouched.

According to the principles of working length, MIPO can be used for diaphyseal humerus fractures with proximal and distal extensions. Excellent to good results have been achieved with sub brachialis plating with no major soft tissue problems and with functional results as per other methods. To conclude MIPO (minimally invasive plate osteosynthesis) technique of anterior bridge plating of humeral shaft fractures is a promising and a reproducible technique with fewer complications and better results as compared to other conventional methods.

Conclusion

Anterior bridge plating using MIPO technique offers a safe and effective management option for humeral shaft fractures as it preserves fracture biology, has minimal blood loss and has better cosmetic results.

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