



## Functional Outcome And Analysis Of Fracture Shaft Of Humerus Treated By Mippo Technique -A Comprehensive Study

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### Abstract

**Introduction:** Although several techniques are available to operatively fix humeral shaft fractures such as intramedullary nailing and Conventional Plate fixation, MIPPO technique for humerus shaft fracture has an advantage of not interfering with biological union at the fracture site and augmenting the natural healing.

**Aim Of The Study:** The aim of the study is to analyze the clinical and functional outcome of humeral diaphyseal fractures treated by MIPPO technique.

### Materials And Methods:

We reviewed a prospective cohort of 15 patients between the age of 18 and 60 years who had closed diaphyseal humerus fractures operated by MIPPO technique. Outcomes were analyzed functionally by UCLA shoulder rating scale and MAYO elbow performance score and radiological union rate. The mean follow up duration is 32 weeks +/- 8 weeks.

**Results:** The advantage of MIPPO technique is not only about the small incision size but also about the fracture reduction and soft tissue dissection from remote site which does not disturb the normal biological healing of fractures and enhances faster healing. The union rate was one hundred percent with mean time of 14.5 weeks and early return to work. The significant drawback of this technique is risk of radial nerve palsy which recovered almost within 3 months post-surgery. Thus, MIPPO technique of humerus fracture provides early functional recovery to the patients.

**Conclusion :** In conclusion, this study supports that MIPO is a decent method of treating humeral shaft fractures but it requires adequate imaging and surgical experience. Optimum arm function is achieved at an early date with better cosmeses. Suitable healing and low infection rates are obtained with MIPO. Risks of iatrogenic nerve injuries are low if appropriate surgical technique is used.

**Keywords:** Humeral Shaft, Minimally Invasive Surgical Procedures, Humerus, Internal Fracture Fixation

### Introduction

The rapid growing population with its constantly increasing vehicles has led to proportionate increase in road traffic accidents. Humeral shaft fractures are commonly encountered in orthopedic surgery

accounting for 1 to 3 % of all fractures. The humerus is a single long bone constituting the upper arm analogous to the femur of the lower limb. It articulates with glenoid forming the shoulder joint in the proximal part which is an inherently unstable

joint and in the distal part it forms the elbow joint with the ulna and radius which is quite stable. The humerus shaft fractures are caused mostly due to direct trauma which causes transverse, comminuted or oblique fractures. In case of twisting injury spiral fractures occur. The conservative treatment of these fractures results in satisfactory results due to wide range of motion in shoulder joint supplemented by elbow joint. Hence the treatment of these fractures is a much debated topic. But in some cases conservative treatment results in varus deformity and limitation of shoulder and elbow motion which leads to reduced function.

The non-operative treatment option includes a wide spectrum ranging from the sling and bandage to the latest extension cast technique. Even if the fracture unites in malunion anterior angulation of  $< 20$  degrees and varus of less than 30 degrees are usually well tolerated. The extreme degree of motion offered by the shoulder and elbow joint makes small degrees of malunion not affect the patients function.

The functional cast bracing has replaced all conservative methods as it preserves the shoulder and elbows range of motion, preventing stiffness and making the patient functionally active at the earliest.

There are several techniques available to operatively fix humeral shaft fractures such as tens nail, intramedullary nail, plate fixation. Recently MIPPO technique of humerus fracture have been developed which does not interfere with biological union going on at fracture site and simply augments the natural healing of fracture site. Various neurovascular structures traversing the bone in close proximity has made the minimal approach to the bone a risk. The most serious complication is the radial nerve palsy. Near normal anatomical reduction and stable fixation without interfering the biological healing of the fracture site with minimal soft tissue disruption makes MIPPO plating a favorable option.

### **Materials And Methods:**

Following institutional review board approval, a prospective study was conducted in 15 patients with shaft of humerus fractures. The patients were treated with plating by MIPPO technique in our institute from May 2020 to April 2021. We included all skeletally mature patients with closed shaft of humerus fracture which are not acceptable by closed

reduction without neurovascular deficit. The patients with compound fractures, skeletally immature patients, pathological fractures, acceptable closed reduction were excluded from the study.

### **Surgical Technique:**

After the anesthesia, patient is positioned supine in operating table with forearm in supination and arm in 90 degree abduction. The supination reduces the risk of radial nerve palsy by increasing the interval between the radial nerve and the plate. After preparation and draping, traction is given and fracture reduction is confirmed under c - arm guidance.

Two incisions made one proximal and one distal. The proximal incision is made between the medial border of deltoid and the lateral border of biceps. The distal incision was made between the biceps and brachioradialis muscle.

After positioning the patient, the surgeon stands on the caudal side of the patient with the c - arm coming from the contralateral side. Incisions are made as described. The radial nerve is protected by the substance of the brachialis muscle and carefully placing the retractors over the muscle. The langenbeck retractors are used in the distal exposure as the hohmann retractors inserted deep may cause neurovascular injury. After the dissection and guarding the nerve, a sub muscular tunnel is created through the proximal incision to the distal incision through a Cobb elevator or through the plate itself. The sub periosteal tunnel should be created carefully avoiding injury to the surrounding soft tissues, atraumatic as much as possible. Then gentle traction is given by assistant with elbow flexed to 90 degrees and forearm in supination to maximize the distance between the nerve and the plate .and reduction is checked with c-arm and the plate is introduced in a graceful manner cautiously avoiding nerve injury. The traction restores the length, alignment and rotation of the fracture usually through the proximal and distal incisions, two screw holes are exposed and these screw holes are drilled and screws are placed after confirming the position of the plate on the bone .these screws are not tightened, the position of the plate after the pre-emptive placement of the screws is confirmed in the image intensifier. Then through stab incision additional screws are inserted proximally and distally so that at least 3 screws are placed

proximally and distally. The antibiotics are given according the routine guidelines.

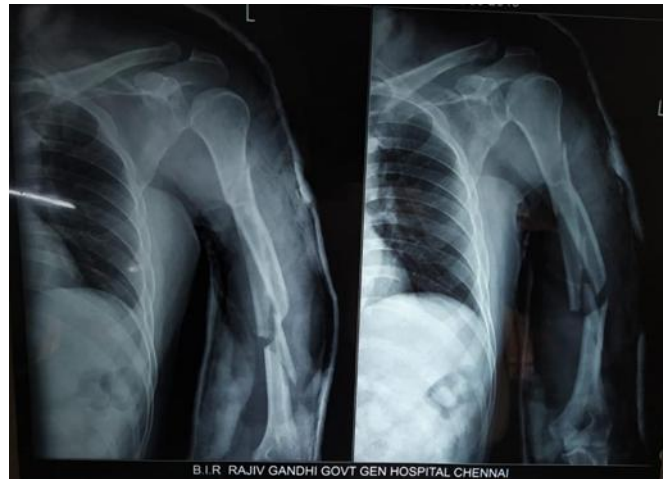
### Post op protocol

Check neurovascular status post procedure. Support the operated limb in a broad arm sling .Wound inspection on the second day. Passive motion

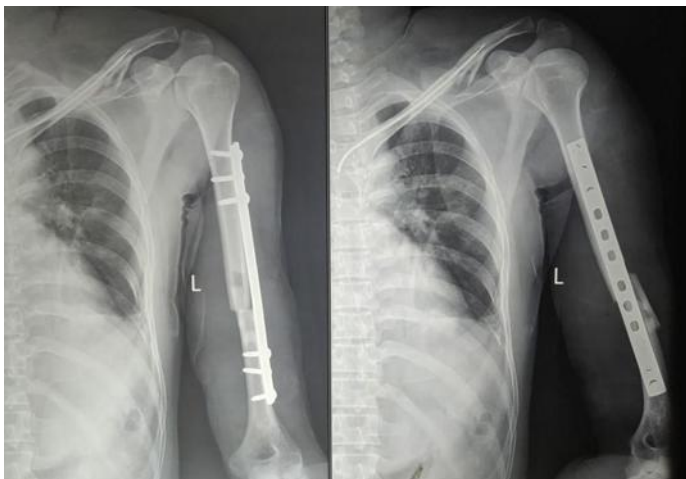
exercises 2 days post op up to 45 degrees. One week post op passive flexion up to 60 degrees. Suture removal done on post-operative day 12. One month post op passive flexion up to 90 degrees. 6 weeks post op active mobilization begun. Weight lifting allowed as tolerated. Check x-rays are taken on monthly interval to check for union.

### Illustration 1:

#### Pre Op:



#### Post op:



#### 6 months post op:





SI NO	NAME	AGE	SEX	MODE OF INJURY	SIDE	NERVE PALSY	AO CLASSIFICATION	TIME SINCE INJURY	DURATION OF SURGERY (MIN)	FOLLOW UP (IN WEEKS)	IMPLANTS	TIME TO UNION (IN WEEKS)	UCLA SCORE	MEPS SCORE	COMPLICATION
1	Ansari	37	M	RTA	Left	Nil	12-A2	12	80	20	14 Holed	14	29	95	Nil
2	Ajith	20	M	RTA	Left	Nil	12-B2	16	75	24	12 Holed	12	32	100	Nil
3	Chandran	70	M	Fall	Left	Nil	12-B2	17	70	30	13 Holed	16	29	95	Nil
4	Guganathan	44	M	RTA	Left	Nil	12-B2	12	100	28	12 Holed	15	26	95	Nil
5	Perumal	56	M	Fall	Left	Nil	12-A3	8	80	36	11 Holed	14	26	95	Radial Nerve Palsy
6	Vasanth	18	M	Rta	Left	Nil	12-A3	10	80	36	9 Holed	12	33	100	Nil
7	Sakunthala	72	F	Fall	Left	Nil	12-A3	7	75	28	10 Holed	16	24	90	Nil
8	Devaraj	47	M	RTA	Left	Nil	12-A1	4	85	40	13 holed	14	34	95	Nil
9	Ajith Kumar	22	M	RTA	Right	Nil	12-A3	4	120	42	10 holed	15	35	95	NIL
10	Anandan	51	M	RTA	Left	Nil	12-B1	7	80	40	16 holed	16	29	95	Radial nerve palsy
11	Prabha	56	F	RTA	Left	Nil	12-A3	5	85	16	9 holed	14	25	95	Radial nerve palsy
12	Arul Das	40	M	RTA	Right	Nil	12-A3	15	80	20	9 holed	14	32	95	nil
13	Nalla Sivam	60	M	Fall	Left	Nil	12-B2	8	85	32	10 holed	16	29	95	nil
14	Kandhan	51	M	RTA	Right	Nil	12-B2	4	80	42	10 holed	18	32	95	nil
15	Rajalakshmi	63	F	Fall	Right	Nil	12-B1	9	78	28	9 holed	12	31	95	nil

**Results**

A total of 15 patients were studied for a period of 2 years in Rajiv Gandhi Government General Hospital Chennai who had shaft of humerus fractures. The age group of the patients varied from 18 to 72 years with an average age being 47.13 years. The follow up ranged from 16 to 42 weeks with mean follow-up duration of 30.8 weeks. Mechanism of injury - most of the fractures were caused due to high velocity injury - Road Traffic Accidents (67%) and other was due to low velocity falls (33%). Another observation made in this study was that the left side was more commonly involved (73%) than the right side (27%). The time period of union varied from 12 to 18 weeks

with a mean time to union of 14 weeks. The surgical time of humerus MIPPO plating ranged from 70 to 85 minutes (mean - 76 minutes). The shoulder function was assessed by UCLA shoulder score (University of California Los Angeles). In the 15 patients operated, 2 patients had excellent outcome, 9 patients had good results and 4 patients had fair results. The elbow function post operatively was assessed using Mayo elbow performance score - by which all 15 patients had excellent result. 3 patients had post op radial nerve palsy that recovered eventually with physiotherapy.

**Discussion:**

Minimally invasive surgical technique does not imply that the length of the incision is small, but rather the soft tissue dissection and the fracture reduction from a distance, remote to the fracture site. The instruments and implants are inserted through this small soft tissue window created and indirect reduction is achieved.

This way, the soft tissue and bone biology is preserved and indirect reduction preserves fracture hematoma, which obviates the need of excessive soft tissue dissection which is needed for open reduction and internal fixation. The placement of plate over bone with absolute stability results in primary bone healing which devoid the bone of the essential callus formation that occurs in secondary bone healing. It is considered that bone healing by callus formation is far more superior to the healing that occurs in primary healing. Also, the plate in open reduction and internal fixation causes osteonecrosis beneath the plate causing refracture after the removal of plate. The union rate of fracture under our study was one hundred percent with no cases of delayed or nonunion with a mean time to union of 14.5 weeks. There was no case of postoperative shoulder impingement as that occurs with nailing. The scar was cosmetic when compared to ORIF. The average blood loss was also less when compared with traditional open technique. The union time was shorter and patients returned to work earlier. MIPPO plating, due to indirect reduction method had higher incidence of radial nerve palsy (transient). The plate must be advanced from proximal to distal in close contact to the bone. The forearm must be supinated at all times (pronation causes the nerve to move closer to the plate according to Apivathakakul study). Hohmann retractors must not be used in the distal incision. Instead, Langenbeck retractor can be used. The humerus MIPO plating has a good result with quick recovery following operation when compared with conventional open reduction and internal fixation technique.

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