

## EVALUATION OF RESULTS OF INTERNAL FIXATION OF CLOSED, DISPLACED, RECENT FRACTURE SHAFT OF HUMERUS BY MIPPO TECHNIQUE

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### Abstract

**BACKGROUND:** The humerus shaft fracture is the second most common fracture of the upper extremity. The predominant causes of humerus shaft fractures include low energy trauma such as fall from a standing height in older population, while in the younger population it is caused by high energy trauma.

**Aims and Objectives -** To investigate the effectiveness of economical MIPPO technique and to determine the radiological and functional significance of MIPPO technique in the patients undergoing treatment for recent fracture shaft of humerus.

**MATERIALS AND METHODS:** A prospective study had been carried out from December 2012 to August 2014 in the Orthopaedics Department of SSKM Hospital, Kolkata, West Bengal, India. Thirty three patients, who presented with fracture shaft of humerus and underwent fixation of humeral shaft fractures by MIPPO technique were included in this study. Complete history was taken and full clinical examination was carried out.

**RESULTS:** The average age group in our study is 35.3 years. Of them 85% are male and 15% are female. In majority cases, mode of injury was road traffic accident. 85% cases had middle 1/3rd fracture shaft of humerus and the average time interval between the injury and surgery was 8.54 days.

**CONCLUSION:** The results obtained in this study have shown that the MIPPO technique is safe, convenient and effective, since there was minimal soft tissue injury with no major complications.

**KEYWORDS:** Minimally Invasive Percutaneous Plate Osteosynthesis (MIPPO); Road Traffic Accident (RTA).

### BACKGROUND

Fracture shaft of humerus is a common upper extremity fracture in adults, second only to distal radius fractures. Usually, is a result of high-velocity injury in the younger population and low-energy trauma in the elderly.

Conservative treatment is usually the mainstay for majority of these diaphyseal fractures; with most (almost 90%) going on to unite completely.

#### Operative Intervention is indicated for

1. Failure of closed reduction.
2. Fractures involving the joints.
3. Neurovascular involvement.

4. Fractures involving the elbow and forearm of the same side.
5. Open fractures.
6. Segmental fracture.
7. Pathological fractures.
8. Bilateral humeral shaft fractures.
9. Periprosthetic fractures.
10. Short oblique or transverse fractures.

Despite the numerous surgical techniques, plate fixation remains the gold standard for fixation of humeral shaft fractures. Minimally, invasive percutaneous plate osteosynthesis is a fairly successful fixation procedure for shaft humerus fractures. This technique has advantages of less soft tissue dissection and avoids the need to expose the

radial nerve; thus, there is also a low risk of iatrogenic radial nerve palsies.[1]

The present study is based on this MIPPO technique to establish its efficacy and usefulness based on clinicoradiological and functional outcomes. This technique allows for quick and appropriate fracture healing without displacing the fracture haematoma to ensure an early return to function vis-à-vis open reduction and internal fixation and intramedullary fixation, thereby decreasing complications like non-union.

#### Aims and Objectives

To investigate the effectiveness of economical MIPPO technique in our countries with limited resources to treat critical and challenging fracture shaft of humerus.

To determine the radiological and functional significance of MIPPO technique in the patients undergoing treatment for recent fracture shaft of humerus.

#### MATERIALS AND METHODS

A prospective study of fixation of humeral shaft fractures by MIPPO technique was carried out at SSKM Hospital, Kolkata with the approval from the medical ethics committee. Between December 2012 and August 2014, thirty three consecutive patients with humeral shaft fracture underwent minimally invasive plating osteosynthesis.

A precise history was elicited from the patients and or relatives to reveal the mode of injury and the extent of trauma. Clinical and radiological assessment was done elaborately and each patient was evaluated critically to rule out any unforeseen post-operative complications. The clinical evaluation of a patient with a humeral shaft fracture comprised complete physical examination and a detailed neurovascular examination. Conventional radiographs in two planes are the standard diagnostic procedures. Routine preoperative investigations like proper Anteroposterior & lateral x-rays, routine blood investigations, pre-anaesthetic checkup, etc. Analgesics, immobilisation & prophylactic antibiotics as indicated. Depending on the level, nature, line of fracture, number of fragments, approach, type of plate (broad or narrow), length of plate, number of screws & interfragmentary screws all were assessed. The patients were taken up for surgery under General Anaesthesia/Brachial plexus block. The operation is

performed with the patient in a supine position with abduction of the injured arm under image intensifier control on a side table. Postoperative protocol was maintained. Patients with no other problems were discharged 1 week postoperatively. All the patients were followed up and anteroposterior and lateral radiographs were obtained every 4-6 weeks until bony union was achieved.

#### Inclusion Criteria

Age 20-60 years, Fracture shaft of humerus and closed displaced fractures.

#### Exclusion Criteria

Open fractures, neurovascular injury, pathological fractures, skeletally immature patients and patients in which time lag between injury and surgical intervention exceeded three weeks.

#### RESULTS

Thirty three patients were treated for the fracture shaft of humerus of by applying the MIPPO technique. All patients had intact distal neurovascular function before the procedure. The plates were fixed with three to four screws in both proximal and distal fragments. The wound was closed without drains or external immobilisation. The patients were encouraged to perform passive range of motion of the shoulder and elbow during the first postoperative week. Active motion was carried out from the second week onwards without a cast or brace.

The average age group in our study was 35.3 years, of them 28 cases (85%) were male and 5 cases (15%) were female

(Table 1). In majority cases, mode of injury was RTA (85%) followed by fall from height (27%) and assault (12%) (Table 2). Left-sided and right-sided fracture reported in 58% and 42% cases respectively. No bilateral case reported in our study (Table 3). 85% cases had middle 1/3rd fracture shaft of humerus followed by 9% and 6% had distal and proximal 1/3rd fracture (Table 4). Associated injuries were also noted (Table 5). The average time interval between the injury and surgery was 8.54 days (range 3-15 days) (Table 6). The average operating time was 74.84 minutes (range 45–105 min.) (Table 7). All fractures united with a mean healing time of 14.72 weeks (range 10-18 weeks) (Table 8). Twenty eight patients (85%) had excellent results; five patients (15%) had good results of their elbow function when assessed with the Mayo elbow performance scoring system

(Table 9). The UCLA scoring system showed excellent results in twenty one cases (64%) and good results in twelve cases (36%) (Table 10). There were no superficial or deep infection and implant failures in our study. There was one case of radial nerve palsy postoperatively. The cock up splint was used and physiotherapy, passive exercises were encouraged by the patient himself. The radial nerve palsy recovered on 3rd postoperative day. There was one case of superficial wound infection which healed with appropriate antibiotic administration and sterile wound management. One patient had delayed union and recovered gradually within 6 months of surgery (Table 11).

Age in Years	Males	Females	Total	Percent (%)
21-30	11	1	12	32.0
31-40	11	2	13	40.0
41-50	5	1	6	14.0
51-60	1	1	2	10.0

**Table 1. Age and Sex**

Side	No. of Patients	Percentage
Left	14	42%
Right	19	58%

**Table 2. Laterality**

Mode of Injury	No. of Patients	Percentage
Fall	9	27%
RTA	20	61%
Assault	4	12%

**Table 3. Mode of Injury**

Level of Fracture	No. of Patients	Percentage
Proximal 1/3	2	6%
Middle 1/3	28	85%
Distal 1/3	3	9%

**Table 4. Level of Fracture**

Associated Injury	No. of Patients	Percentage
Both bone leg	1	3%
Ischial Tuberosity	2	6%
Both bone forearm	1	3%
Distal radius fracture	2	6%
Shaft of femur	1	3%
Nil	26	79%

**Table 5. Associated Injury**

**DISCUSSION**

In this study, thirty three patients who sustained humeral shaft fractures included in our clinical study with maintaining inclusion and exclusion criteria were treated with the MIPPO technique. In our study, all the fractures united with a mean healing of 14.72 weeks (range 10 to 18 weeks), which is better than that reported by Zhiquan et al 2010,[2], 21.25 weeks in case of open reduction and internal fixation as reported by Fernandez DellOca AA, 2002.[3] It is also reported that the healing time is 16.8 weeks which is

significantly higher than our study as observed by Keijen Lian et al, 2013.[4] In our study, the mean operating time was 74.84 minutes (Range 45 – 105 min.), whereas Zhiquan et al 2010[2] reported it was 113.8 minutes (70-160 min.) in case of open reduction and internal fixation of humeral shaft fracture. According to Keijen Lian et al 2013,[4] it was 126 min. in case of intramedullary nailing which is more than our study. An added advantage with MIPPO is that it is devoid of the entry-point problems of intramedullary nailing such as rotator cuff impingement as seen by Petsatodes G P et al., 2004.[5] In our study, the UCLA scoring system showed excellent results in twenty one cases (64 %) and good results in twelve cases (36%). Twenty eight patients (85%) had excellent results; five patients (15%) had good results of their elbow function when assessed with the Mayo elbow performance scoring system. No shoulder dysfunction was reported in terms of pain and restriction of movement. Ajmal et al 2001[6] reported that thirty-three humeral nailings were carried out using the Russell-Taylor nail and gave a union rate of 70%. Thirteen patients (41%) had poor shoulder function. Only 17 (51%) of the patients were satisfied with the outcome. Fourteen patients (42%) needed further surgery.

One of the chief issues after both antegrade and retrograde techniques has been the insertion site morbidity created at the nail entry site. Some patients developed shoulder pain. The incidence of shoulder dysfunction has been reported to range from 6% to as high as a 100 % as observed by Ingman AM and Waters DA., 1994[7] and Reimer B., 1998.[8] In the reviewed literature, there were no reports of non-union after MIPPO technique and also in our study no case of non-union found. The rates of non-union after intramedullary humeral fixation have ranged between 5% and 29% in the literature, with many of the higher incidences having been noted in Reimer B., 1998[8] In case open reduction and internal fixation technique interferes with the local vascularity and fracture haematoma leads to osteonecrosis beneath the implant, which can cause delay union or non-union, the reported rate of non-union was 5.8% as seen in Paris H et al., 2000.[9] The primary bone healing without callus formation is not very strong and there exists a real risk for re-fracture after removal of the implant as observed by Sarmienta A.et al 2002[10] in the open technique. However, in our series, one patient (3%) had radial nerve palsy postoperatively which shows sign of

recovery within third postoperative day and clinically complete recovery seen within 21 days of surgery. Reason for radial nerve palsy in our study may be due to over-traction by soft tissue retractor. In open reduction and internal fixation, careful exposure and protection of the radial nerve is required during the entire procedure. Despite the stress on meticulous radial nerve protection, the incidence of iatrogenic radial nerve palsies following this procedure is reported to be from 5.1% (Paris H et al., 2000[9]) to 17.6% (Lim KE et al., 2001[11]) in different series in the literature. The occurrence of iatrogenic radial nerve palsy in case of open reduction and internal fixation, 31.3% (Zhiquan et al., 2007[3]), was significantly higher than in our study (3.03%). The technique of placing the plate extraperiosteally protects the radial nerve from injury, as it lies under the cover of the brachialis, on the anterior side of the arm away from fracture site, supporting our findings of less radial nerve palsies with the technique used in our study.

In our study, we had one case of infection (3%) and one delayed union (3%) whereas Zhiquan et al 2010[2] reported 6.3% delayed union in case of open reduction and internal fixation (Zhiquan et al., 2007[3]). The infection and delayed union occurs in our first case of study may be due to less surgical skill in our team which leads to longer operative time and poor tissue handling. Infection controlled with the help oral antibiotics for 1 month and no extra measure taken for delayed union except oral calcium tablet. Taken together, these results with previous findings suggest that recent fracture shaft of humerus could be effectively treated with the MIPPO technique, with advantages of shorter fracture union time and lower incidence of iatrogenic radial nerve palsies. Thus, our case series shows that optimum arm function is achieved at an early date following MIPPO of humerus shaft fractures. MIPPO is also associated with less scarring and improved cosmesis.

## CONCLUSION

The present study involving the MIPPO technique in the treatment of recent humerus shaft fractures has shown the procedure to be safe and effective with minimal soft tissue injury and no major complications. Fracture union is augmented by the process of bridging callus which progresses to complete union. This prospective comparative study substantiates the superiority of MIPPO technique as

an effective method of shaft humerus fracture fixation with fewer disadvantages and shorter fracture union time and fewer incidences of radial nerve palsies.

## REFERENCES

1. Zhiquan A, Bingfang Z, Yeming W, et al. Minimally invasive plating osteosynthesis (MIPO) of middle and distal third humeral shaft fractures. *J Orthop Trauma* 2007;21(9):628-33.
2. Zhiquan An, Zeng B, He X, et al. Plating osteosynthesis of mid-distal humeral shaft fractures: minimally invasive versus conventional open reduction technique. *International Orthopaedics* 2009;34(1):131-5.
3. Dell'Oca FAA. The principle of helical implants: unusual ideas worth considering. *Injury* 2002;33(Suppl 1):SA29-40.
4. Lian K, Wang L, Lin D, et al. Minimally invasive plating osteosynthesis for mid-distal third humeral shaft fractures. *Orthopedics* 2013;36(8):e1025-32.
5. Petsatodes G, Karataglis D, Papadopoulos P, et al. Antegrade interlocking nailing of humeral shaft fractures. *J Orthop Sci* 2004;9(3):247-52.
6. Ajmal M, OSullivan M, McCabe J, et al. Antegrade locked intramedullary nailing in humeral shaft fractures. *Injury* 2001;32(9):692-4.
7. Ingman AM, Waters DA. Locked intramedullary nailing of humeral shaft fractures. Implant design, surgical technique, and clinical results. *J Bone Joint Surg Br* 1994;76(1):23-9.
8. Reimer B. Humeral shaft fractures-intramedullary nailing. In: Wiss D (edr). *Master techniques in orthopaedic surgery*. Philadelphia: Lippincott-Raven 1998:81-94.
9. Paris H, Tropiano P, Dorval BC, et al. Fractures of the shaft of the humerus: systematic plate fixation. Anatomic and functional results in 156 cases and a review of the literature. *Rev Chir Orthop Reparatrice Appar Mot* 2000;86(4):346-59.
10. Sarmiento A, Waddell JP, Latta LL. Diaphyseal humeral fractures: treatment options. *Instr Course Lect* 2002;51:257-69.
11. Lim KE, Yap CK, Ong SC, et al. Plate osteosynthesis of the humerus shaft fracture and its association with radial nerve injury-a retrospective study in Melaka general hospital. *Med J Malaysia* 2001;56(Suppl C):8-12.