

PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF FRACTURE FIXATION OF METACARPAL BY MULTIPLE INTRAMEDULLARY PINS**Dr. Ashok Vidyarthi, Dr. Brajesh Dadarya, Dr. Ajay Dhanopeya***

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Article Received on 12/02/2018

Article Revised on 04/03/2018

Article Accepted on 25/03/2018

ABSTRACT

Aim: The aim was to study the functional outcome of metacarpal shaft fracture treated with intramedullary fixation of pins. **Methods:** A nonrandomized, uncontrolled prospective study was performed on 38 patients with 58 metacarpal fractures were treated with intramedullary pinning. All patient were screened using inclusion and exclusion criteria and those, willing to participate in the study was included and were followed up prospectively at the time of discharge, at 4 weeks, at 6 weeks, at 8 weeks, and 12 weeks and assess the Hand x ray-AP/Oblique, Total active movement, Grip strength, VAS score. Final results were noted according to the % TAM score for 2nd to 5th metacarpals. **Results:** Male patients had a significantly higher frequency (84.2%) in comparison to female patients (15.8%) Most common ray affected was 4th and 5th ray followed by 2nd ray and then third ray. 45% of fractures were oblique type and 41% fractures were transverse with spiral and comminuted being 12% and 2% respectively. Shaft of metacarpal fracture was maximum affected (50%) followed by base (18.4%) and neck (15.8%) and head (15.8%). 50% patients underwent implant removal in a period of 6 weeks. Mean – 6.9 ± 1.15 weeks (min. 5 weeks, max. 10 weeks). 42. 1% patients of metacarpal fracture had radiological union in 6 weeks. Mean time to union 6.21 ± 1.094 (min. 4 weeks, max. 8 weeks). Mean grip strength at final follow up was 24.55 ± 8.366 (min 10 and max 50) for affected hand, whereas mean grip strength at normal hand was 36.03 ± 10.476 . Mean pre-op VAS pain score 6.53 ± 1.202 (min 4 and max 8) and mean VAS pain score at 8 weeks follow up is 1.42 ± 1.681 (min 0 and max 4).

KEYWORD: VAS Score, Intramedullary Pinning, Metacarpal Fracture.**INTRODUCTION**

Fractures of the metacarpals and phalanges are most common and constitute 10% of all upper extremity fractures. 30-40% of all fractures in hand occur in the metacarpals. Incidence of metacarpal and phalangeal fractures are more common in males and peaks at age of 10-40 years.

Border Metacarpals (1st and 5th) are more commonly involved. In 1957 Lord advocated closed retrograde pinning of metacarpal fractures by inserting K-wires through the flexed MP joint. In 1975, Foucher introduced the bouquet technique of closed anterograde nailing of metacarpal fractures using multiple small pre-bent K-wires. No where in the body the form and function are so closely related each other, than hand. So any injury in hand is likely to alter the function.

METHODS

The Aim Of the Study was to study the functional outcome of metacarpal shaft fracture fixed with intramedullary pins and to study the technical difficulties and complications of metacarpal fractures treated by

intramedullary pins. This was a nonrandomized, uncontrolled prospective study conducted from January 2016 to July 2017 at Department of Orthopaedics, Traumatology and Rehabilitation, Out Patient Department No. 04 and casualty of N. S. C. B. Medical College, Jabalpur between the age of 18-60 years of both male and female gender were taken for study. Ethical clearance was obtained before beginning of the study from Ethical Clearance Committee.

Inclusion criteria were

- All fracture diagnosed metacarpal fracture (shaft, neck) except first.

Exclusion Criteria were

- We exclude patients younger 18 years, due to different remodelling capacity and fracture pattern.
- Patients older than 60 years due to possible changes in functional demand of hand and in order to avoid bias regarding age related arthritis and osteoporosis.
- Skin infection/ fungal myositis / congenital deformity of hand.

As soon as patient was attended detailed history including the name, age, sex, address, contact number, occupation, and history of medication was noted. Local examination was done and care was taken to detect any associated injuries, vascular injuries, compartment syndrome & peripheral nerve injuries.

Followed by physical assessment investigations in the form of standard radiographs of the hand, i. e., antero-posterior & oblique views were obtained to confirm the diagnosis and to assess fracture pattern. Functional fracture classification was used to classify the fractures and Laboratory investigations like hemogram, Blood urea, Serum Electrolyte and R A Factor.

All patients with metacarpal fractures were admitted and temporary immobilization was given in the form of cock-up splint. The operative procedure and its advantages was explained in detail to each patient and an informed consent was obtained. Fitness was taken for surgery, and patient was operated as soon as possible.

Regional anaesthesia (supraclavicular block & wrist block) was given to the patient.

Patient was placed in supine position on a plane table. The affected upper limb is abducted on the side table.

For Open reduction and Internal Fixation, dorsal approach was the most preferred surgical approach.

Post operative radiographs were taken on the next day. Dressing was checked on 2nd post operative day. Suture removal was done on the 11th post operative day. Postoperative follow up to assess union, radiologically and clinically done at 4, 6, 12 weeks and 6 months. During each follow up repeat xray and assessment of complications if any was documented. Improvement in range of motion at metacarpophalangeal joint was evaluated at each follow up visit.

During the each visit the following parameters were also assessed:-

- Hand x ray-AP/Oblique
- Total active movement
- Grip strength
- VAS Score

TECHNIQUE

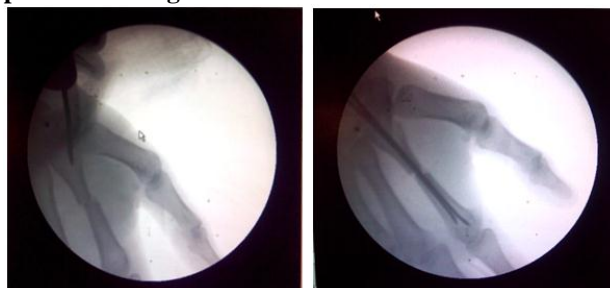
Creating Entry portal By Awl

Metacarpal	Entry point
2 nd metacarpal	Center of base
3 rd metacarpal	dorsoradial
4 th and 5 th metacarpal	dorsoulner

A small nick was given & Entry point made with help of awl at the proximal part of metacarpal base



Entry continued under image intensifier & Pass the pins across the fracture site after reduction, both the pins was divergent end



Multiple pins (3 pins in this case) introduce through single entry point & Cut the pins by tip cutter, and buried into soft tissue



After cut the pins, suture was done at incision site

Final Xrays after pinning



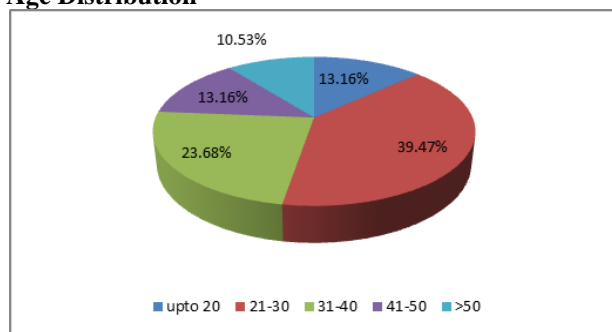
RESULTS

Male patients had a significantly higher frequency (84.2%) in comparison to female patients (15.8%) most common age group involved in fracture metacarpal is 21-30 years (39.47% of whole). Mean age of males 33.81 ± 12.97 (min 17, max 70), Mean age of females 31.167 ± 10.65 (min 20, max 50), Metacarpal fractures were more common amongst labourers. 63.2% cases were seen in labourers followed by 13.2% cases in students. Dominant hand was more commonly affected

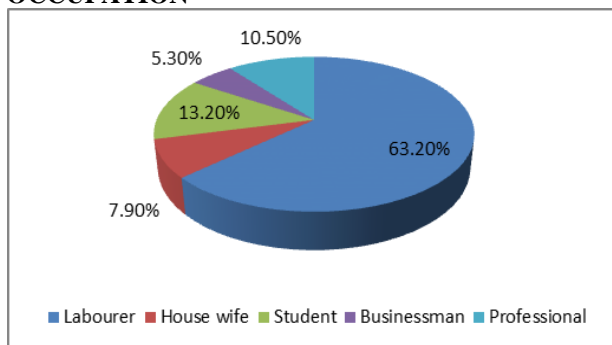
in our study because people generally carry out their work with dominant hand, 94.7% cases were seen in Right hand dominant individuals. Most of the injury reported had a history of fall on ground (42.1% of total) followed by assault (34.2%). 63.2% patient have single fracture and 36.8% patient have multiple fractures.

Most common ray affected was 4th and 5th ray followed by 2nd ray and then third ray. 45% of fractures were oblique type and 41% fractures were transverse with spiral and comminuted being 12% and 2% respectively. shaft of metacarpal fracture was maximum affected (50%) followed by base (18.4%) and neck (15.8%) and head (15.8%). 50% patients underwent implant removal in a period of 6 weeks. Mean – 6.89 ± 1.15 weeks (min. 5 weeks, max. 10 weeks). 42.1% patients of metacarpal fracture had radiological union in 6 weeks. Mean time to union 6.21 ± 1.094 (min. 4 weeks, max. 8 weeks). 57.9% patients with fracture had no complications, while 21.1% had stiffness, 10.5% had Pin irritation, 5.3% had shortening, 5.3% had malunion. Mean grip strength at final follow up was 24.55 ± 8.366 (min 10 and max 50) for affected hand, whereas mean grip strength at normal hand was 36.03 ± 10.476 . Mean pre-op VAS pain score 6.53 ± 1.202 (min 4 and max 8) and mean VAS pain score at 8 weeks follow up is 1.42 ± 1.681 (min 0 and max 4).

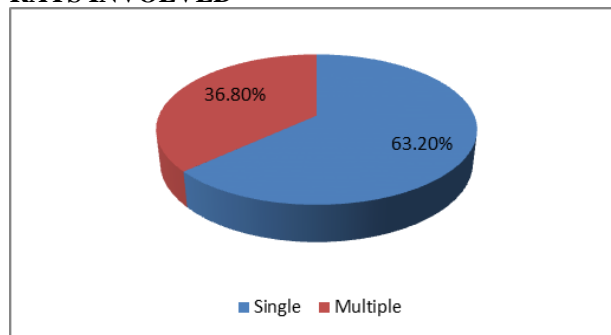
Age Distribution



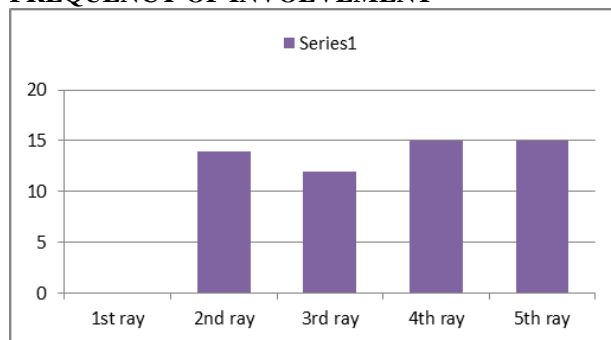
OCCUPATION



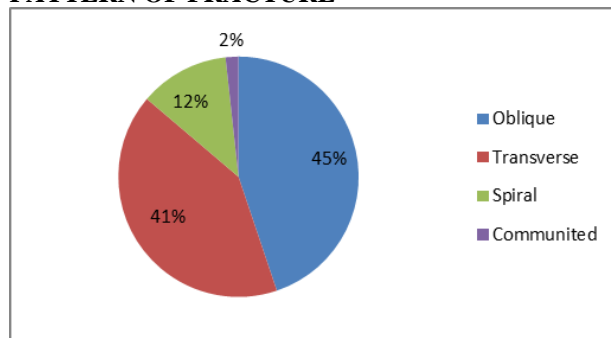
RAYS INVOLVED



FREQUENCY OF INVOLVEMENT



PATTERN OF FRACTURE



RADIOLOGICAL UNION

- 42.1% patients of metacarpal fracture had radiological union in 6 weeks.
- Mean time to union 6.21 ± 1.094 (min. 4 weeks, max. 8 weeks).

COMPLICATIONS

Complications	Frequency	Percent
No Complication	22	57.9
Stiffness	8	21.1
Pin irritation	4	10.5
Shortening	2	5.3
Malunion	2	5.3
Total	38	100

RESULT ON THE BASIS OF TAM COMPARED TO THE NORMAL

RANGE (TAM) COMPARED TO THE NORMAL HAND	FREQUENCY	PERCENT
50-69% (FAIR)	7	18.4
70-84% (GOOD)	18	47.4
85-100% (EXCELLENT)	13	34.2
TOTAL	38	100

RESULT ON THE BASIS OF TAM COMPARED TO THE NORMAL

- In our study 47.4% patients are having Good result, 18.4% patients are having Fair result and 34.2% patients are having Excellent result.
- No poor result was seen.

COMPARISION OF GRIP STRENGTH

	N	Mean	S. D.	Minimum	Maximum
Grip Strength In Affected Side (In Kg)	38	24.55	8.366	10	50
Grip Strength On Normal Side (In Kg)	38	36.03	10.476	0	62

DESCRIPTIVE STATISTICS

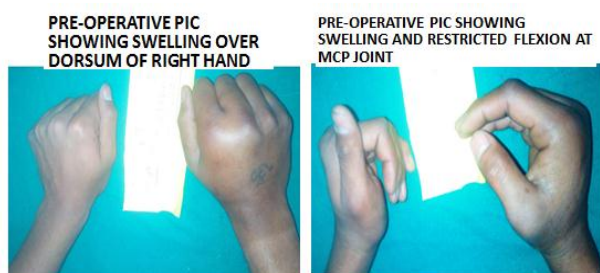
	N	MEAN	S.D.	MINIMUM	MAXIMUM
Union (Weeks)	38	6.21	1.094	4	8
Tam (Degree)	38	203	26.369	150	250
Pip Movement(Degree)	38	83.16	16.99	55	110
Mcp Joint Movement (Degree)	38	65.0	16.23	30	90
Grip Strength (Kg)	38	24.55	8.366	10	50

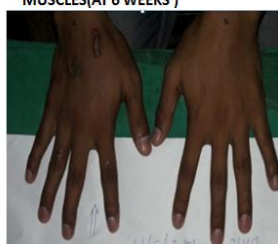
CHANGE IN VAS SCORE

Vas Pain Score	Cases	Mean	S.D.	Minimum	Maximum
Pre-Operative Vas	38	6.53	1.202	4	8
Immediate Post Pre Op Vas	38	6.79	1.359	4	8
Follow Up 4 Weeks	38	2.29	1.37	2	8
Follow Up 6 Weeks	38	2.29	1.187	0	4
Follow Up 8 Weeks	38	1.42	1.081	0	4

IMPLANT REMOVAL

- In our study 50% patients underwent implant removal in a period of 6 weeks.
- Mean – 6.89 ± 1.15 weeks (min. 5weeks, max. 10weeks).

FUNCTIONAL OUTCOME**PREOP XRAY****IMMEDIATE POSTOP**

AFTER 4 WEEKS**AP VIEW****OBLIQUE VIEW****AFTER 6 WEEKS****AP VIEW****OBLIQUE VIEW****SHOWING FLEXION AT MCP JOINT
COMPARED WITH NORMAL SIDE(AT 6
WEEKS)****FUNCTION OF INTEROSSEI
MUSCLES(AT 6 WEEKS)****AFTER 12 WEEKS****AP VIEW****OBLIQUE VIEW****DISCUSSION**

Though various methods of internal fixation in metacarpal fractures exist, the principles of treatment include restoration of articular anatomy, stable fixation of fractures, elimination of angular or rotational deformity and rapid restoration of mobility and function. There have been many reports of problems arising with using plating for these fractures, mainly in relation to the soft tissue trauma and post-operative fibrosis. The Kirschner wire can be safely used to reduce and stabilise metacarpal fractures but it may cause impingement and

lack of functional stability. The technique of using multiple K wires for metacarpal fractures was introduced by Foucher ("bouquet" osteosynthesis) and is based on Ender's flexible intramedullary pinning.

In our study we have modified the technique using multiple pins of adequate diameter (diameter of 1mm, 1.5mm, 1.8mm). which is pre-bent to act as an elastic support. With the elastic pre-bent pins acting as a three point fixation, adequate stability is achieved to commence early mobilization. With minimal soft tissue dissection, avoidance of periosteal stripping and flexible fixation as opposed to rigid fixation; abundant periosteal callus is generated encouraging fracture healing. In addition this procedure is relatively simple, with reduced operating times, minimal radiation exposure and can be performed as day case surgery thereby reducing hospital costs. The demerits of the pinning technique are lack of absolute stability, wire migration, impingement of soft tissues, pin site problems, infection and the necessity for implant removal.

Foucher recommends leaving sufficient length of the wire to allow easy secondary removal. But in our study the pin is cut flush with the bone and is buried to allow wound closure and to prevent pin tract infection.

The diameter of the wire chosen (diameter of 1mm, 1.5mm, 1.8mm) depends on the bone and should be strong enough to resist minimal forces during early mobilisation. Foucher's bouquet osteosynthesis method was described using three 0.8 mm wires.

Modification in our study contrast to other study In our study

Pins cut and Buried beneath to skin and soft tissue compared to Foucherbouchets^[17] technique where pins are protrude out to the skin, so our technique prevent pin tract infection and cosmetically better. In our study Multiple pins used compared to Mohammed R et al^[8] study where single K- wire was used, multiple pins provided sufficiently stability, Pins was used without locking the pins compared to Orbay^[4] study where locking pins and locking sleeve was used. Range of movement started early as possible after fixation compared to Kim et al^[10] study where immobilization upto 5 weeks and No additive splint was used compared to the Chamma et al^[7] study where volar slab was applied. For better function outcome of we started mobilization exercises after fixation, Initially Finger and wrist mobilization with support by non injured hand than without support and boll squeezing exercises.

CONCLUSION

- It is Short and simple procedure. Best for Transverse/short oblique fractures it lead to Early mobilization & Early return to work There is No added splints. Cosmetically better than ORIF and EX – FIX.

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