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Functional outcomes of fixation of metacarpal and phalangeal fractures with titanium mini plate and screw system in Indian rural population

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I. INTRODUCTION

Metacarpals are most important structure of hand that forms arch and helps in making grip.

Metacarpal fractures are most common type of fractures seen in all hand fractures. Which accounts for approximately 30%(1).This fractures mainly occurs because of axial loading,direct fall or torsion force.According to that they are classified into oblique,transverse,comminuted fracture.(2)Especially in rural area where minor RTA and assault cases are common and many patient come with metacarpal and phalangeal fracture(3). Generally this fractures are treated conservatively by splint immobilization or casting.
If it is unstable,intraarticular,angulated,segmental loss or with rotated fragment it requires fixation.Main purpose for treatment is to maintain or restore length ,deformity correction,achieving adequate stability,initiation of movement early.Spiral and oblique fractures if not treated properly high chance to go in malunion.Comminuted fractures with or without bone loss requires maintaining and restoring length.(*)

Fracture with Intra-articular extensions into the metacarpophalan- geal joints require accurate reduction to restore joint congruity. A Titanium mini plate was developed for fractures in the metaphyseal region of the metacarpals and phalanges; it was approved in 1983 by AO.since then it is widely used.

Before invention of mini-plates and screws of 1.2,1.5,2 mm diameter k wires were used in internal fixation of this fractures.This plates if used properly has good fixation , allows early mobilization and good outcomes than with k wires which protrudes outside and requires prolong immobilization.(4)

Open reduction may result in scarring,tendon adhesion and joint stiffness.But advantages are more than disadvantages of this type of fixation.

Plate resists deforming volar pull of intrinsic muscles and also buttresses thus provides good stability.(**)

The aim of our study was to see the clinical and radiologic outcomes of patients with metacarpal fractures, who were treated with ORIF with mini titanium plates/screw in our rural setup.

II. MATERIAL AND METHODS

22 case with metacarpal or phalangeal fracture treated with titanium mini plates (1.5,2.0 or 2.7 mm) or screws (of 1.2,1.5,2.0 mm diameter) between 1st june 2019 to 31st december 2020 at Rural Medical College, Loni a rural tertiary care hospital were analysed.

Inclusion criteria-
Patient of age more than 18 with metacarpal or phalangeal fracture,
patient willing to give consent and undergo plate/screw fixation for fracture management,
Fresh fractures
Patient requires fine motor skills for their work

Exclusion criteria-

Medically unfit patient , patients not giving consent, pathological fractures, compound

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fractures ,lost to follow up were excluded from the study.

On admission a brief history was elicited to document the mechanism of injury. Clinical examination followed by haematological and other routine lab. investigations were done for all patients. Radiological investigation included the xrays antero-posterior and oblique view of hand .Written and informed consent was taken from all patients.

Surgical method

After giving regional(brachial) block i.v. antibiotic was given.surgery was performed in supine position. Tourniquet inflated and metacarpals were exposed through a dorsal longitudinal incision between these bones while Proximal phalangeal fractures were exposed through a dorsal midline extensor splitting approach.

After exposing the bone ; reduction was achieved and hold in position with bone holding forceps/towel clips or small k wires.Contoured mini condylar plate of T or L shape fixed with appropriate size screws .so that screws does not become prominent on volar side and not irritates flexor tendon.sometimes only mini screws of 1.2/1.5 mm were used.Reduction checked under c-arm fluoroscopy.Extensor tendon if splited sutured with prolene.skin suturing done and sterile dressing applied after skin closure along with slab in intrinsic plus position.Pillow cover elevation was given.

Post op dressing regularly done and patients were discharged on post op day 5 or 9.slab was removed after postop day 12.physiotherapy was started like stretch exercise,counting of fingers exercise within limit of pain tolerance.Patients were allowed to do normal routine activities after sixth week postoperatively.

Follow up of this patient taken in opd clinically and radiologically.clinically by checking active ROM of operated side ,grip,quick DASH score.radiologically by taking xrays at every

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followup visit and check for any loss of reduction and healing of fracture.

III. DISCUSSION

Fractures of hand are the most common fractures of upper extremity. Mostly due to accidental falls or sports related injuries or assault .

The metacarpal are longest bones in hand and important in stabilization of fingers(1).There are volar plate and deep intermetacarpal ligaments present so shortness in metacarpal fracture is not generally seen. Dorsal angulation is seen due to unbalanced action of interosseous muscles and extensor tendon distal to the fracture fragment.

There is presence of loose areolar tissue in hand which allows edema fluid to accumulate, and leads to early stiffness(3) . so hand needs to be mobilized as quickly as possible. Conventional slab or cast immobilization leading to stiffness has made surgeons to find newer modalities to fix these fractures. The main thing in the treatment of hand fractures are to allow bony union in good position, soft tissue healing and early rehabilitation.This was possible with mini plates and screws.

If fractures are stable it can be treated with conservative method like immobilization with in intrinsic plus position(wrist in 30-40 degree of extension,metacarpophalangeal joint in 80-90 degree of flexion,interphalangeal joint in full extension)with plaster slab or cast.

James reported loss of function in 77% of fingers with unstable phalangeal fractures treated by closed means(4) .while ORIF with k wire produces less rigid fixation and its rotational stability is also less.As compared to this mini plates and screws provides good fixation , more stability and allows early mobilization.Also some studies mention that fixation with plate has more stable fixation than k wires(5).Black did a similar study which showed that dorsal plating with or without lag screw provided more stability (6).

In this procedure the dissection should be precise to avoid excess periosteal striping and excessive soft tissue trauma. The plates should be contoured properly to avoid fracture site distraction.Drilling and tapping should be accurate so that screw does not become loose and in this condition repositioning of plate is very difficult because of length of bone is very less.Severity in soft tissue injury decides the final outcome of ROM (7).

Advantages of these plates and screw are that they require minimal space,adequately stabilizes the fragments,because of its shape it also prevents rotation of the fragment.one disadvantage with this is it requires careful planning before surgery.

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Preop xray of patient with proximal phalynx fracture

Post op xray

Preop xray of patient with 4th and 5th metacarpal

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Xray at 2 months follow up postop

IV. RESULTS

The total of 22 patients treated by ORIF with titanium mini plate/screw fixation out of which 20 were male and 2 were female.

Mean Age of patients were 34.1years(19 to 50 years) and mean follow up period was 6 months(3 to 16 months).

Total Range of motion was 256 degrees. Total active movement(TAM) is defined as total active 3 flexion range of metacarpophalangeal and interphalangeal joints.Normal TAM for fingers are 260.Results decided as follows:-if TAM is <180degree considered as poor,180-210 considered as fair,>210 considered as good.

Mean grip strength measured with dynamometer were 42(+/- 7.6) for operated hand and 43.7 (+/- 8,2) for normal hand.78%patients were able to flex their digits to distal palmar crease.

Mean quick DASH score was 2.9.Radiologic union was achieved in all patients.One patients had difficulty in movement and in one patient due to palpable screw implant was removed with another operation.one patient had superficial infection which subsided after debridment.we lost follow up of 3 patients.

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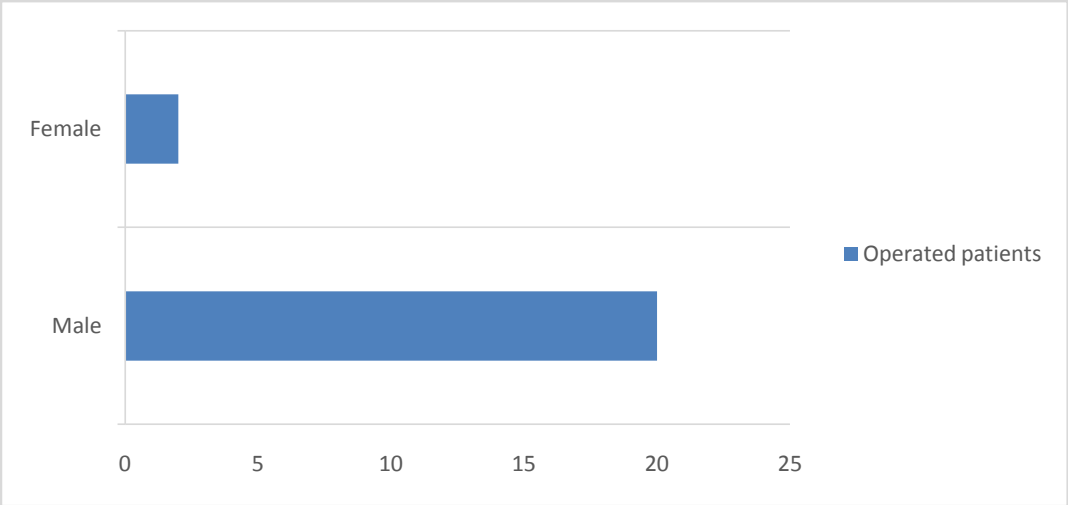
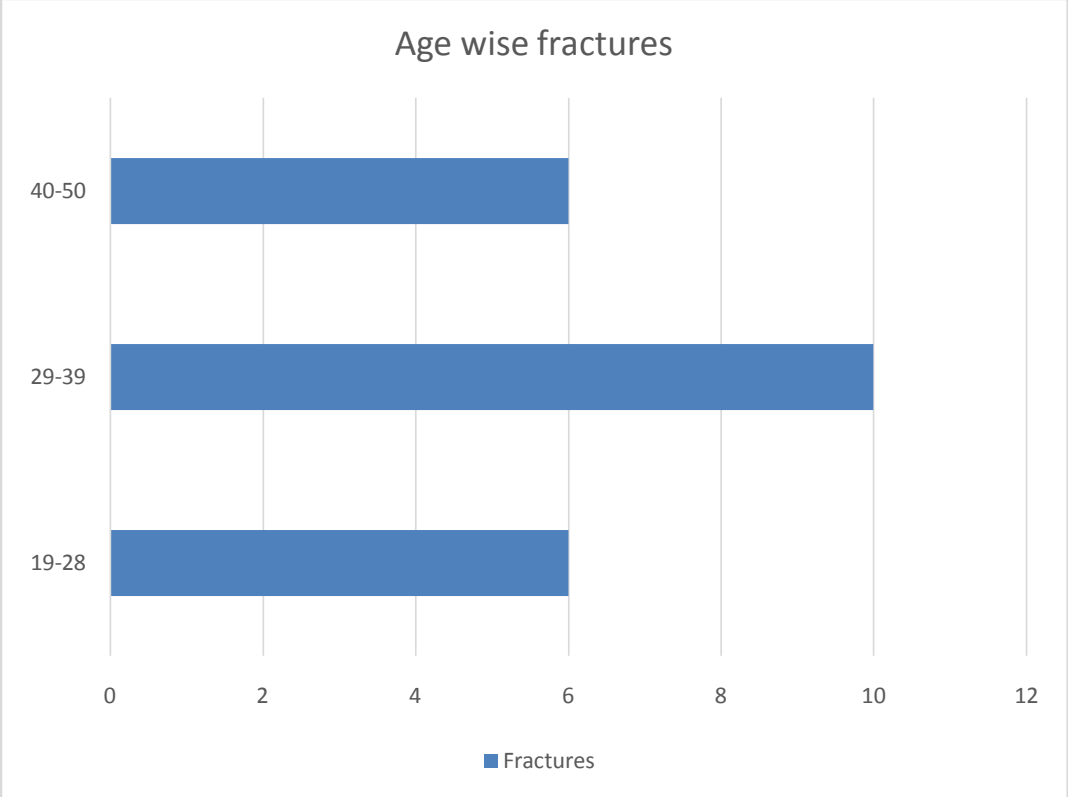
	Metacarpal	Proximal phalynx	Middle and distal phalynx	Total
2nd	2	2	0	4
3rd	3	4	0	7
4th	2	1	0	3
5th	6	2	0	8
				Total 22





V. CONCLUSION

In conclusion we can say that mini plate/screw fixation is good option for treatment of unstable metacarpal and phalangeal fracture.Stable fixation allows early ROM and patient can return back to duty early.patient selection,radiologic assessment,proper planning preoperatively ,precise dissection can further improves outcomes.

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