

A Prospective Study of Closed Metacarpal Fractures and Comparison of Treatment Modalities

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Abstract

Background: Background and Objectives: 104 Metacarpal fractures in 78 patients were treated at our institution from September 2010 to May 2017, with the objective of studying clinically and radiologically, the incidence, mechanism of injury, types of fracture and various treatment aspects. Results were compared to assess the efficacy of different treatment modalities and compare their functional outcomes of the closed metacarpal fractures of hand.

Materials and methods: 104 metacarpal fractures in 78 patients were enrolled from September 2010 to May 2017. The treatment modalities were broadly categorized into two groups, Group A consisted of conservative treatment, and Group B consisted of surgical treatment. Group A included 41 fractures treated with cock-up splint (n=32) and thumb spica (n=9), while 63 fractures were treated in Group B, which included closed or open reduction (OR) and internal fixation (IF) with K-wires (n=42), OR and IF with miniplate and screws or miniscrews alone (n=15), and mini external fixator (n=6). Total active range of motion as suggested by the American society for surgery of hand and Gingrass's criteria were used for functional assessment and to assess the efficacy of conservative and surgical modalities for closed metacarpal fractures of the hand.

Results: Final evaluation of the patients done at the end of three months. The excellent to good results seen in Group A and B were 80.5% and 87.3%, respectively. Seven complications were seen in Group A, which included four cases with malunion and three cases with stiffness. Six complications were seen in Group B, which included four cases with stiffness and one each of pin tract infection and operative wound infection.

Conclusion: Conservative treatment is an inexpensive method, particularly suitable for stable fractures, and in patients who are poor candidates for surgery. Surgical modalities have distinct advantage of stable fixation but with added risk of stiffness. Both conservative and surgical modalities have good efficacy when used judiciously. Single fractures have shown better grade of total active range of motion compared to multiple fractures.

Treatment objective may be compromised if post-treatment physiotherapy and rehabilitation using systemic protocol is not followed.

Key words: Metacarpal fracture, hand, closed reduction, open reduction, Conservative and Surgical treatment.

Introduction

Fractures of metacarpals and phalanges are the most common fractures of the upper extremity [1]. In a case series of 11000 fractures, Emmett and Breck noted that these fractures accounted for 10% of the total [2]. The outer rays of the hand (thumb and little finger) were the most commonly injured. Unfortunately, the metacarpal and phalangeal fractures are often neglected or regarded as trivial injuries. The metacarpal fractures are the 3rd most common and comprising 30-40% of all hand fractures [3-5]. The incidence is most common in males and peaks between the ages of 10 and 40 years [6], a time when the athletic injury and industrial exposure is greatest.

The closed treatment of fractures of hand gained a poor reputation because of problems of malunion, stiffness, and sometimes loss of skin or other soft tissues. Furthermore, modern techniques and material for internal fixation have become incredibly sophisticated and are far superior to previously used kirchner wire (K-wire) fixation. It is no wonder that with such equipments and our desire to fix things,

more and more fractures of the hand are being treated by internal fixation [7-9]

Most fractures are functionally stable either before or after closed reduction and will fare well with protective splintage and early mobilization.9 Certain fractures require operative fixation. Selection of optimal treatment depends on a number of factors. Although prolonged immobilization is to be avoided because of risk of permanent deformity and stiffness, overly aggressive attempts at internal fixation may lead to soft tissue damage, tendon adhesion, infection, and the necessity for a secondary procedure for implant removal. Operative fixation must be used judiciously and with expectation that the ultimate outcome will be as good as, and optimally better than, the outcome after nonoperative management. Regardless of the treatment selected, the goal is full and rapid restoration of hand function.11

We have conducted this study on patients of closed metacarpal fractures between September 2010 to May 2013 with the aim to study the efficacy of different treatment modalities and compare their functional outcomes of the closed metacarpal fractures of hand.

Material & Method

104 closed metacarpal fractures in 78 patients were treated at our institute. Patients were divided into 2 groups, group A consisting of conservative treatment and group B of surgical treatment. Group A consisted CR with cock-up splint and

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Table 1: Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Immobilization (weeks)	78	3.9487	0.7189	2	6
Union (weeks)	78	5.7436	1.10707	4	10
TAM (degrees)	88	221.08	37.75431	120	260
TF of thumb (degrees)	16	106.25	25.13298	45	140
Palmer abduction of thumb (degrees)	16	52.19	9.3039	25	60
PIP Movement (degrees)	88	96.11	14.3247	60	110
MCP Movement (degrees)	88	62.98	19.4036	15	85
Grip strength (pounds)	78	57.01	14.17	20	75
Pinch strength (pounds)	78	14.12	3.05	6	20

thumb spica, while Group B consisted of CR/OR and IF with k-wires, OR and IF with miniplate and screws or miniscrews alone and mini external-fixators.

All modes of treatment were augmented with cock-up splint and thumb spica for thumb fractures.

During the period between September 2010 and May 2017, all closed metacarpal fractures (Intraarticular and extraarticular) of any age and sex managed by conservative or surgical method were managed by conservative or operative methods included in the study. And all open metacarpal fractures and Pathological fractures are excluded.

As soon as patient was attended by us detailed history was taken from the patients or his relatives and a meticulous examination was done and all the details were recorded in a prescribed format.

standard radiographs of the hand, i.e., anteroposterior and oblique views were obtained to confirm the diagnosis and to assess the fracture pattern. Functional fracture classification I was used to classify the fractures.

Closed reduction was done for stable fractures and treated conservatively with immobilization in cock-up splint or thumb spica. Unstable fractures were splinted until the surgery. Analgesics were given to relieve pain. Written informed consent was taken from patients and relatives as a preop protocol.

CR was tried under C-arm guidance. For OR and IF dorsal approach was the most preferred surgical approach.

Table 2: Distribution of the sample by the type of fracture and the treatment given

TREATMENT	Metacarpal Injured					TOTAL
	Trans	Oblique	Spiral	Commin	Avulsion	
Cock-up splint	9	9	5	7	2	32
	18.40%	32.10%	83.30%	41.20%	50.00%	30.80%
Thumb spica	1	7	0	0	1	9
	2.00%	25.00%	0%	0%	25.00%	8.70%
CR+IF with K-wire	11	6	1	3	1	22
	22.40%	21.40%	16.70%	17.60%	25.00%	21.20%
OR+IF with K-wire	18	1	0	1	0	20
	36.70%	3.60%	0%	5.90%	0%	19.20%
OR+IF with Miniplate and screws	9	1	0	1	0	11
	18.40%	3.60%	0.00%	5.90%	0%	10.60%
OR+IF with Miniscrews	0	3	0	1	0	4
	0%	10.70%	0%	5.90%	0%	3.80%
Mini Ex-Fix	1	1	0	4	0	6
	2.00%	3.60%	0%	23.50%	0%	5.80%
TOTAL	49	28	6	17	4	104
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Parental antibiotics were given for 3 days followed by oral antibiotics for 5 to 7 days.

Active finger and wrist movements were encouraged post operatively to promote better circulation and to reduce edema. Elevation was advised throughout the treatment with adequate pain relief.

Post operative radiographs were taken on the next day. Dressing was checked on 2nd post operative day, 5th post operative day and 10th post operative day as per schedule of our dressing protocol. Suture removal was done on the 10th post operative day.

Review of the patient was done for every 2 weeks for 3 to 4 months and examined thoroughly. Immobilization was discarded for the mini external fixator treated cases at the end of 1 week, while for others at the end of 3 to 5 weeks.

At 4 to 6 weeks post operation, any external hardware in the form of k-wires or external fixator was removed and x-rays were repeated. After confirmation of fracture union clinically and radiologically, patient was encouraged for joint movements, Improvements in the ROM were noted on every visit. Grip strength, pinch strength, and TAM and untoward complication of the treatment were also noted. Final results were noted according to the % TAM score for

Table 4: Distribution of the sample by treatment given and results obtained

TREATMENT	RESULTS				TOTAL
	Excellent	Good	Fair	Poor	
Conservative	18	15	5	3	41
	42.90%	32.60%	62.50%	37.50%	39.40%
Surgical	24	31	3	5	63
	57.10%	67.40%	38%	63%	60.60%
TOTAL	42	46	8	8	104
	100.00%	100.00%	100.00%	100.00%	100.00%

Table 4:

Result	%TAM compared to normal 260 degrees
Excellent	85-100%
Good	70-84%
Fair	50-69%
Poor	<50%

Table 5: % TAM Score 16 suggested by American society for surgery of hand (used for 2nd to 5th Metacarpal)/TAM= Total flexion at MCP joint + PIP joint + DIP joint – Extension deficit of all three joints

TREATMENT	RESULTS				TOTAL
	Excellent	Good	Fair	Poor	
Cock-up splint	16	10	4	2	32
	38.10%	21.70%	50.00%	25.00%	30.80%
Thumb spica	2	5	1	1	9
	4.80%	10.90%	12.50%	12.50%	8.70%
CR+IF with K-wire	7	14	0	1	22
	16.70%	30.40%	0.00%	12.50%	21.20%
OR+IF with K-wire	8	9	1	2	20
	19.00%	19.60%	12.50%	25.00%	19.20%
OR+IF with Miniplate and screws	6	3	1	1	11
	14.30%	6.50%	12.50%	12.50%	10.60%
OR+IF with Miniscrews	3	1	0	0	4
	7.10%	2.20%	0.00%	0.00%	3.80%
Mini Ex-Fix	0	4	1	1	6
	0.00%	8.70%	12.50%	12.50%	5.80%
TOTAL	42	46	8	8	104
	100.00%	100.00%	100.00%	100.00%	100.00%

2nd to 5th metacarpals and Gingrass criteria²⁶ for thumb metacarpal.

Management Techniques

Group A – Nonoperative management

1. CR and Cock-up splint immobilization

Displaced fractures that are malaligned can often be manipulated into alignment and stabilized by closed reduction under hematoma or local block with 1% lignocaine

For metacarpal neck axial traction is used to disimpact the fracture, followed by digital flexion to 90° at the MCP and 90° at the proximal interphalangeal joint. The proximal phalanx then functions as a joystick for the fractured head because of the tightness of the MCP ligaments in flexion. Dorsally directed pressure combined with rotatory force (if necessary) allows reduction. Immobilization in the intrinsic plus position (MCP joint flexed 90°, IP joints in extension and wrist in 30° dorsiflexion) with a dorsal/volar plaster slab reduces the deforming forces of the interosseous muscles, maintains fracture rotation, and places the collateral ligaments under proper tension.

For shaft longitudinal traction, dorsal pressure at the fracture site, and rotation as needed. Three point molding is useful for transverse patterns: dorsal pressure at the fracture site and palmar pressure proximally and distally. Metacarpal head and extra-articular base fractures typically require longitudinal traction only.

2. CR and Thumb spica

The closed reduction technique consists of thumb traction combined with metacarpal extension, pronation, and abduction. Direct downward pressure is applied to the dorsal radial metacarpal base and thumb spica is applied in position of wrist 20-25° extension, forearm neutral and thumb in position of function (holding can).

Group B – Operative management

1. CR and IF with K-wires

After CR, Several pinning techniques can be used for metacarpal head, neck, shaft, and base fractures

Transfix pinning of the fractured metacarpal to an intact adjacent metacarpal - Two transfix pins are recommended distally which can add rotational stability and at least one proximally

Cross K-wire fixation - antegrade with an entry point on the dorsal metacarpal surface or retrograde from the MCP joint. By flexing the MCP joint to 90°, retrograde pins can enter near the origin of the collateral ligaments (dorsal, central, or volar) and avoid injury to the articular surface. The pins should cross each other proximal or distal to the fracture site for maximal stability intramedullary.

For Bennett fractures, transarticular pinning - Placing one or 2 pins from the metacarpal shaft into the trapezium while maintaining reduction can counteract the deforming force of the abductor pollicis longus. In some cases, a combination of pinning techniques is useful.

2. OR and IF

Surgical approach

1. For OR and IF with k-wire (1 to 2.5mm), miniplate and screws, miniscrews and mini ex-fix accessed from radial aspect of thumb and ulnar aspect of little finger, central metacarpal by dorsal longitudinal incision between adjacent metacarpals.

2. Junction tendinum interconnecting the common extensor tendons was split to enhance exposure.

3. In thumb the incision may be curved to expose the CMC joints.

4. If the metacarpal head needs to be exposed the extensor mechanism was split down in the middle or may be entered through the radial sagittal band.

5. The radial side offers better exposure to the joint than the ulnar side.

6. Carefully incise through the intrinsic fascia in order to preserve an optimal gliding mechanism.



Figure 1: Case 1 Photographs showing good ROM of 4th MC fracture treated by CR and Cock-up splint.



Figure 2: Photographs showing excellent result of 1st MC base fracture treated by CR and thumb spica.



Figure 2: Photographs showing excellent result of 1st MC base fracture treated by CR and thumb spica.

A. OR and IF with Miniplate and Screws

Plates were placed on the dorsal surface in order to function as a tension band; but to avoid disturbance to gliding of extensor tendon dorsolateral is preferred to midline dorsal. Periosteal sleeve should be elevated and prebending of plate as per AO principle of internal buttressing advocated.

B. OR and IF with Miniscrews

Lag screw technique is used for the approximation of 2

fracture fragments in which compression provides fracture stability without distorting normal anatomy. The near cortex is overdrilled to the diameter of the screw thread. The far cortex is drilled to the diameter of the screw core.

C. Mini-external fixator

2.5-mm pins are used in metacarpal fractures. A single proximal and distal pin is adequate in many cases. Two sets of pins should be used when significant deforming forces are anticipated. After pin insertion through midaxial or



Figure 3: Photographs showing 5th MC neck fracture treated by CR and IF with K-wire with excellent result at 3 months and fracture united.



Figure 4 & 5: Photographs (case 4) A-E shows 5th MC shaft fracture treated by OR and IF with K-wire and good ROM at 3 months with fracture union. (Case 5) F-H shows 1st MC base treated by ORIF with K-wires

dorsolateral incision, the connecting rods and swivel clamps are inserted and tightened.

Observation And Results

104 closed metacarpal fractures of hand in 78 patients were treated at our institute by conservative and surgical methods from September 2010 to May 2013. There were 5 patients with loss for follow up and they were not included in the study.

Males significantly had a higher frequency (84.6%) compared to females (15.4%). The mean age of the patients with MC fracture of the hand was 36.71 years. Females significantly had a higher mean age compared to males. The mean age of male patients was found to be 35.24 as compared to females whose mean age was 44.83 years. Chi-square test revealed a significant ($X^2=37.385$; $p<0.000$) difference among the frequencies of male and female subjects.

In our study a significant difference was observed between the frequencies of different age groups, indicating that most of the cases were in between the age group of 17-40 years ($X^2=53.385$, $p<0.000$).

In our study a significant difference was observed in distribution of the sample by occupation ($X^2=46.487$, $p<0.000$) indicating that metacarpal fractures predominant in labourers.

Most of the injuries reported had RTA as a mode of injury

followed by fall. Chi-square revealed a significant ($X^2=35.333$, $p<0.000$) difference among frequencies of different modes of injury.

In our study 64.4% fractures were occurred on right side, while in 35.6% were affected on left side. Chi-square revealed a significant difference ($X^2=8.654$, $p<0.003$) among the frequencies of different sides of injury.

Dominant hand was more commonly affected in our study, because people generally carry out their work with dominant hand ($X^2=47.115$, $p<0.000$).

Fifth metacarpal was the most commonly injured, followed by fourth, third, second and first. Chi-square revealed a significant difference ($X^2=14.173$, $p<0.007$) among the frequencies of the rays injured.

Shaft was maximally affected region of bone (52.9%) followed by base (26.9%), neck (13.5%), and head (6.7%). Chi-square revealed a significant difference ($X^2=51.923$, $p<0.007$) among the frequencies of the location of the fracture.

With RTA, fall of object and assault, the most common location of fracture was in shaft (57.1%, 68.4% and 100% respectively), in trauma related to fall it was base (45.5%), while in sports related injuries, it was in neck (42.8%). A significant ($CC=0.450$, $p<0.009$) association was seen between the location of fracture and the mode of injury.

Chi-square revealed a highly significant ($X^2=65.519$, $p<0.000$) difference among the frequencies of different



Figure 6: OR and IF with Miniplate and screws for 2nd and 3rd MC shaft fracture shows good ROM and union at the end of 3 months.



Figure 7: Treated by Mini external fixator showing good ROM

fracture patterns.

Chi-square revealed a minimal significant ($X^2=4.654$, $p<0.031$) difference among the frequencies of treatment modalities.

30.8% fractures were treated with cock-up splint, 8.7% with thumb spica, 21.2% with CR and IF with K-wire, 19.2% with OR and IF with K-wire, 10.6% with OR and IF with miniplate and screws, 3.8% with OR and IF with miniscrews, and 5.8% with mini Ex-fix. Chi-square revealed a highly significant difference ($X^2=41.519$, $p<0.000$) among the frequencies of various treatment modalities.

Mean duration of immobilization in all fractures was average 3.95 weeks, and the mean union in weeks overall was 5.74 weeks.

Mean TAM for four fingers, TF for thumb, PIP joint, grip strength, pinch strength shown in table. MCP joint motion was 96.11 and 62.98 degrees respectively.

A highly significant ($CC=0.608$, $p<0.000$) association was observed between the fracture pattern and the treatment modality chosen.

Chi-square revealed a highly significant ($X^2=297.346$, $p<0.000$) difference among the frequencies of different complications in surgical modalities.

Conservatively treated fractures had 4 malunion and 3 stiffness, while the surgically treated cases, 4 stiffness, 1 pin tract infection and 1 post operative wound infection was seen. A non-significant ($CC=0.262$, $p<0.106$) association was observed between the treatment modality and the type of complications in conservatively treated metacarpal fractures.

Complications seen were, 4 malunion and 2 stiffness in cock-up splint, 1stiffness in thumb spica, 1 stiffness in CR and IF with k-wire, 2 stiffness and 1 pin tract infection in OR and IF with k-wire, 1 post-op wound infection in OR and IF with miniplate and screws, and 1 stiffness in mini ex-fix. A non-significant ($CC=0.438$, $p<0.422$) association was observed between the complications seen and the treatment modalities.

The results obtained were almost equal for the conservative and operative treatment. In conservative treatment 80.5% ($n=33$) excellent to good results, 5 fair and 3 poor results were seen, while in operative treatment 87.3% ($n=55$) excellent to good results, 3 fair and 5 poor results were seen. A non-significant ($CC=0.165$, $p<0.408$) association was observed between the type of treatment given and the

results. Single fractures have shown better grade of total active range of motion compared to multiple fractures.

The poor results included 2 in cock-up, 1 in thumb spica, 1 in CR and IF with k-wire, 2 in OR and IF with k-wire, 1 in OR and IF with miniplate and screws, 1 in mini ex-fix and none in OR and IF with miniscrews. A non-significant association was observed between the various treatment modalities and the results.

Weeks of work loss were found less than 4 weeks in 10 patients, 4-6 weeks in 54 patients and more than 6 weeks in 14 patients. A significant association ($X^2=45.54$, $p<0.000$) was observed in work loss period of metacarpal fractures.

96.2% of the patients retain their original work and 3.8% of the patients had to undergo change in their job. A significant association was observed in sample distribution by the work resumed or changed.

Statistical Methods Employed

Following statistical methods were employed in the present study

1. Frequencies
2. Descriptives
3. Chi-Square test
4. Contingency coefficient test
5. Independent samples 't' test

Discussion

Overall the most common age group involved was seen in 17-40 yrs age group (52.5%). In a study of 701 fractures by Stanton J S et al¹⁷ the overall mean age was 31 years with most common being in young adults.

In our study, the frequency of the metacarpal rays involved were 5th metacarpal (34.6%), followed by 4th (18.3%), 3rd (16.3%), 2nd (15.4%) and 1st (15.4%). In a study of 45 fractures by Gupta R et al¹⁶ most common injured metacarpal was 5th (59%), followed by 4th, 3rd and 2nd metacarpal.

In our study shaft fractures were most common (52.9%), followed by base (26.9%), neck (13.5%) and head (6.7%). In the study of 52 closed metacarpal fractures by Ozer et al²⁰, the most common location of fracture was in shaft (56%), followed by neck and base and last head.

In our study 39.4% ($n=41$) of fractures were treated conservatively, while the rest 60.6% ($n=63$) were treated surgically.

Overall 87.5% fractures had no complications, while 13

fractures had some kind of complication (7 with conservative and 6 with surgical). 80.5% excellent to good results were seen in conservative, and 87.3% with surgical treatment.

In the study of 262 fractures by Westbrook et al [21] 75% were treated conservatively and 25% treated operatively. They concluded that the results of both conservative and operative methods were equally good and no significant difference in complications. In the study of 63 fractures by MCKerrell et al 22 62% fractures were treated conservatively and 38% were operatively. They concluded that no significant difference in results between two methods.

In the study of 1602 fractures by Prokop et al [23] 67.4% were treated conservatively and 32.6% were surgically. In conservative 94% had excellent to good results, while in surgical was 85%.

In our study, the average duration of immobilization was 3.95 weeks and the average time for fracture union was 5.74 weeks. 121 metacarpal fractures in 105 cases were reviewed by Rhee et al [24] average duration of immobilization was 4 weeks and average union was 5.6 weeks.

In the study by Omokawa et al [18] the average duration of union was 8 weeks. Roth and Auerbach et al [15] reviewed 37 patients with metacarpal fractures and average union was 7 weeks.

9 fractures were treated by thumb spica. One stiffness was noted. According to Gingrass criteria [26], 7 (77.8%) had excellent to good results, 1 fair and 1 poor results. In the study of 113 metacarpal fractures by Knopp et al [12] after conservative treatment by cock-up splint and strapping, the functional results were good to excellent in 92.7%, while 5.8% had satisfactory and 1.5% poor functional results.

In the study by Prokop et al 23 94% were excellent to good results in cock-up splint treated cases. In the study of 41 fractures of 1st metacarpal by Peterson et al 25 showed 66.7% cases had excellent to good results treated by thumb spica.

In our study 22 fractures were treated by CR and IF with K-wire. 1 digital stiffness was seen as a complication. 21 fractures (95.5%) had excellent to good results, and 1 (4.5%) poor result was seen. In the study of 45 fractures by Gupta et al 16 80% fractures had excellent to good results and 20% fair and no poor result was seen. In the study by Mohammed et al 14 85% fractures had excellent to good results and 15% had poor with complication of pin tract infections. Gonzalez et al 13 reviewed 98 metacarpal fractures those were reduced closed and fixed with intramedullary fixation with K-wire. All fractures went on to heal. Three complications occurred.

In our study 20 fractures were treated with OR and IF with K-wire. 3 complications were seen, 2 stiffness and 1 pin tract infection. 17 fractures (85%) had excellent to good results, 1 had fair and 1 had poor results. In the study of 38 fractures

by Ozer et al [20 33] (86.8%) fractures had excellent to good and 5 complications were seen. Average TAM was 237 degrees.

In our study 11 fractures were treated by OR and IF with miniplate and screws. 1 complication of post-operative wound infection was seen. Nine (81.8%) had excellent to good results, 1 fair and 1 poor results. In the study of 50 metacarpal fractures by Gereli et al [19] 37 (86%) fractures were seen excellent to good, 5 (11.6%) were fair and 1 (2.3%) were poor results. Average TAM was 220 degrees.

In our study 4 fractures were treated by OR and IF with miniscrews. No complication was seen and 100% excellent to good results. In the study by Roth et al [15], 37 patients with metacarpal fractures were treated with interfragmentary screw fixation for long oblique fractures. All healed at an average of 7 weeks with no complication.

In our study 6 fractures were treated by mini external fixator. 1 stiffness was seen. 4 (67%) were seen excellent to good, 1 fair and 1 poor results. In a study of 10 fractures by Gupta et al 6 (60%) were excellent to good, 3 (30%) were fair and 1 (10%) was poor results.

In a study of 50 fractures by Gereli et al [19] an average TAM was 220 degrees and mean loss of grip strength was 7.8%. In a study of 52 fractures by Ozer et al [20] an average TAM was 232.5 degrees and grip strength was 60.5 pounds. In a study of 45 fractures by Gupta et al [16] excellent TAM (>215) was observed with 60% CR and IF with K-wire.

Conclusions

In the management of closed metacarpal fractures of hand by various treatment modalities,

1. It is important to characterize various fracture patterns to categorize them into the most suitable treatment options available.
2. With a judicious approach, both conservative and surgical modalities of treatment have good results.
3. For most stable fractures, conservative treatment modalities are sufficient, but for most unstable and multiple fractures, surgical treatment gives best result.
4. Conservative treatment is a reliable, inexpensive modality, especially in children and in elderly age groups, but associated with complication of malunion.
5. Closed pinning is the most commonly done surgical procedure for a reducible, unstable fracture. It is cost effective, simple and rapid procedure, and is well tolerated and with added advantages of early bone healing, lesser infection rate, and decreased incidence of malunion.
6. OR and IF with k-wire or miniplate and screws are the most preferable treatment for closed multiple metacarpal fractures.

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