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TO EVALUATE THE FUNCTIONAL OUTCOME OF METACARPAL FRACTURES TREATED BY DIFFERENT TECHNIQUES

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Abstract

Background: Metacarpals fractures are most common. Management varies from conservative to operative techniques.
Aim: To evaluate the functional outcome of metacarpal fractures treated by different techniques.
Patients and Methods: a total of 65 fractures in 50 patients managed by various modalities (conservative as well as operative). Functional outcome was assessed by using TAM and DASH scoring system at 6th week, 3rd month and at 6th month.
Results: 62 fractures united and three fractures mal-united at the time of final assessment. Overall excellent and good results were achieved in 90% cases (45 out of 50 cases).
Conclusion: Operative technique is better option in case of unstable fracture and conservative technique is better in case of stable fractures. Finally we concluded that the detailed clinical and radiological assessment of fracture and choosing the correct method of treatment are critical in achieving good results.
Keywords: Metacarpal bones, total active movement (TAM), disability of arm, shoulder and hand score (DASH).

Introduction

Fractures of metacarpal bones are more common in humans, but their treatment varies widely in the different regions of the world. Treatment varies because of various reasons, that includes availability of resources, surgeon preference and experience, local practice patterns etc. Fractures of the metacarpal bones of the hand constitutes between 14-28% of all visits to the hospital due to trauma by various means like road traffic accidents, assault, industrial accidents etc[1].

Most of the times these metacarpal fractures are treated as minor injuries that results in major disability or deformity of the hand[2, 3]. Majority of metacarpal fractures are isolated injuries simple, closed and stable while many metacarpal fractures have excellent outcome without surgery. But open and displaced fracture need some form of fixation. Recent studies have shown good functional results with surgical treatment of metacarpal fractures using mini plates and screws as compared to the conservative treatment or K –wire fixation. Most common drawback of conservative treatment is prolonged immobilization of the hand which leads to troublesome stiffness later on which can be addressed by operative fixation and early intuition of motion therapy.

The functional outcome and result of the management of hand fracture is of predominant importance, rather than fracture healing the only isolated goal[4]. Keeping the wide range of complications in mind and the importance of hand in day to day activity of life and compounded wit paucity of literature regarding management and lack of an established algorithm of management of metacarpal fracture, the aim of this study is to assess the functional outcome of metacarpal fracture managed by various methods both conservatively as well as operative.

Aims and Objectives:

1. To access functional outcome of metacarpal fracture managed by conservative as well as operative methods.
2. To access the functional outcome of metacarpal fracture managed by plating.
3. To access the radiographic evaluation of metacarpal fracture managed by operative methods.
4. To study complications.

Material and Methods

Sample Size Selection: All the cases of metacarpal fracture admitted under department of Orthopaedics in GMC Jammu will be included in the study. The study will be conducted for a period of 12 month.

Inclusion Criteria
1. Age > 18yr
2. Both genders
3. Trauma less than 2-week-old

Exclusion Criteria
1. Patient not giving consent
2. Patient reporting after two weeks of trauma
3. Age< 18
4. Pathological Fractures
5. Intra-Articular Fractures

Study Design: A Prospective Study.
A written informed consent has taken from all the patients for their inclusion in the study. Ethical clearance have obtained from the hospital.

Methodology

Initial Assessment: Acutely injured patient centres on the ABC's as recommended by the ADVANCE TRAUMA LIFE SUPPORT (ATLS) protocols published by American college of surgeons.

Indication for Closed Reduction
1. Closed Isolated Fracture
2. Minimally Displaced Fracture

Indications for Operative Management
1. Displaced Irreducible Fractures
2. Shortening greater Than 6 mm
3. Angulation 30-40 degree In Small/Ring Finger Or >10 degree In Middle and Index Finger
4. Malrotation
5. Segmental Fracture
6. Multiple Metacarpal Fracture

Post- Operative Care
Post-operative AP, Lateral and oblique views were obtained to check the reduction and implant safety.

Follow Up and Rehabilitation Protocals:
Passive as well as active finger movements encouraged. Patient recalled on 6th weeks to study the implant position, fracture healing, fracture reduction, post traumatic arthritis or any other complication. Further post-operative visits were rescheduled on 3rd and 6th month. Functional outcome of the patient was evaluated by TAM and DASH scoring system.

Table 1: Tam Scoring System

		Result
1.	TAM $\geq 210^0$	Excellent
2.	TAM 180^0 - 210^0	Good
3.	TAM 150^0 - 180^0	Fair
4.	TAM < 150^0	Poor

Union-5 points and non-union zero point
Negative points were given for associated complications

Results:

Present study includes 65 fractures in 50 patients managed by various modalities of treatment [conservative as well as operative]. Age of the patient involved in the study was above 18 years and maximum no. of patients belongs the age group 19-30 years. Male dominated the study (out of which 80% were male).

In 56% cases right hand was involved. Most common mechanism of injury was road traffic accident (13 cases) and blunt trauma (12 cases). Closed fracture cases (40 patients) were more as compare to open fracture (10 patients). 5th metacarpal (24 cases) was more commonly involved. Transverse fracture was most common fracture pattern (30 cases). Metacarpal shaft was most commonly involved (34 cases)

36 patients were treated operatively and out of which maximum number of patients (20) were treated with longitudinal k wires. 29 patients were treated non-operatively.

Final assessment was done after 6 months by assessing the patient clinically as well as radiographically. Functional results were given by using TAM SCORING SYSTEM. In 60% cases (30 cases) tam score was >210 degree. In 30 % cases (15 cases) tam score was 180-210 degree. None of the patient in this study had any neurovascular injury. Only 3 patients had associated tendon injuries which simultaneously repaired.

Out of 40 patients only 4 cases had shown deformity angulation complication in closed fracture cases and out of 10 patients 2 had shown deformity, 1 had osteomyelitis and 3 had shown wound infection complication in open fracture.

Discussion

Metacarpal injuries are frequently encountered in the orthopedic OPD and emergency room. Metacarpals fractures are extremely debilitating injuries and can cause significant impact on individual's life and thus need to be treated with utmost care[5]. Earlier most hand fractures were treated by non-operative methods with

good outcome[6]. Early treatment options of metacarpal fractures were limited. It is only limited to closed reduction and its results were usually unsatisfactory. Due to open reduction and internal fixation by different methods leads to satisfactory results[7, 8, 9,]

According to James study, in 77% cases there is loss of functions of fingers treated by closed method[10]. Fixation of metacarpal fracture with external fixator has been described in literature. Shehadi et al reported that return in total range of motion can be achieved upto 100% of metacarpal fracture fixed with external fixator[11]. In the study of 21 metacarpal fractures, a J shaped nail formed from a curved 2.0 mm diameter k wire bent sharply at the proximal end was found to be useful in the neck or transverse shaft fracture of the metacarpals without concomitant injuries such as severe soft tissue damage[12].

In a study of 52 consecutive closed, displaced, extra-articular metacarpal fractures, results of intramedullary nail (IMN) fixation were compared with those of plate screw (PS) fixation. No significant differences in clinical outcomes were found, but the incidence of loss of function, penetration to the metacarpal- phalangeal joint, and secondary surgery for hardware removal in the operating room were much higher in the IMN group[13]. In the literature several studies have reported the satisfactory results for unstable metacarpal and phalangeal fractures fixed with AO mini plates and screws[14,15,16-25].

Most of the times the fractures are managed conservatively with plaster casting / slab. Surgical intervention is required for special situation like unstable variety of fractures. Earlier only limited treatment options were there but these days surgical treatment with intramedullary k-wiring, transverse K-wiring, Bouquet techniques, cerclage, mini external fixators , screw fixation (lag principle) and fixation with plate and screws and many more[26].

The principal goals of treatment are to restore hand grip and to improve the outcome of hand function. However indications for conservative or surgical treatment of metacarpal fractures are not well defined in the literature. Surgery is usually indicated for the fractures that have significant hand functional disability or cosmetic issue[27]. k-wiring is a popular method among orthopaedic surgeons worldwide for metacarpal bone fractures and using a k-wire has a benefit as it can be used as a joystick to help in reducing fracture intra-operatively, however if the k-wire is not rigid enough it may lead to loss of reduction subsequently and may be complicated by pin tract infection or pin breakage[28].

Metacarpal screw fixation has been commonly used in the past but it does not produces satisfactory results in long oblique pattern of fracture or a fracture where gross comminution is there[29]. Various studies have compared the functional outcome of metacarpal fractures treated by different methods. Hongyi et al when they compared results of plating versus K-wiring they reported that mean MHQ score was 96.7%[30].

Open reduction and internal fixation with K wire is one of the treatment modalities in these unstable fractures but they provide less rigid fixation and are rotationally unstable, there is increased chances of pin tract infection and problems due to protruding ends of K-wire are. Interosseous k wiring provides rigid fixation equivalent to plating are useful only in transverse diaphyseal fractures[1]. Report by Shehadi et al showed full return of total range of motions in up to 100% of metacarpal fractures treated with external fixator[7]. This mode of fixation is useful in compound metacarpal fractures with bone loss. But the routine use of external fixator is discouraged. There are many literature studies showing satisfactory results of unstable metacarpal and phalangeal fractures treated with AO miniplate and screws [14,15].

A study by Souer et al[31] showed good functional outcome by total active motion more than 230 degree in 18 of 19 patients for whom plate fixation was done in closed unstable metacarpal fractures. Another study by Gupta et al[1] showed excellent functional outcome with total active movements more than 230 degree in all of his patients of unstable metacarpal fractures treated with plate fixation. Another study by Dabezies Schutte[18] showed no complication in 27 unstable metacarpal fractures treated with plate fixation. Low complication rate seen in our study was similar to these results.

Our study highlights the fact that average TAM score of metacarpal fracture is 225.4 degree. Overall functional results in our study based on TAM criteria of American society for Surgery of Hand is excellent in 60%, good in 30%, fair in 6% and poor in only 4% cases. In our study complications observed only in 20% cases that includes residual deformity in 10 % cases, rotation mal-alignment in 2% cases, osteomyelitis in 2% cases and superficial wound infection in 6% cases. These all complications were treated with antibiotics and regular dressing without affecting the final outcome. Eventually all patients had improved ROM following physiotherapy.

Conclusion

Functional outcome is of paramount importance and restoration of function is the primary expectation of patient. The operative management of metacarpal fracture has definitely an advantage over the closed methods especially in displaced, unstable, comminuted, open and multiple fracture. We can do conservative management in stable, un-displaced and closed injuries.

The operative management of metacarpal fracture result in accurate reduction of fracture without any angulation or rotation, better stability at the fracture site and hasten union of fracture. The joint should be mobilized early following fixation to prevent the stiffness of fingers and regain the desired ROM at the joint. Post-operative physiotherapy of hand is must.

Detailed clinical and radiological assessment of fracture, careful preoperative planning, meticulous dissection, precision in surgical technique (coverage of plate with soft tissue) and choosing the correct method of treatment are critical in achieving good results and minimising the complication.

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