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Dr. Rahmat Ali
Mch (ortho), MS (ortho),
fellowship-Spine Surgery, Sr.
Consultant ortho surgeon
Combined Dist. Hospital Sant
Kabir Nagar, Lucknow, Utter
Pradesh, India

Dr. Shakeel Ahmad Qidwai
Professor, Department of
orthopedics, Era's Lucknow
Medical College, Lucknow, Utter
Pradesh, India

Dr. Amit Nandan Mishra
Professor, Department of
orthopedics, Era's Lucknow
Medical College, Lucknow, Utter
Pradesh, India

Dr. Sandhya Mishra
Associate Professor of
Department of Community
Medicine, IMayo Institute of
Medical Sciences, Barabanki,
Utter Pradesh, India

Correspondence

Dr. Amit Nandan Mishra
Professor, Department of
orthopedics, Era's Lucknow
Medical College, Lucknow, Utter
Pradesh, India

A study of clinical outcome of unstable metacarpal and phalangeal fractures treated by internal fixation

Dr. Rahmat Ali, Dr. Shakeel Ahmad Qidwai, Dr. Amit Nandan Mishra and Dr. Sandhya Mishra

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Abstract

This is a retrospective study of 38 patients with 44 unstable fractures of metacarpals and phalanges. 37 were males and one female had an average age of 32 years. The mean follow period was 16 months.

The operative procedure used to achieve stable fixation were Closed/Open K-wire fixation, mini-screws Mini-plates and screws. All patients with K-wire fixation were immobilized in a plaster splint for 3 weeks and those with screw or plate and screw fixation were immobilized in a bulky dressing and encouraged to make early gentle movements.

The overall results were good 64%, satisfactory 27% and poor 11.4%. It is observed that K-wire fixation is easy to perform with minimal soft tissue damage. A.O. screws and plates are reserved for special circumstances to be used only by surgeons experienced in A.O. techniques. Poor results are usually obtained in patients with extensive soft tissue injury, particularly with tendon injuries, flexor/extensor or both and more so in association with bone loss.

Keywords: clinical outcome, unstable metacarpal, internal fixation

Introduction

The majority of hand fractures can be treated successfully by close methods. About 5% to 10% of metacarpal and phalangeal fractures are unstable and require an operative procedure to achieve stability. James reported that 77% of fingers lost function after non-operative treatment of unstable fractures of metacarpals and phalanges^[1, 2].

Early mobilization of a stabilized fracture is a key to success in avoiding stiffness arising from adhesions around joints and tendons^[1, 3, 4]. Kirschner wires have been versatile and successful in the management of such fractures^[5, 6, 7]. The objection to K-wire fixation is that no compression is achieved at the fracture site and the extra-osseous portion of the wire may cause pain, infection and obstruction to adjacent joints.

The concept of rigid fixation and early mobilization using plates and screws was developed by the A.O.Group^[3, 8, 9].

The aim of this study was to review the results of treatment of unstable metacarpal and phalangeal fractures in one hospital using K-wires, A.O. screws, Mini-screws, mini-plates and screws.

Patients and Methods

At Aasra hospital, Lucknow between January 2009 and March 2013, 38 patients with 44 fractures of metacarpals and phalanges were treated by stable fixation using K-wires, A.O. screws and plates. All except one were males with an average age of 32 years ranging from 10 years to 74 years. The mean follow period was 16 months.

The dominant right hand was involved in 24 patients (63.2%), the left hand in 14 cases (36.8%). The mechanism of injury included work-related accidents falls or fights and gunshot trauma. 27 fractures involve metacarpal (19 MC Shaft, 5 MC Neck and 3 Bennett's fracture dislocation). 17 fractures involved phalanges (11 PP and 6 MP). 7 patients had compound injuries, four of which had associated tendon injuries with or without bone loss and 3 without tendon injuries.

A mid-lateral approach was used for phalangeal fractures and plates were applied on the dorso-radial surface of the phalanges. K-wires were used as I.M. nails, as well as being used transversally proximal and distal to the fractures.

The follow-up clinical assessment was made using questionnaire:-

1. Is there any pain in the involved finger/ hand?

2. Is there any cold intolerance in the involved finger/hand?
3. Is there any obvious deformity in the involved finger/ hand?
4. Is the patient able to touch the palm of the hand with the involved finger?
5. Is the patient able to perform the same work as he did previously?

The operative procedure used is shown in Table 1.

Table 1: Fixation Methods in various Fractures

Fixation	Fractures				
	Meta carpal Shaft	Metacarpal Neck	Bennett's	PP	MP
CRPF w/ K wires	8	2	3	4	1
ORIF w/K wires	9	3	0	2	2
ORIF w/ Screws	1	0	0	2	2
ORIF w/ Plates and Screws	1	0	0	3	1

Results

The results of the treatment were placed in one of the three categories: Good, Satisfactory or Poor, depending upon the range of motion, deformity, pain, ability to do his job and Patient satisfaction.

Of 34 fractures fixed with K-wires (Closed and open), 22(64.7%) had well results, nine (26.4 %) satisfactory and three (8.8%) poor results. All patients with Bennett's fracture had good results with K- wire fixation (Table 2).

Table 2: Results of Various Fractures and Fixations

Fixation Group	Total	Good	Satisfactory	Poor
Metacarpals and Phalanges fixed with K wires	34	22(64.7%)	9(26.4%)	3(8.8%)
With A.O. screws	5	2(40%)	2(40%)	1(20%)
With Mini plates	5	3(60%)	1(20%)	1(20%)
Total	44	27(64%)	12(27%)	5(11.4%)

Complications

Two patients with metacarpal fracture had poor results in the form of limited flexion at the MCP joint and patients dissatisfaction. Both had been treated with two K-wires to achieve stabilization of the fractures but a loss of reduction was observed in postoperative X-rays (Figure 1). One patient treated with A.O. screw for a fractured metacarpal had stiffness at the MCP joint due to initially poor fixation. One patient with a proximal phalangeal fracture and another with a middle phalangeal fracture experienced joint stiffness and difficulty in returning to previous work. All these patients had some degree of associated soft tissue or tendon injuries.



Fig 1: Radiograph showing imperfect fixation in an unstable fracture of the neck of the 2nd metacarpal with loss of reduction. Patient also had associated extensor tendon injury which resulted in a poor outcome.

Two patients in the group of K- wire fixation had a minor pin

site infection which responded to the removal of K-wires and treatment with oral antibiotics. The major problem with plate fixation was persistence of pain and in about 40% of cases, the plates were removed to relieve the pain and to improve the final mobility.

Discussion

The treatment of metacarpal and phalangeal fractures includes various techniques ranging from brief splinting and early motion through techniques of closed/open reduction and k wiring to the methods of rigid fixation with wires, screws and plates.

The majority of metacarpal and phalangeal fractures are stable injuries and good results can be obtained with conservative treatment. Five to Ten percent of fractures are unstable and will require stable fixation. In the literature there is no consensus of opinion as to the best form of stable fixation for metacarpal and phalangeal fractures. The surgeon should always opt for the simplest, safest and least expensive method which in his hands is likely to produce a satisfactory outcome. It is impossible to outline hard and fast indications for any of these techniques because they will always vary with each patient and clinical situation^[10].

The steel pins introduced by Martin Kirschner in 1909 still remain the most popular tools in the surgeons armamentarium for internal fixation of hand fractures. Screws and plates have still not replaced the simple and ubiquitous Kirschner wires which, skillfully applied, give sufficient stability to prevent fracture displacement. In many cases the lack of rigid fixation is a minor drawback compared to the reliability, versatility and relative ease of K-wire insertion. The important requirements for successful K wiring (closed/open) are accurate reduction of fracture fragments and their maintenance during the procedure to prevent fragment distraction. A low speed drill facilitates accurate placement of K wires.



Fig 2a: radiography showing unstable fracture of 3rd and 5th metacarpal shaft in an adult male patient.

In this study, 64.7% of fractures had good results with K-wire fixation (open or closed) 26.4% had satisfactory and 8.8% poor results. Poor results were obtained in three fractures which had associated tendon injuries or bone loss and this holds true with the observations made by Huffaker *et al* in 1978^[11].

The concept of rigid fixation in hand fractures, using A.O. mini fragmentary screws and plates and early mobilization was developed by the A.O. ASIF group^[3, 9, 12]. The fractures suitable for A.O. miniscrew fixation are oblique fractures of metacarpals and phalanges and uni-condylar fractures (Figure 2A and 2B).

In this study the results with mini-screws were quite satisfactory with only one poor result and that because of improper placement of a screw resulting in deformity, disability and pain. This is confirmed by Barton NJ 1984^[5] Internal fixation of small bones of the hand is difficult and the margin of error is smaller and it is all too easy to submit the finger to the hazards and disadvantages of an operation without achieving the rigid fixation so that in the end the finger is stiffer than has never been treated".



Fig 2b: Radiograph of same patient after 3 weeks internal fixation with A.O. screws and K-wire. Patients good functional recovery.

In this study, no complication of tendon rupture was reported^[13]. Our results of mini plate and screw fixation were satisfactory except that 40% of cases required plate removal for pain which also improved the mobility of the joints.

Removal of the implant is generally recommended because of stress shielding causing osteopenia and weakness of underlying bone with the consequent risk of re-fracture of atrophied bone. Another reason for the removal of the plate is because its superficial position and relative large size is a major source of continual discomfort and intolerance with the gliding and joint mobility.

Conclusion

It is recommended that plates in the hand should be used only when, in the surgeon's opinion, less invasive procedure may not give the best results and the techniques should be performed only by experienced surgeons.

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