ORIGINAL ARTICLE

Results of Open Proximal Phalangeal Fractures by "Gantry Technique"

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Abstract

One hundred and twenty-six phalanges of 120 patients in the age group 10-50 years, with open proximal phalangeal fractures of hand were treated with 'gantry fixation' from August 1989 to July 1993. There were 100 males and 20 females. Right hand was involved in 70 and left hand was involved in 50 patients. All fractures were operated in emergency operation theatre and were debrided and fixed. The patients were allowed supervised ROM exercises of the adjacent joints and were followed up for 24 weeks. Twelve patients had complication in the form of superficial infection (8), deep infection (3), restriction of ROM of adjacent joints (7) and mal-union (7). It was observed that gantry fixation of phalangeal fractures is easy, safe and reliable method of treating fractures of the hand.

Key Words

Phalangeal fracture, Gantry technique

Introduction

Fractures of small bones of hand are very common because of rapid industrialization and increase in the incidents of crime in our society. These fractures, although easily recognized are difficult to treat even for the experienced orthopedic surgeon. The major complications like mal-union and stiffness of the adjacent joints greatly compromise the function of the hand. Although many techniques for fixation of these fractures are in vogue, they are highly sophisticated (e.g. AO plating) and not possible for a general orthopedic surgeon to implement. External fixation of these fractures by gantry system is a fast and effective method of treating these injuries. This method allows rigid fixation, better soft tissue care and early rehabilitation with early recovery. We present our experience with this method of phalangeal fracture management.

Materials and Methods

The study was conducted on 126 proximal phalangeal fractures in 120 patients in an age group of 10-50 years, in the Hospital for Bone and Joint Surgery Barzulla, Srinagar. There were 100 (83.34%) males and 20 (16.66 %) females in the study. All those patients with proximal phalangeal fractures of the fingers and thumb ware taken up while as patients with closed fractures, intra-articular fractures and fractures associated with vascular injury of the digits were excluded from the study.

Surgery was performed under general or regional anesthesia depending upon the age of the patient, extent of the injury and site of the injury. A routine protocol of management comprising of examination under anesthesia, wound debridement and fracture stabilization was followed in all the patients.

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The fractures were stabilized by passing two transverse or horizontal K wires through proximal and distal fragments or through normal healthy areas above and below the injured phalanx. The fracture was gently manipulated and reduced with the help of these K wires after achieving rotational alignment of the digits. The reduction was maintained by fixing the two transverse wires with two vertical wires on either side of the injured finger. The wires were cemented externally with acrylic cement (Fig. 1-3).

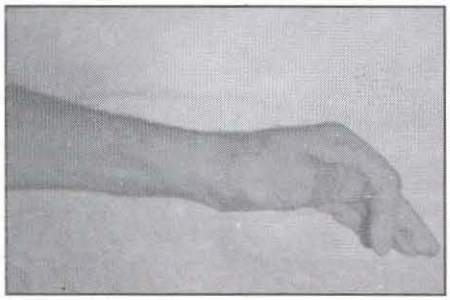

Fig. 1. Showing the compound phalangeal fracture of the left hand sustained in bandsaw injury.

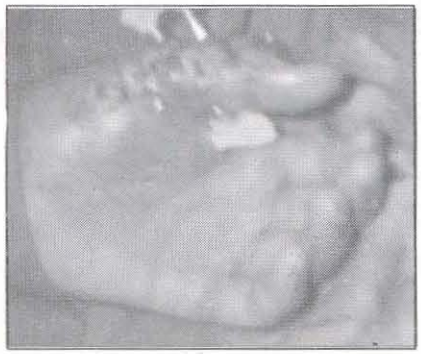

Fig. 2. Showing the above injury treated by parallel K. wires held in place by acrylic cement.

Fig. 3. Showing the immediate post-operative x-ray of the above case.

In case of phalangeal fractures of the fingers additional support was achieved by fixing the proximal phalanges of the adjacent finger with the transverse wires. The hand was immediately elevated for a period of 24 hours or more in case of severe injury, severe swelling or any sign of infection. All patients were given I/V antibiotics for period of one week irrespective of the presence or absence of infection. The patients were encouraged to exercise the joints as early as possible (Fig. 4,5).

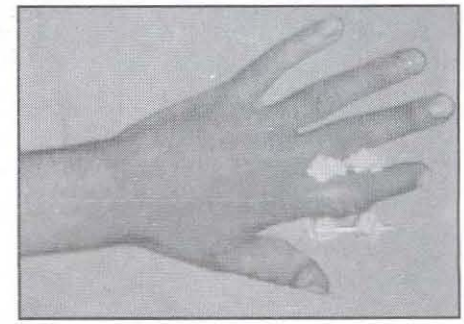

Fig. 4. Showing the proximal phalangeal fracture of index finger doing full extension of PIP joint after surgery.

Fig. 5. Showing the proximal phalangeal fracture of index finger doing active range of movement at 2 weeks.

Patients were followed up at 24 hours, 3 days, 1 week, 2 weeks, 3 weeks, 6 weeks, 12 weeks and 24 weeks. At each follow up, alignment, ROM of the adjacent joints and distal neuro-vascular status was recorded. At final follow up, the results were graded as excellent, good and poor according to the following criteria.

Excellent – Normal function and sensation.
< 10% loss of ROM of MCP + IP joints.

Good – Normal function and sensation
10 - 20% loss of ROM of MCP + IP joints.

Poor – > 20 % loss of ROM of MCP + IP joints
Abnormal alignment
Significant displacement
Unsound union
Impaired function and sensation

Patients were followed for 24 weeks when the final follow up was done. K-wires were removed at 3 weeks but removal was delayed by 2 weeks in case of infected fractures.

Observations and Results

The study comprised of 126 proximal phalangeal fractures of fingers and thumb in 120 patients who reported to the hospital. There were 100 (83.34%) males and 20 (16.66%) females. Right hand was involved in 70 (58.34%) while as 50 (41.66%) had left hand involvement. Ninty (75%) patients were manual and 30 (25%) patients were sedentary workers. The various modes of injury encountered in this study are shown in Table I.

Seventy percent of the patients reported to the hospital within 24 hours, 17% between 24 to 48 hours while 13% of the patients reported after 48 hours of sustaining trauma. The site of trauma, pattern of the fracture and fingers involved is shown in Table II and Table III respectively. The final results are shown in Table IV.

Table I

Mode of Injury	No. of Cases
Band-saw	58
Vehicular trauma	9
Fall	14
Domestic	17
Fire arm injury	5
Miscellaneous	17
Total	126

Table II

Site of Trauma and type of Fracture

Site of Fracture	No. of Phalanges
Proximal Phalanx	126
Transverse	38
Oblique	31
Spiral	29
Comminuted	28

Table III

Finger Involved	No. of Phalanges	Percentage
Thumb	36	28.57%
Index	29	23.02%
Middle	26	20.63%
Ring	19	15.08%
Little	16	12.70%
Total	126	100.00%

Table IV

Final Results

	Cases	%tage
Excellent	58	46%
Good	52	41.3%
Poor	16	12.7%

Discussion

Different methods of fixation of the phalangeal fractures have been used with the aim of achieving anatomical reduction, rigid fixation and early mobilization. Sophisticated multi-plane hand external fixators have already established a firm place in specialized and advanced hand centers. However, in a general orthopedic center and due to the huge rush of patients a system must be devised which is easily applicable and cost effective.

Immobilization of fractures for more than 3 weeks is not conducive to good functional result, as has been stressed by many authors (1,2). Proximal phalangeal fractures generally take 6 -7 weeks for union. It has been emphasized that the surgeon should not wait for radiological union of the fractures but start early mobilization of the hand, due to the impending risk of joint stiffness (2). The main aim of fixation of phalangeal fractures is to limit unnecessary exploration and trauma to the important soft tissues and fragile gliding surfaces of the phalanges.

Single K-wire fixation of these fractures was previously employed, but it does not afford any resistance to rotatory and distractional forces across the fracture.

Crossed pin fixation, although providing rigid stability has the disadvantage of keeping the fracture ends apart, thus contributing towards non-union (3). In addition, early mobilization of the fingers is impaired due to soft tissue transfixion. There has been an increasing tendency to ORIF of these fractures by plates and screws with newer A. O. techniques (4).

Mini plate and screw fixation is being currently employed in advanced hand centres, but requires unnecessary and iatrogenic dissection of delicate and functionally crowded areas and secondary intervention for removal of the implant. In addition, placement of an internal fixation device increases the risk of infection, thus jeopardising the final results. The custom made, "gantry system" consisting of two horizontal K wires bonded with acrylic cement to vertical K. wires has evolved as a viable alternative to sophisticated hand fixation system due to its low cost and comparable results (5-7). The transverse K-wires are passed in proximal and distal fragments or through healthier areas proximal and distal to the traumatized zone, without further disturbing the injured tissue; the slight control distraction allows a close reduction of badly comminuted fractures while the ligaments and tendons keep the fragment in place (7).

The present study is comparable with those published by other authors as regards functional outcome and return to active job (8,9). Eight percent cases had regained more than 50% range of motion by one week. At three months follow up 72 patients had more than 75% ROM and were actively doing their job. 83.3 % patients had ROM of more than 75% at 24 weeks and 46% patients had excellent results at final follow up whereas 42% and 12% patients had good and poor results respectively.

There was a progressive improvement in fracture heeling with time. It was assessed clinically and radiologically. The average healing time in our series was 3.5 weeks. At 6 weeks 95.5 % cases had sound union both clinically and radiologically. However, 3 patients united within 12 weeks. The cause of late union could be attributed to poor patient compliance in one and severe infection in the other two cases.

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