

# Role of Primary Skeltal Stabalization in Management of Crush Hand Injuries

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**This is a series of 24 patients with Gustillo III crush hand injuries presenting to Mayo Hospital Emergency Department. They were managed according to a pre-decided protocol, with fixation with K-wires within 24 hrs of presentation. With a low infection rate of just 12.5% in these heavily contaminated wounds, we achieved good mobility in 79.1% patients at six months follow up, with minimal other complications and just 2 amputations. This argues heavily in favor of early fixation being used as the standard treatment in such injuries.**

**Key Words:** Hand injuries, skeletal stabilization, trauma, fracture

The hand of man differs from the manus of other creatures in being a grasping mechanism combining great strength with finely controlled accuracy and at the same time serving as the chief tactile organ. Injuries of the hand therefore have an enormous impact on hand function and on quality of life. Occupational hand injuries are a major cause of morbidity and their incidence has been steadily increasing<sup>1</sup>. They account for nearly 10% of hospital Emergency Department visits<sup>2</sup> and one third of all trauma related visits<sup>3</sup>. Hand is very important from a functional point of view and for earning the livelihood. Injuries here have the maximum potential to cause permanent disability both physically and socially<sup>4</sup>. Hence maximum functional recovery must be the goal in every hand injury.

We present here the results of a series of 24 patients of crush injury of the hand which were dealt with primary skeletal fixation.

## Objective:

To evaluate the role of primary skeletal stabilization in crush hand injuries to achieve restoration of skeletal architecture and smooth joint motion.

## Patients and Methods:

A series of 27 cases of crush hand injuries presenting to Orthopedics Emergency of Mayo Hospital was studied. Since three were subsequently lost to follow-up the remaining 24 patients were included in the study. Only Gustillo and Anderson Type III injuries were included in the study. (Table 1)

All patients with concomitant life threatening injuries were excluded from our series, since their other injuries took precedence over hand injuries.

The patients were managed according to a set protocol. A detailed history regarding mechanism and timing of injury was taken noting if the hand was dominant or non dominant. All sources of constriction (rings, bandages etc.) were removed. Wound was thoroughly irrigated with Normal Saline and Pyodine solution. No constricting bandages were applied to prevent any possibility of impeding venous return; while wound was

dressed with thick sterile compressive swabs and elevated to stop oozing of blood. Appropriate X rays were then taken.

Table 1: Gustillo and Anderson Classification for Open Fractures\*

Type 1	Tidy laceration <1cm, no contamination, soft tissue crush or comminution
Type 2	Tidy laceration >1cm, no contamination, soft tissue crush or comminution
Type 3	Untidy laceration >10cm, soft tissue crush / periosteal stripping / comminuted or segmental fracture/ traumatic amputation. Special categories include gunshot, blast, machine injuries or any open fractures with vascular injury requiring repair

\*McRae R. Practical fracture management, Third Edition, London: Churchill Livingstone, 1999: 22-3

The patient was shifted of operation theatre and with full aseptic measures local regional or general anesthesia was administered. All foreign material was removed by irrigation with sterile soap and water or other appropriate solvent. The wound was then examined and debrided.

All patients received Inj. Cephradin 500 mg i/v 8 hourly routinely and those with contaminated wounds received Inj. Gentacin 80mg i/v 8 hourly with Inj. Metronidazole 500 mg i/v 8 hourly.

If they remained stable they were re examine under anesthesia within 24 hours. Repeat debridment and copious jet irrigation with a 20cc syringe was done. All the fractures were then fixed primarily with Kirshner wire (K wire) of 1mm, 1.5 mm, 1.8 mm, 2 mm sizes in longitudinal or cross manner using a power drill at low speed. Appropriate soft tissue coverage procedures (suturing, grafting or flap transfer) were then done or planned.

Patients were then followed in the OPD for a minimum of six months and functional utility of hand was evaluated at the end of that period. In the absence of amputation the passive function results were defined as:

- EXCELLENT: Passively bring the tip of finger 1.5 inch proximal to distal palmer crease and no more

than 5 degree extension loss at each interphalangeal joint

- GOOD: Passively bring the tip of finger 1 inch proximal to distal palmer crease and no more than 10 degree extension loss at each interphalangeal joint
- POOR Passively bring the tip of finger <1 inch proximal to distal palmer crease and >10 degree extension loss at each interphalangeal joint

For thumb the total flexion range of metacarpophalangeal joint (MPJ) and interphalangeal joint (IPJ):

- EXCELLENT >60 degrees
- GOOD 0-60 degrees
- POOR If IPJ cannot be flexed 10 degrees

Complications related to fractures were malunion, nonunion, infection, stiffness and amputation.

**Results:**

A total of 24 cases were selected for this interventional study. They were mostly young adults with a mean age was 24 years, ranging from 14 to 24 years. Males dominated our group 87.5% (21 pts) were males. An overwhelming majority of our patients were from urban origin i.e. 91.6% (22 pts). Arrival times to the definitive care center were shorter for the urban group and this was found to be statistically significant.(Table 2) The average time to presentation was well within the 6 hour limit.

Table 2 Arrival Time

Arrival Time (Hrs)	n=	%age
< 3 hrs	18	75
3.1 – 6 hrs	2	8.3
> 6.1 hrs	4	16.7
Mean	4.58	
Mean (Urban)	3.2	
Mean (Rural)	6.7	

(p 0.05 , T test)

Of all the patients both male and female, 66.6% (16 pts) were manual worker and suffered injuries during activities related to their jobs, however in only 43.7% (7) of these patients total or partial financial liability was borne by the employers. In a majority of cases the workers were forced to bear their own expenses with no responsibility taken by the employers.

Dominant hand was injured in 58.3% (14 pts), which was about equal to the injuries to non-dominant hand i.e. 41.7% (10 pts).

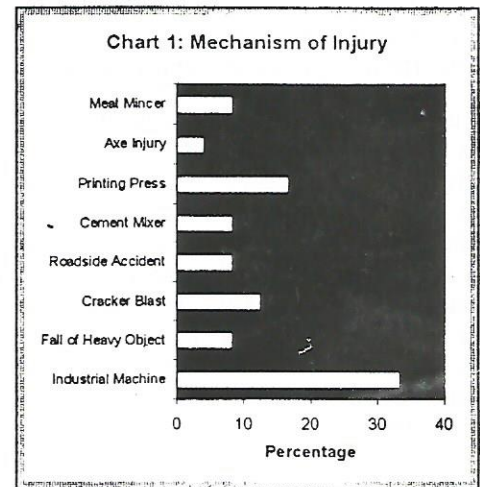
The mechanism of injury was evenly distributed to various causes. (Table 3) 70.1% (17 pts) received injuries due to handling machines with inadequate protective precautions taken. The majority of patients had grossly contaminated wounds with dirt, animal or vegetable matter i.e. 62.5% (15 pts).

The outcome of our intervention was noted at 3months and at 6 months (Table 3)

Table 3: Functional Outcome

Result	At 3 months	At 6 months
Excellent	11(45.8%)	14(58.3%)
Good	4(16.6%)	5(20.8%)
Poor	7(29.1%)	3(12.5%)
Amputation	2(8.3%)	2(8.3%)

Significant wound infection developed in three patients, which was treated with surgical debridment and antibiotics. Malunion occurred in just one patient.



**Discussion:**

Injuries to the hand usually occur in young and otherwise healthy individuals and have enormous implications for occupation, home life, and future career choices. And this is the organ most frequently injured<sup>5</sup>.

Males by far outnumber females in the series. The actual sex distribution in comparable studies is about equal<sup>6</sup>. The explanation could be that females do less machinery-related jobs, but more significantly it may be because females are generally neglected in our social setup. Since our tertiary care facility is located in an urban center, we get less rural referrals, which forces the villagers to resort to less expert care. The obvious need would be to increase the awareness for the specialized care that a hand injury requires in comparison to injuries to the other skin and soft tissue structures. Similarly the patient retrieval time needs to be shortened even for rural patients as this directly affects the likelihood of infection.

An overwhelming majority of our patients suffered work related injures with a less than adequate financial recompensation on the employers part, thus consigning the patient to a lifetime of unemployment and poverty in the event of a less than perfect outcome. Although about 62.5% of the patients had gross contamination of the wound, only 12.5% developed wound infection, partly because we routinely used antibiotics in all the patients. This is comparable to other studies<sup>8</sup>.

Our most important outcome goal was the assessment of the range of motion (ROM) of the MP and IP joints. At three months follow up, 62.4% patients the results had excellent or good ROM. This improved with further vigorous mobilization and physiotherapy upto 79.1%<sup>(8,9,10)</sup>. Hence with early fixation only a fifth of the patients had a disability significant enough to merit a radical change in lifestyle. The vast majority of patients had satisfactory results.

#### Conclusion:

We conclude that early fixation of hand fractures yields excellent results and needs to be promoted as the treatment of choice along with soft tissue repair or reconstruction as the standard mode of treatment in our healthcare facility.

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