



## SALVAGE TECHNIQUES OF CRUSH INJURIES OF THE HAND: A CASE SERIES

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## ABSTRACT

**Background:** Crush injuries of the hand are unfortunately quite common. The causes of crush injuries of hand range from industrial machine injuries, road traffic accidents, fall of heavy object on hand to domestic ones like mixer grinder injury and door - jam injury. **Study Design:** Prospective, interventional, institution based, conducted at a tertiary care hospital - Apollo Multispeciality Hospitals Limited, Kolkata, India. **Method:** Our study includes 10 patients admitted through the casualty, over a time period of 6 months. All patients were operated upon within 24 hours of presentation and underwent salvage procedures. Follow up was done at 1, 3, 6 and 12 weeks. All flaps settled well with reasonably good functional outcomes. **Conclusion:** Timely intervention of crush injuries of hand give excellent functional outcomes with minimum residual deformities or loss of function.

**KEYWORDS :** Crush Injury, Suzuki Frame, Reverse Radial Forearm Flap, Homo Digital Flap.

## INTRODUCTION:

Crush injuries of the hand are, unfortunately common injuries presenting in the emergency department of any tertiary care hospital and can be difficult to salvage. It can vary from a minor fingertip injury sustained by getting compressed between the edges of a closing door or a compression injury occurring from fall of a heavy object on the palm. A **crush injury** is defined as compression of the extremity causing neuromuscular disruption and in case of hand, is sustained when the fingers, or palm are caught between two surfaces with great force, causing damage to the skin and its enclosed contents of soft tissues and bone.[1] With industrialization, there is an alarming increase in the incidence of crush injuries of hand such as high energy road traffic accidents and machine injuries. As a result of advanced trauma care and reconstructive options, finger tips terminalised in the past are now being salvaged.[2]

## Methodology:

This prospective, interventional, institutional based study was conducted at the Department of Plastic Surgery, Apollo Multispeciality Hospitals Limited, Kolkata, India. Study period was 6 months, (January 2021 to June 2021). Patients in the age group of 20-60 years visiting the emergency department with crush injury of hand (open hand injuries, with or without fractures) were included in the study. After a thorough clinical examination, pre operative investigations were done. X ray of hand was obtained to rule out fractures and dislocations. Informed consent was taken before performing the surgical procedure. After antiseptic dressing and draping, wound was thoroughly irrigated with normal saline. The most essential

part of open fracture management is aggressive debridement.[3] After debridement and hemostasis, bony fixation was done. Tendon injuries if any, were repaired. Three of the two cases did not require bony fixation as they were very distal tuft fractures in which the DIP function was optimal, and local flap coverage was sufficient. K wire fixation was done for rest of the cases with fractures.

Two patients with crushed middle phalanx and PIP joint fracture needed application of modified dynamic Suzuki wire frames.[4] One patient with undisplaced 2<sup>nd</sup> metacarpal fracture with loss of skin over dorsum of hand needed flap coverage with pedicled, reverse radial forearm flap. Two thumb tip injuries were salvaged with Moberg and homodigital reverse pedicle island flaps respectively.[5] Two other finger tip injuries needed only soft tissue cover with V-Y advancement flaps.

Post operatively the hands were kept elevated and active movement of fingers was advocated.[6] Intravenous antibiotics were given for 48 hrs post operatively for contaminated wounds. Patients were advised follow up at 1, 3, 6 and 12 weeks. K wires and Suzuki frames were removed at 4 weeks.

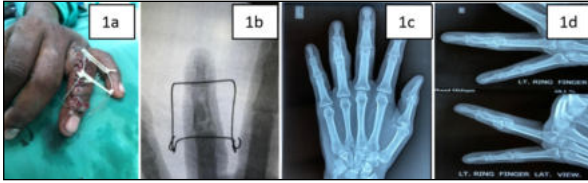
## RESULTS

This study was carried out on a sample of 10 patients with acute crush injuries of hand with or without associated fractures.

All flaps settled well without any losses. Some restriction in flexion was noted in one of the patients having PIP joint fracture treated with ligamentotaxis.

Table 1: General Details

SERIAL NO	AGE	SEX	TYPE OF INJURY	TIME SINCE INJURY	SALVAGE PROCEDURE	COMPLICATIONS
1	22	M	CRUSHED INDEX FINGER TIP	1 HOUR	V-Y ADVANCEMENT	NIL
2	27	M	RING FINGER TIP PULP LOSS	2 HOURS	CROSS FINGER FLAP	NIL
3	37	F	OPEN 2 <sup>nd</sup> METACARPAL FRACTURE WITH SKIN LOSS	4 HOURS	REVERSE RADIAL FOREARM FLAP	NIL
4	41	F	MIDDLE FINGER NAIL BED AVULSION	2 HOURS	PRIMARY REPAIR	NIL
5	53	M	RING FINGER OPEN FRACTURE MIDDLE PHALANX & PIP JOINT	4.5 HOURS	MODIFIED SUZUKI FRAME+SOFT TISSUE REPAIR	RESTRICTED PIP FLEXION
6	26	M	PLUP LOSS THUMB+NAIL BED AVULSION	1.5 HOURS	REVERSE HOMODIGITAL ISLAND FLAP	NIL
7	21	M	CRUSHED TIP OF THUMB	1 HOUR	MOBERG FLAP	NIL
8	35	M	MIDDLE FINGER PIP JOINT FRACTURE DISLOCATION	2.5 HOURS	MODIFIED SUZUKI FRAME	NIL
9	28	F	CRUSHED TIPS MULTIPLE FINGERS	1 HOUR	V-Y ADVANCEMENT	NIL
10	30	M	NAIL BED AVULSION OF THUMB	4.5 HOURS	PRIMARY REPAIR	NIL



**Figure 1**

**Figure 1a** – application of modified Suzuki frame after soft tissue repair,

**1b** – X ray view of the frame in situ,

**1c, d** – 3 months follow up AP, Oblique and Lateral views.



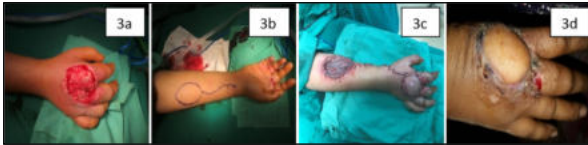
**Figure 2**

**Figure 2a** - loss of pulp and nail bed,

**2b** – reverse homo-digital flap harvested,

**2c** – 3<sup>rd</sup> POD flap in situ,

**2d** – healed thumb at 12 weeks.



**Figure 3**

**Figure 3a** – undisplaced fracture 2<sup>nd</sup> metacarpal with skin loss,

**3b** – reverse radial flap marking,

**3c** – flap inset, and donor area skin grafted,

**3d** – wound healing complete at 2 weeks.

## CONCLUSION

We, therefore conclude from the excellent functional outcome of this case series that early intervention of crush injuries of the hand retain as much function as possible. A decision of amputation should only be made when the injury is life-threatening (life before limb) or salvage procedures cannot preserve the function required.

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