

## Crane Principle Revisited

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**Abstract**

*Background:* Reconstructing defect is the goal of the plastic surgeon which is done on the principle of reconstruction ladder but certain defect needs coverage requiring improvising on the principles, once such is crane principle. In this study, we would like to highlight the use of crane principle in reconstructing defect of hand and protecting vital structures.

*Methods:* 18 year male with full thickness defect of a volar and dorsal aspect of wrist post electrical burn injury underwent flap cover for the defect.

*Results:* Marginal necrosis of flap noted, flap debrided, healthy wound bed noted.

*Conclusion:* Covering of defect employing crane principle though described in earlier days is still relevant in the management of defect with limited donor site.

**Keywords:** Crane principle; Defect; Hand

**Introduction**

Traumatic/ infective cause leading to exposure of vital structure like bone, joint, tendons, vessels, nerves compounds the initial insult sustained. Coverage of such tissue is a prime concern and reconstructive ladder based approach is jumped to achieve coverage of these exposed structures. The problem arises when Peter can't afford to pay to Paul; in such scenario, the use of a carrier or crane was described by Gillies and Millard' in their text, "The Principles and Art of Plastic Surgery" in 1957. They showed the use of one flap, a tubed pedicle flap, to carry another flap to its final resting place, referred to this as a living crane [1].

In this case study, we would like to elaborate on

the age-old principle used to treat our patient who sustained high voltage electrical burn injury.

**Methods**

Our patient is an 18 year old male who sustained accidental high voltage electrical burn injury. Entry point being right hand and exit point left hand. The patient had full thickness burns over the dorsum of right wrist with compartment syndrome of the right hand, right forearm. Fasciotomy was done; deep muscles of the forearm were unhealthy, discolored and edematous. Patient Wound grossly infected with exposed flexor tendons and median nerve. The patient underwent serial debridement and Hypogastric flap cover (**Figs. 1,2**).



**Fig 1:** Volar and dorsal defect of hand



**Fig 2:** Hypogastric flap reconstruction of defect

### Results

Margin necrosis of flap was noted, on postoperative day 7, the entire flap was dismantled.

The bed of the flap had completely granulated which could be covered by skin graft (**Fig. 3**) but flap was reinserted in view of the defect, aesthetic and plan for secondary reconstruction.



**Fig 3:** Wound bed after flap dismantle

## Discussion

Traditionally reconstructive plastic surgeons approach tissue reconstruction by paying due attention to the reconstructive ladder. This was viewed as a ladder with each successive rung representing an increasingly complex mode of treatment. This concept was principally introduced as an aid to obtaining wound closure. Thus the simplest method represented on the ladder is by the primary closure and the most sophisticated is by way of free tissue transfer. It was envisaged that one "climbed" this "ladder" when attempting to close wounds. Thus only after the simplest technique has failed should one try the next level of complexity [2].

Millard in 1969 expanded Crane principle to transport and deposit subcutaneous tissue to cover exposed vital structures of hand and after a week the skin flap is returned to its bed, leaving behind a quarter of its thickness as a vascular bed which can be covered by a skin graft [3].

Erol [4], in 1976, used vascular pedicle to carry tissue; a skin graft was placed over the superficial temporal vessels and later transferred as a pedicle flap based on these vessels. This work demonstrated the utility of vascular pedicles to transfer tissue locally.

Shens [5] prefabricated flaps using the facial vascular bundle and Hyakusoku *et al.* prefabricated a hair-bearing skin flap for lip reconstruction.

Reconstructive methods using crane principle has been advanced from random flap transfer to prefabrication but the basic principle remain the same. In our study, the crane principle was used to protect the flexor tendon of the hand and neurovascular structures.

## Conclusion

Covering of defect employing crane principle though described in earlier days is still relevant in the management of defect with limited donor site.

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