

Original Article

Resurfacing of hand injury with groin flap: an analysis of thirty four cases

Ghosh JC¹, Hazra SC², Singha SK³, Aolad FR⁴

Abstract

Hand injuries are prevalent among the young adult and middle aged active people specially who are engaged with machinery works. Hand performs the unique and essential mechanical function and for fulfillment of this function it is imperative to provide good soft tissue coverage with sensibility. Skin grafting causes wound contraction and result in gliding of tendon directly under skin and is also unable to provide sensibility. Though cutting and slicing injury can be closed directly, crushing, degloving and avulsion injury needs coverage with a flap. Free flap require highly skilled microvascular anastomosing technique and needs expertise. Pedicle flap are suitable for this purpose where facilities for free flap transfer are not available. This prospective observational study which was done in National Institute of Traumatology and Orthopadic Rehabilitation during the period from January 2000 to december 2001 involving thirty four patients with a age range of 15-50 yrs who sustained hand injury from machinery injury, road traffic accident and electric burn. The patients were followed up at 4th (week), 6th (week), 8th (week), 16th and 20th week. Majority of patient are male. 58.82% of patient had suffered from machinery injury and 23.52% of patient had suffered from road traffic accident. During resurfacing of hand injuries, 58.82% of patient needed a flap length between 15 to 17 cm and rest of the patient (41.16%) requires flap length below 15 cm. Among all patients, 70.6% required 7 cm to 10 cm wide flap and rest of the patient between 5 cm to 7 cm. About 86% of patients had no loss of flap, 10.71% had marginal distal flap loss, 3.57% patient had distal flap loss up to 5% and no patient had distal flap loss >5%. Functional out come in terms of Eating, drinking, dressing, washing, writing were satisfactory in all cases except

only one patient who developed stiffness of hand which was 3.58% of total patient. Functional outcome were evaluated in terms of eating, drinking, dressing, washing, writing and other purposeful movement; and also in terms of joint movement, power grip and pinching. All patient regained full range of movement except one patient who had deficit of finger movement. In conclusion groin flap can be a better choice for resurfacing the hand injury with acceptable results. This study recommends the use of groin flap as routine choice for resurfacing larger hand injuries.

Key words : Hand injury, skin grafting, flap coverage

Introduction

Hand is one of the most important organs of human body which consist of well formed skeletal framework on which multiple tendons works to bring out the purposeful function. This skeletal framework and tendons are covered with soft tissue and skin. The hand serves three basic functions; sensory perception, Precise manipulation and power grip.^{1,2} Without normal sensation and the ability to oppose, these digits loses their ability of manipulative precision. The hand of man differs from that of other creatures in being having a grasping mechanism combining great strength with finely controlled accuracy and at the same time serving as the chief tactile organ. Hand has rich cortical connection both sensory and motor innervations.³⁻⁶

With more mechanization in the home and at work, the hand is injured with increasing frequency. As much as man has been able to increase efficiency by replacing the hand with instruments and apparatus, the number of injuries caused by these various instruments and apparatus have significantly increased. In our country most of the hand trauma are caused by machinery injuries, road traffic accident and electric burn. The injuries may be of a variable combination of skin, soft tissue, tendons, nerves, blood vessel & bone damage. When bones and tendons are exposed for a long time they become dried, desiccated, infected and ultimately destroyed with loss of function. All these can easily be prevented by covering the exposed bones and tendons with a flap. Hand injuries are of three main types; cutting and slicing, crushing, degloving and avulsion.^{1,7,8} Cutting and slicing injury can be closed directly after sufficient excision of the devitalized skin.

Provisions of skin cover in hand trauma takes priority

1. *Dr Jagodish Chandra Ghosh, Senior Consultant, Infectious Diseases Hospital, Mohakhali, Dhaka.
2. Dr Samaresh Chandra Hazra, Junior Consultant, Infectious Diseases Hospital, Mohakhali, Dhaka.
3. Dr Sudhansu Kumar Singha, Assistant Registrar, National Institute of Traumatology and Orthopadic Rehabilitation (NITOR), Dhaka.
4. Professor Md Faroque Reza Aolad, Director (Ex), National Institute of Traumatology and Orthopadic Rehabilitation (NITOR), Dhaka.

*For correspondence

because the granulation tissue which is produced in the process of healing by secondary intention matures to fibrous tissue. The presence of a raw surface is a potential focus of infection also. Fibrosis and infection are both harmful, which are responsible for stiffness of joints following trauma. As the hand perform unique mechanical function, it is also imperative to provide good soft tissue coverage of the hand. Skin graft, when used, may cause wound contraction. More over skin graft fails to provide sensibility which is important for hand function. All flaps include the entire thickness of skin and subcutaneous tissue along with their own blood supply. So they provide better and durable skin and soft tissue coverage. Moreover they provide sensibility also. They also provide subcutaneous fat through which tendons can glide. There is chance of minimum wound contraction as there is no myofibroblast within the flap.^{7,8,9}

While replacing the missing tissue, it should always be kept in mind about the quality of the tissue that is lost and an attempt to replace the tissue with similar one. Groin flap may be one of the ideal flap for coverage of exposed tendons and bones of the hand. It provides a minimum tissue bulk and good skin colour and texture. It also provide sufficient length and breadth required for resurfacing the dorsum and palmar aspect of the hand.^{3,10} The hand can be placed in a comfortable position without causing discomfort to the shoulder, elbow & wrist joint. The major disadvantage of this flap is that, it require two staged surgery as other pedicle flap, and the pedicle of the groin flap is also close to external genitalia which is at potential risk of having infection.

Methods

It was a prospective observational study which was done in National Institute of Traumatology and Orthopaedic Rehabilitation during the period from January 2000 to december 2001. Thirty four patients who sustained hand injury were included in this study.

Patients between 15-50 yrs of age, who sustained from machinery injury, road traffic accident and electric burn were included in this study. Patient coming with wounds free of infection within 72 hours were included in this study. Bone fracture, if any, were stabilized before flap coverage. Patient who had grossly infected wound, major neurovascular deficit and those who came 72 hours after injury were excluded from this study.

Purposive sampling method was followed as per inclusion and exclusion criteria. A structured data sheet containing history, examination finding, and operative procedure were used to collect the data. Collected data were

analyzed with the help of computer and a scientific calculator.

In this study 34 (thirty four) cases of hand injury over the palm, dorsum of the hand and web spaces were covered by groin flap. In all cases recipient area were prepared preoperatively. Wound swab were taken and culture sensitivity were done. Pre operative injectable antibiotics followed by oral antibiotic for about 10-14 days postoperatively were given to all patient.

Operative procedure

The wound was, under either general anesthesia or regional block, irrigated thoroughly with copious amount of normal saline and then with antibacterial agents during the operative procedure. Tourniquet was not used in any case. Particular attention was given to excise the merest silver of skin was from the wound edge only and as much skin as possible was spared. Wound was extended by planned incision to obtain adequate exposure in case of need. The patient was positioned so that the femoral triangle is visible. After skin preparation flap were elevated by dissecting superficial to deep investing fascia to ensure that the superficial circumflex iliac vessels are included in the flap. Proximal dissection was not carried beyond the medial border of the sartorius muscle to prevent injury to superficial circumflex iliac artery. At the lateral border of sartorius, the dissection was carried deeply to the fascia and stopped at the medial border at the muscle. In most cases donor area was narrow and was closed by mobilization of the skin from above and below. In four cases skin graft were added to close the donor site. Flaps were checked regularly before the patient was discharged from the hospital. The patients were then followed up at 4th (week), 6th (week), 8th (week), 16th and 20th week. All patients were advised for active and passive exercises.

Results

In this study, thirty-four patients were managed during the two years period from January 2000 to December 2001. Out of 34 patients, 6 (six) were lost from follow up. The rest of the patients were followed up for a variable period extending from three month to six months. Mean follow up time was 4.2 month \pm 0.27 month.

The age range of the patients was 15-50 years. Majority of patient belonged to the age group 26-35 years. Majority of patient are male (94.11%).

58.82% of patient had suffered from machinery injury and 23.52% of patient had suffered from road traffic accident, indicating that majority of the patient had machinery injury.(Table -I)

Table-I: distribution of patients depending on mode of accident

Mode of accident	Number of patient	Percentage of total patient
Road traffic accident	08	23.52
Machinery injury	20	58.82
Electric burn	6	17.6

During resurfacing of hand injuries, 58.82% of patient needed a flap length between 15 to 17 cm and rest of the patient (41.16%) requires flap length below 15 cm. (Table-II)

Table-II : distribution of patient according to the requirement of flap length

Length of flap	Number of patient	Percentage of total patient
10 cm to 12 cm	7	20.58
15 cm to 17 cm	20	58.82
17 cm to 19 cm	7	20.58

During resurfacing of hand injuries, 58.82% of patient needed a flap length between 15 to 17 cm and rest of the patient (41.16%) requires flap length below 15 cm. (Table-II)

Table-V: distribution of patients on the basis of functional out come (n=28)

Functional out come	Full range of movement		Restricted movement		Stiffness		Disability	
	No. of Patient	Percentage of total patient	No. of Patient	Percentage of total patient	No. of Patient	Percentage of total patient	No. of Patient	Percentage of total patient
Eating	28	100	Nil	00	Nil	00	Nil	00
Drinking	28	100	Nil	00	Nil	00	Nil	00
Dressing	28	100	Nil	00	Nil	00	Nil	00
Washing	27	96.42	Nil	00	1	3.58	Nil	00
Writing	28	100	Nil	00	Nil	00	Nil	00

Table-III: Distribution of patients according to width of flap

Width of flap	Number of patient	Percentage of total patient
5 cm to 7 cm	10	29.4
7 cm to 10 cm	24	70.6

About 86% of patients had no loss of flap, 10.71% had marginal distal flap loss, 3.57% patient had distal flap loss up to 5% and no patient had distal flap loss >5%(Table-IV)

Table - IV: distribution of patient in terms of flap necrosis

Flap loss	Number of patient	Percentage of total patient
No loss of flap	24	85.71
Marginal distal flap loss	03	10.71
Distal flap loss upto 5%	1	3.57
Distal flap loss >5%	Nil	0.0%

Functional out come in terms of Eating, drinking, dressing, washing, writing were satisfactory in all cases except only one patient who developed stiffness of hand which was 3.58% of total patient. (Table – V)

All patient regained full range of movement except one patient who had deficit finger movement. (Table–VI)
All patient regained full range of movement except one patient who had deficit finger movement. (Table –VI)

Table-VI: functional outcome after resurfacing the hand injury with groin flap

Range of movement	Full		Good		Acceptable		Poor	
	No. of Patient	Percentage of total patient	No. of Patient	Percentage of total patient	No. of Patient	Percentage of total patient	No. of Patient	Percentage of total patient
Finger movement	27	96.42	1	3.58	Nil	00	Nil	00
Wrist movement	28	100	Nil	00	Nil	00	Nil	00
Handgrip	28	100	Nil	00	Nil	00	Nil	00
Pinch	28	100	Nil	00	Nil	00	Nil	00

Discussion

In present series thirty four patients with hand injury were treated by resurfacing the wound with groin flap. All patients were kept under follow up for an average 4.2 months (\pm 0.27 month). Six patients were lost from the follow up. So result of this study is analyzed from the follow up of twenty-eight patients. The age range was 15-55 years and among them 70.58% patient were in the age range 26 – 35 years. This reflect that hand injury are much more prevalent in patient who are young and active. In this series, 94% of the patients are male reflecting that male are more commonly predisposed to hand trauma.

Among al patients, 58.82% patient sustained hand trauma from machinery injury reflecting that hand injuries are prevalent among those who work in machine tool or factory and workshop.

In context to the length and breadth of the flap, about 59% of patient had required a flap length between 15-17 cm and breadth between 7-10 cm indicating that extend of most hand injuries in this series were quite large. The distant pedicle flap was most satisfactory method for coverage of such quite large defects. The other suitable method for coverage of such quite large defect is distant hypogastric flap. Both the groin and hypogastric flap contain abundant amount of fat, the hypogastric one contain more fat than that of groin. At the same time, skin which is often hairy in hypogastric flap is usually free of hair in groin flap. So groin flap was more satisfactory for resurfacing of these injuries.^{9,10,13}

In this study, 24 patients had no loss of flap, which is about 86% of total patients. Three patients had marginal distal flap loss and only one patient had a distal flap loss

of about 5% of its length. None of the patients had flap loss more than 5% of the flap length, so only 14% of patient had partial flap loss.

Flap which lack a clear cut directional orientation of blood flow and have no focal point where arterial input and venous outflow are recognizably concentrated tends to have inefficient perfusion characteristics.⁹ The groin flap has a well-defined vascular pedicle containing superficial circumflex iliac artery which is a direct branch of femoral artery. In all case in this study the flap was mapped out preoperatively, in case of demand additional margin of reserve was taken and the inseting of flap were done without tension. Due to all these precautions taken for resurfacing the hand injury with groin flap, it gave a satisfactory result.

Result of resurfacing the hand injury with groin flap were categorized as good, acceptable and poor an the basis of (a) Extent of loss of flap (b) Flap adhesion (c) Whether flap loss were salvageable or not. Depending on above criteria about 69% patient had a good result and another 18% patient showed acceptable result. So the resurfacing of the hand injury with groin flap gives a very good result.

Functional outcome were evaluated in terms of eating, drinking, dressing, washing, writing and other purposeful movement; and also in terms of joint movement, power grip and pinching. Regarding eating, drinking, dressing and writing, the entire 28 patients, who completed the follow-up, showed good result. Only one patient developed stiffness of fingers. Regarding joint movement, power grip and pinching; 96% of patient had regained full range of finger movement. All patients had regained full range of wrist movement.

The patients were selected as per strict inclusion criteria and the sample size was not too large. Still, it can be concluded from the study, that groin flap can be a better choice for resurfacing the hand injury with acceptable result.

References

1. Apley GA, Solomon L. Apley's system of orthopedics and fracture. 7th ed. B Heinemann: Oxford ; 1993. p. 333-34.
2. Cuschieri A, etal. Essential surgical practice. 3rd ed. Butter worth-Heineman Ltd : oxford; 1995. 460-61.
3. Chase RA. Atlas of Hand Surgery. 1st edition. W B Saunders Company :Philadelphia ; 1973. p. 136-146
4. Crenshaw AH. Campbell's operative orthopaedics. 8th ed. Mosby year book; 1992: 3181-99
5. Guyton AC, Hall JE. Text Book of Medical Physiology. 9th edition. Saunders Company : Philadelphia; 1998. p. 199-220
6. Ganong WF. Review of Medical Physiology. Appleton and Lange : New york; 1999. p.582-600.
7. Hunter JM et al. Rehabilitation of the hand, Surgery and therapy. 3rd ed. The CV Mosby company : New York; 1990. p. 3-92
8. Mc Minn RMH. Last's Anatomy, regional and applied. 91h ed. Churchill living stone : London; 1994. p. 53-143.
9. Mc Gregor AD, Mc Gregor JA. Fundamental technique of plastic surgery. 10th ed. Churchill living stone : London; 2000. p. 183-213.
10. Mc Gregor IA, Jackson IT. The groin flap. Br. J. Plastic Surgery. 1972, 25;3 : 104-10.
11. Mc Carthy JG, James W, May JR, Littler JW. Plastic Surgery, W.B Saunders Company : Philadelphia; 1990. p. 1-21
12. Mc Carthy JG, James W, May JR, Littler JW. Plastic Surgery. W.B Saunders Company 1990; Vol 7 : 4441-58
13. Soutar DS, Tanner NSB. The radial forearm flap in the management of the soft tissue injury of the hand. British journal of plastic surgery. 1984; 37: 18-26.