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"Groin Flap" for Reconstruction of Defects on Dorsum of the Hand

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Abstract

Background: The groin flap has been using in reconstructive surgery for more than 4 decades. As hand injury is common occurrence and proper management of hand give active manpower and thereby reduce burden on country's economic status. So, this study was aimed to find out the outcome of groin flap for coverage of a wound over dorsum of the hand. Objective: The aim of the study was to evaluate the Groin Flap" for Reconstruction of Defects on Dorsum of the Hand. **Methods:** This Prospective observational study was conducted among the patients of Department of Plastic Surgery and Burn unit of Dhaka Medical College & Hospital, Dhaka, from August, 2017 to July, 2019. Total 60 patients having defects over dorsum of the hand resulting from traumatic injury, post electric burn wound, post burn deformity and hand infection admitted during study period were included into the study following ethical approval from ERC of DMC. Data were compiled, edited, managed and analyzed. The results were tabulated in table. Data analysis was done by Pearson's chi square test. P value was significant at <0.05. Then data analyzed using the software SPSS (statistical package for social sciences). **Result:** The mean age of the respondents was 30.68±12.24 years with a majority in age group 20-29 years with male predominance 38(63.3%). The mean length and width of the wound was 8.15 (±2.60) cm and 6.00 (±1.86) cm respectively. The mean length and width of flap was 8.97 (±2.82) cm and 6.30 (±1.83) cm. Maximum length of flap was 18 cm and maximum width of flap was 10 cm. About 10% patients experienced marginal necrosis and only 2% experienced total flap loss while 86.67% patients had no flap related complication. In donor site, only10% had wound dehiscence. Results of reconstruction, 83.3% patients had excellent wound coverage, 13.3% patients had satisfactory wound coverage and only 3.3% patients had poor wound coverage. **Conclusion:** Considering the overall outcome of groin flap may be a good option for reconstruction of defects on dorsum of hand.

Keywords:- Pedicled; Groin flap; Dorsum of hand.

INTRODUCTION

The upper extremity is one of great importance as it holds and sustains the hand, which is after brain, our body's most perceptive organ. The soft tissue envelop of the hand is uniquely designed to provide tactile input from our environment must also withstand substantial wear over a lifetime. In our country most of the hand trauma are caused by machinery injuries,

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Vol-7, Issue-6 | November-December 2021
Page no- 340-351 | Section- Research Article (Cardiology)

RTA, and burn. The injury may involve a variable combination of skin, soft tissue, tendons, blood vessels and bone damage. All these injuries can easily be reconstructed by covering the exposed bones and tendons with a flap. Most of the hand surgeons have to face the challenge of reconstruction of hand regarding type and extent of tissue loss for restoring optimum hand function by using the reconstructive tools such as skin grafts, local flap, regional flap, distant flap, free flap. Skin grafts do not necessarily provide the optimal functional or aesthetic result. Skin graft over paratenon or periosteum may lead to unstable scar. Moreover skin graft fails to provide sensitivity which is important for hand function. All flaps include the entire thickness of skin and subcutaneous tissue and carry with them their own blood supply, so they provide better and durable skin cover, also provide sensibility because of their own cutaneous nerve supply.

Local flaps are reserved for smaller defects. Because of the size limitation of local and regional flaps and the potential involvement of these flaps in the injury zone, distant flaps may be required in cases of extensive tissue loss. Among all distant flaps, the groin flap has traditionally favored flap for upper extremity reconstruction. This flap based on the superficial circumflex iliac artery, is relatively straightforward to elevate, and is capable of providing significant amounts of reliable skin cover. The aim was to study the outcome of groin flap for reconstruction of defects on dorsum of the hand. The groin flap based medially and lies along the line of the groin, using as its arterio venous system the superficial circumflex iliac vessels. The artery arises 2-3 cm below the inguinal ligament, usually from the femoral artery, occasionally from the superficial epigastric artery at its origin. It runs laterally, parallel to the inguinal ligament, and at the medial border of sartorius gives a deep branch. From that point onward it gradually becomes more superficial, passing into the tissue which would be raised as a groin flap. Lateral to the anterior superior iliac spine it divides and is no longer regularly identifiable. The corresponding vein has a general pattern parallel to the artery ending at the saphenous opening which is very close to the origin of the artery.

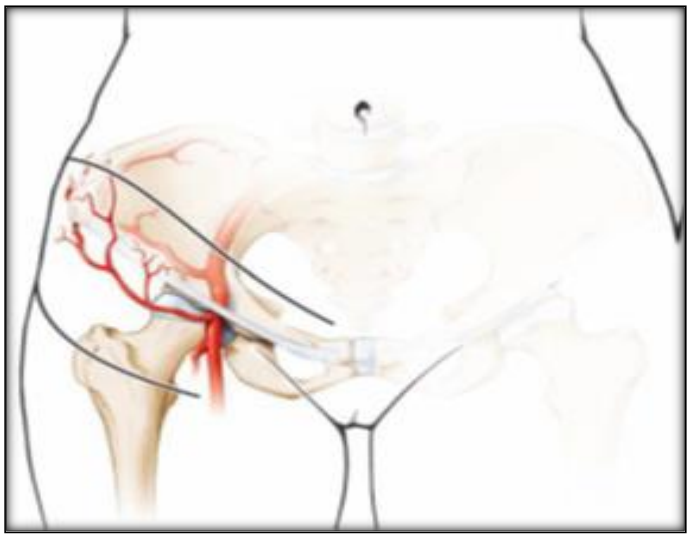

Image I: Dominant pedicle: superficial circumflex iliac artery and groin flap.

(Reference: Michael Zenn, Glyn Jones,Reconstructive Surgery,Anatomy,Technique and Clinical Applications, vol 2, chapter 10, page 1244)

Surgical Anatomy (Landmarks): The skin of the lateral groin may be elevated as a flap extending between the femoral vessels and the posterior iliac spine. The long axis of the flap is centered over a line parallel and 3 cm inferior to the inguinal ligament with a flap width of 6

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Page no- 340-351 | Section- Research Article (Cardiology)

to 10 cm. A simple, convenient technique for flap marking is to include 2 fingerbreadths above the inguinal ligament and 4 fingerbreadths below the inguinal ligament, the dimensions of which will easily capture a safe and well vascularized skin flap. Composition: Fasciocutaneous, Size: 25 cm × 6 to 10 cm. The standard flap dimensions are 25 cm × 10 cm, with the flap extending from the medial edge of the sartorius muscle to a variable distance 5 to 10 cm lateral to the anterior superior iliac spine. If the width of the flap is increased, direct donor site closure becomes progressively more difficult. Arterial Anatomy (Type A Fasciocutaneous) Dominant Pedicle: Superficial circumflex iliac artery, Regional Source: Superficial femoral artery. Length: 2 cm, Diameter: 0.8 to 1.5 mm. Location: Arises from the femoral vessel deep to the deep fascia of the medial groin. The superficial branch passes over the medial border of the sartorius muscle to enter the fat of the groin. The deep branch can pass through some of the muscle bulk of the sartorius before entering the groin flap as a musculocutaneous perforator. Either vessel can support the skin island. Venous Anatomy: Single veins accompanying the arterial circulation, draining to the saphenous vein; the average venous diameter is 1.5 mm. Nerve Supply (Sensory): Lateral cutaneous nerve of T12.

Flap Harvest (Design and Markings): The pubic tubercle and the anterior superior iliac spine are palpated and a line is drawn between these two landmarks. This line is the surface marking of the inguinal ligament.

The rule of thirds applies to marking the borders of the flap, one third above and two thirds below the inguinal ligament. The "thirds" refers to 3 cm or 2 fingerbreadths as a measure. One third or 3 cm above the inguinal ligament and two thirds or 6 cm below the inguinal ligament demarcate the boundaries of the flap's width. The vascular pedicle lies 3 cm below and parallel to the inguinal ligament. The point of origin of the vascular pedicle is determined by palpation of the femoral artery within the femoral triangle, the depression visualized immediately inferior to the fold of the groin. This triangle is formed by the inguinal ligament superiorly, the medial border of the sartorius laterally, and the lateral border of the adductor longus medially. The projected course of the sartorius is marked to define the lateral boundary of the femoral triangle. Patient Positioning: The patient is placed in the supine position with a beanbag or folded towel under the posterior iliac spine on the side of the planned flap. Flap Dissection: A Doppler probe helps to locate the pedicle over the medial edge of the sartorius and trace its course laterally to the anterior superior iliac spine. The venae comitantes are either located deep to the femoral artery entering the femoral vein or entering the saphenofemoral vein junction. The superficial vein, the primary draining vein of the flap, is located superficial to the superficial circumflex iliac artery and drains into the saphenous vein at the level of the saphenous bulb located immediately distal to the fossa ovalis. The deep branch courses into the medial aspect of the belly of the sartorius before perforating the anterior surface of the muscle to enter the deep aspect of the overlying fat and skin. Dissection of this vessel creates a perforator groin flap with a potentially longer pedicle. The flap is elevated in a distal to proximal direction. The skin is incised around the lateral, superior, and inferior margins. Elevation is begun in a plane

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E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-6 | November-December 2021
Page no- 340-351 | Section- Research Article (Cardiology)

directly superficial to the fascia lata. The flap is elevated from the anterior superior iliac spine and the external oblique fascia and inguinal ligament. When the sartorius muscle is visualized, the flap is elevated deep to the investing fascia immediately superficial to the muscle belly. The medial edge of the sartorius muscle denotes the proximal limit.

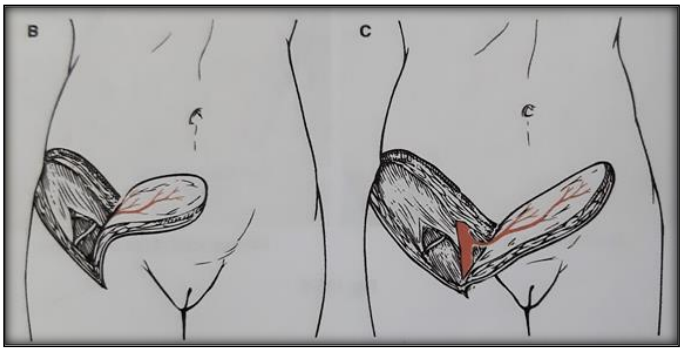

Image II: Relationship of flap pedicle to groin muscle and fascial layers.

(Reference: Michael Zenn, Glyn Jones, Reconstructive Surgery, Anatomy, Technique and Clinical Applications, vol 2, chapter 10, page 1248)

MATERIAL AND METHODS

The study was conducted at the Department of Plastic surgery & Burn unit, Dhaka Medical College & Hospital, Dhaka, Bangladesh, to evaluate the Groin Flap" for Reconstruction of Defects on Dorsum of the Hand.. A total of 60 cases were chosen at random for the study, sampling is carried out during study period on patients with wound over dorsum of hand as per inclusion and exclusion criteria. All patients are counseled for surgery and informed written consent for surgery as well as preoperative and post-operative photograph was taken. From August 2017 to July 2019 a clinical examination and evaluation were conducted. Inclusion Criteria were wound over dorsum of hand resulting from machinery, road traffic accident, electric burn, flame burn, post burn deformity and hand infection and Patient age up to 60 years. Exclusion Criteria were Patients with associated life threatening injury, Patient having trauma in the donor site, Patients with major psychiatric disorders and Patients not consenting to take part in the study. This Prospective Observational study done in Department of Plastic surgery & Burn unit, Dhaka Medical College & Hospital. Patients attending with defects over dorsum of the hand resulting from traumatic injury, post electric burn wound, post burn deformity and hand infection were approached for this study and 60 patients were enrolled, as per inclusion and exclusion criteria. All selected patients counseled for surgery and informed written consent for surgery as well as pre-operative & post-operative photographs were taken. Detail history taken from each patient including clinical history and demographic information. All patients underwent reconstructive surgery on their defected hand by using thin groin flap. Surgery done meticulously in department of Plastic surgery, DMCH. Proper pre, per and postoperative care taken of each patient and all received necessary management according to their condition. Then they evaluated clinically for outcome. All data recorded in a predesigned case record from and checked for inconsistency. Then data analyzed using the software SPSS (statistical package for social sciences).

RESULTS

This prospective observational study was performed in the department of Plastic surgery & Burn unit of DMCH, Dhaka. After careful

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Vol-7, Issue-6 | November-December 2021
Page no- 340-351 | Section- Research Article (Cardiology)

history taking, examination and appropriate investigations fulfilling inclusion and exclusion criteria, total 60 patients with defects over dorsum of the hand resulting from traumatic injury, post electric burn wound, post burn deformity and hand infection admitted in department of Plastic surgery & Burn Unit during study period, irrespective of their gender, race, ethnic group and age was included in this study. The main aim of the study was to study the outcome of groin flap for reconstruction of defects over dorsum of the hand. Greater part of the patients was male (63.3%) and rest 36.7% were female. More than 1/3rd of the patients were day laborer (36.7%). Major part of the patients had reason for being defect was machinery injury (26.7%) followed by road traffic accident (23.3%), post-infection (23.3%), post-burn (20%) and electric burn (6.7%). Most (76.7%) of the patients had no co-morbidity. Only 20% patients had HTN and/or DM. Local examination of defect over dorsum of the hand among patients revealed 26.6% had tendon exposure and 10% had bone exposed. Wound swab C/S of defects found no growth among 56.7% of the study patients. Among 26 (43.3%) patients who had infection, 20 (76.9%) had Pseudomonas species and rest 6 (23.1%) had Acinetobacter. The mean length of the wound was 8.15± 2.60 cm and width were 6.00± 1.86 cm. The maximum length was 14 cm and maximum width was 10 cm. The minimum length was 4 cm and minimum width was 3 cm. The mean length of flap was 8.97±2.82 cm and mean width was 6.30±1.83 cm. Maximum length of flap was 18 cm and maximum width of flap was 10 cm. Minimum length of flap was 4 cm and minimum width of flap was 3 cm. Good outcome found in majority (86.67%) flap. Satisfactory outcome in 10% flap, and poor outcome in 3.3% flap. Majority (86.67%) patients had no flap related complication. 10% had marginal necrosis and only 3.3% had total flap loss. About 90% flap donor site had no complication. Rest 10% had wound dehiscence.

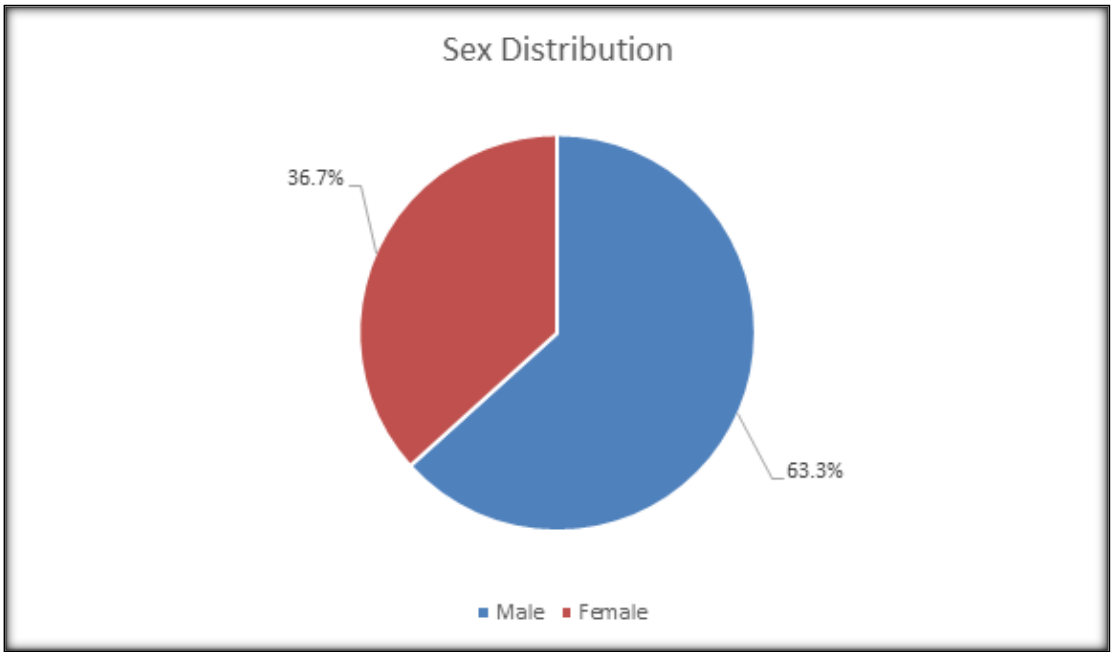

Figure 1: Distribution of patients according to sex (n=60)

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Vol-7, Issue-6 | November-December 2021
Page no- 340-351 | Section- Research Article (Cardiology)

Table 1: Distribution of cases according to age (n=60)

Age group (Years)	n=60	%
< 19	12	20
20-29	18	30
30-39	13	21.7
40-49	11	18.3
>50	6	10
Total	60	100
Mean age	30.68±12.24	

Table 2: Distribution of patients according to occupation (n=60)

	Frequency	Percentage (%)
Business	4	6.7%
Service	4	6.7%
Day laborer	22	36.7%
Farmer	2	3.3%
Student	14	23.3%
Housewife	14	23.3%

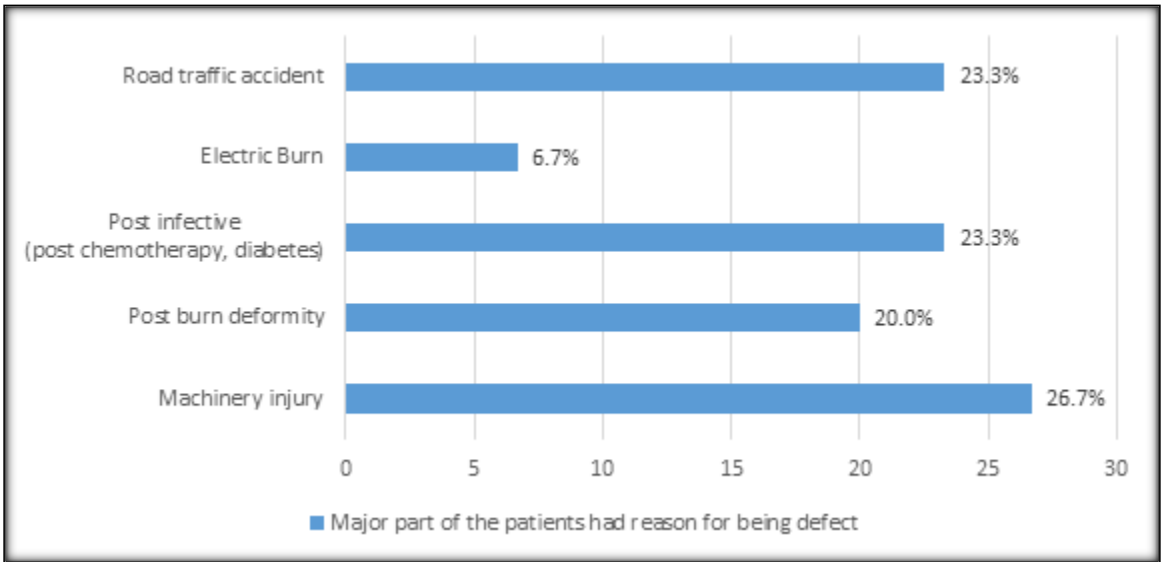

Figure 2: Etiology of defect (n=60)

Table 3: Co-morbidity among patients (n=14)

	n	%
Diabetes Mellitus	8	13.3%
HTN	4	6.7%
Bronchial asthma	2	3.3%

Annals of International Medical and Dental Research
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Vol-7, Issue-6 | November-December 2021
Page no- 340-351 | Section- Research Article (Cardiology)

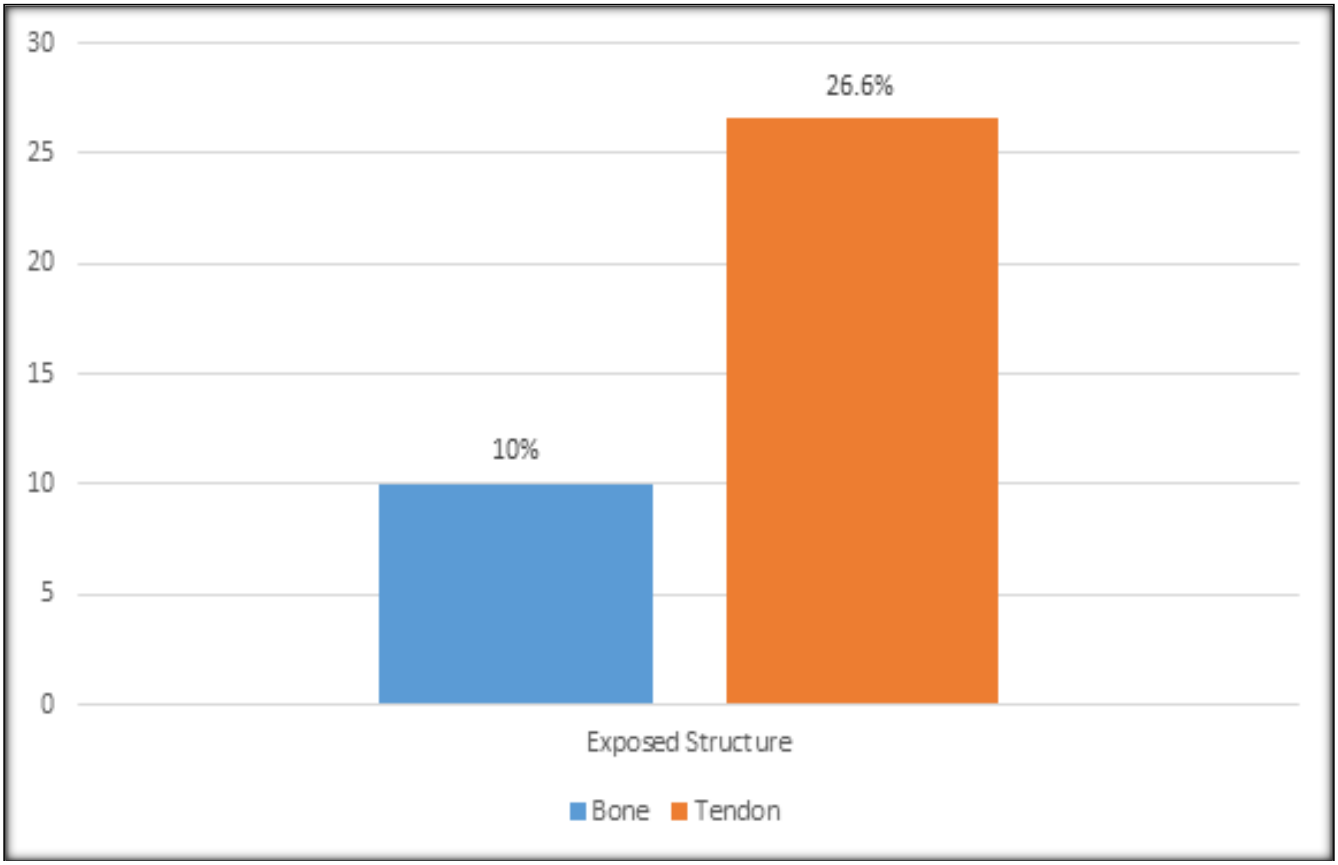

Figure 3: Exposed vital structures among patients (n=60)

Table IV: Micro-organisms present according to C/S report among patients (n=52)

	n	**%**
Growth present	26	43.3%
Pseudomonas species	20	76.9%
Acinetobacter	6	23.1%

Table V: Length and width of wound and flap (n=60)

		Mean±SD (in cm)	**Minimum (cm)**	**Maximum (cm)**
Wound	Length	8.15± 2.60	4	14
	Width	6.00± 1.86	3	10
Flap	Length	8.97±2.82	4	18
	Width	6.30±1.83	3	10

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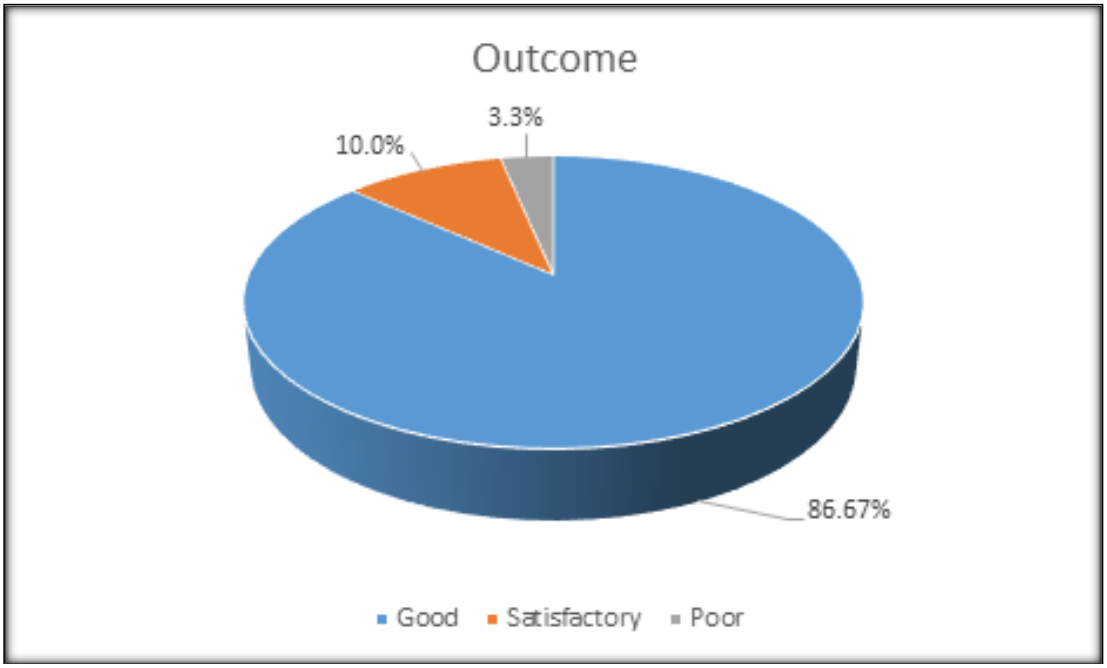

Figure IV: Flap related outcome (n=60)

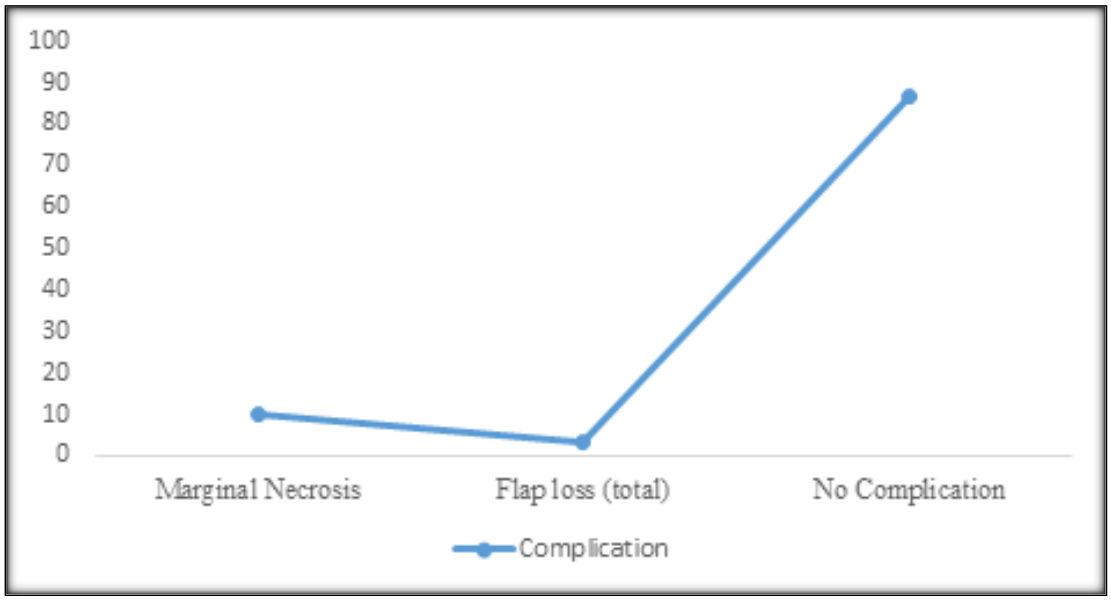

Figure V: Flap related complications (n=60)

Table V: Morbidity of donor site (n=60)

	n	**%**
Wound dehiscence	6	10%
No complication	54	90%

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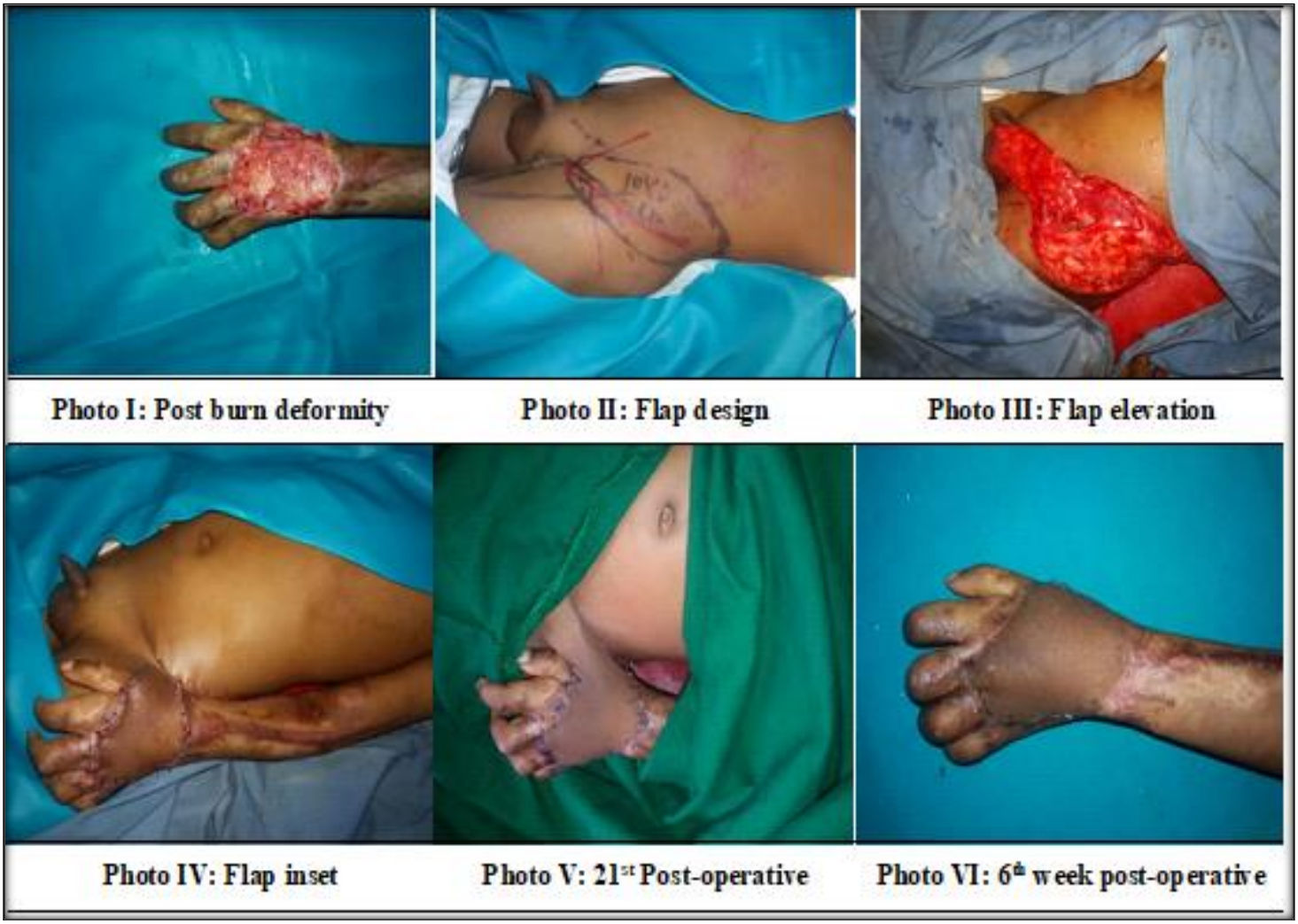
Page no- 340-351 | Section- Research Article (Cardiology)



DISCUSSION

The dorsum of the hand is a very specialized region with thin and fragile skin characterized by poor subcutaneous tissue. The dorsal aspect of the hand is frequently prone to different types of injuries (crush, degloving, hot press, friction...) resulting in exposed tendons and bone.[1] Such defects necessitate early flap coverage to protect underlying vital structures, preserve hand functions and to allow for early rehabilitation.[2] Many flaps have been described and used for coverage of various hand defects. Of these flaps, there are reversed flow flaps that sacrifice a great vessel like reversed radial forearm flap, and reversed perforator forearm flaps that do not sacrifice vessels.[3] Also, there are distant flaps that are often used for the reconstruction of larger defects and offer a great amount of skin without other donor site morbidity to the injured hand. Distant flaps may be pedicle or free flaps.[4] The standard flaps used in the reconstruction of hand are the groin flap, the abdominal flap, the bilobed flap, the abdominal pocketing procedure and free vascularized flaps. The Abdominal flap is a time-tested flap that is used for resurfacing

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Vol-7, Issue-6 | November-December 2021
Page no- 340-351 | Section- Research Article (Cardiology)

degloving injuries of the palm or dorsum of the hand. It has the advantages of ease of elevation, ease of positioning and vascular reliability, while the groin flap is a pedicled flap which is based on the superficial circumflex iliac artery. It provides thin, compliant skin for the thumb, single finger and double finger defects. This flap has the advantage of primary donor site closure, hidden donor site, vascular reliability and versatile use.[5,6] Disadvantage of conventional pedicle groin flap have been discussed in various recent reports. The flaps are usually bulky, required further debulking, and causes patient discomfort, joint stiffness.[7] The main aim of this prospective observational study was to evaluate the outcome of groin flap for reconstruction of defects over dorsum of the hand. Total 60 patients with defects over dorsum of the hand resulting from traumatic injury, post electric burn wound, post burn deformity and hand infection admitted in department of Burn & Plastic surgery, DMCH during study period, irrespective of their gender, race, ethnic group and age was included in this study after careful history taking, examination and appropriate investigations fulfilling inclusion and exclusion criteria.

Average age of all patients was 30.68±12.24 years (10-56 years). Maximum age was 56 years and minimum age 10 years. Maximum were in 20-29 years age group (30%) and followed by 30-39 years (21.7%), ≤19 years (20%), 40-49 years (18.3%) and ≥50 years (10%). Study conducted by Goertz and associates found mean age 33.[8] Another study conducted by Jonathan A. Zelken and associates found mean age of their cases 31.6 years which is also consistent to the findings of this study.[9]

Among the study cases maximum 38(63.3%) were male and 22(36.7%) were female with a similarity to several other studies.[10] Goertz et al found male/female ratio was 4:1.[8] Gosh JC and associate found majority of patients are male (94.11%).[11]

Major part of the patients had reason for being defect was machinery injury (26.7%) followed by road traffic accident (23.3%), post infective (23.3%), post-burn (20%) and electric burn (6.7%). According to Gosh JC et al among their 34 study cases 58.8% of patient had suffered from machinery injury and 23.5% of patient had suffered from RTA.[11] Mohamed Abdelrahman and associates found majority of patients had reason of defect was crush injury.[12]

Wound swab C/S of defects found no growth among 56.7% of the study patients. Among 26 (43.3%) patients who had infection, 20 (76.9%) had Pseudomonas species and rest 6 (23.1%) had Acinetobacter.

The mean length of the wound was 8.15± 2.60 cm and width were 6.00± 1.86 cm. The maximum length of wound was 14 cm and maximum width of wound was 10 cm. The minimum length was 4 cm and minimum width was 3 cm. The mean length of flap was 8.97±2.82 cm and mean width was 6.30±1.83 cm. Maximum length of flap was 18 cm and maximum width of flap was 10 cm. Minimum length of flap was 4 cm and minimum width of flap was 3 cm. This finding is similar to the findings of Gosh JC et al, maximum flap length 17 cm and maximum width of flap 10 cm.[11] Another study conducted by Mohamed Abdelrahman and associates found mean flap size 20×9 cm2 in the suprafascial group and 15×9 cm2 in the subfascial group.[12]

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Page no- 340-351 | Section- Research Article (Cardiology)

Maximum (86.67%) patients had no flap related complication. 10% had marginal necrosis and treated conservatively. only 3.3% had total flap loss and needed skin grafting. About 90% flap donor site had no complication. In a study 85.7% of patient had no flap loss, 10.7% had marginal distal flap loss.[11] In another study total flap loss is described in 0 to 8% of cases.[13] A study by Goertz et al on the effectiveness of pedicled groin flaps in the treatment of hand defects found only one flap loss occurred among 49 patients, results were mostly classified as good, and 82% of patients would undergo the procedure again.[8] Of all the 50 flaps raised in hand injury in the study of McGregor et al, only 3 (6%) had shown some marginal necrosis.[14] Almobarak et al found soft tissue defects of the hand can be reconstructed effectively with the use of groin flaps as these flaps are easy to harvest and can be done with neither specific instruments nor advanced training needed for free flap reconstruction.[10]

The paramount requirements of an effective distant flap used for hand cover is immediate total cover of the defect and freedom to mobilize the small joints of the hand and the groin flap has been found to meet these.[14] In addition, certain other less essential features are desirable and these also are present in the groin flap. Firstly, all raw areas are eliminated straightaway by tubing the pedicle and primarily applying a single sheet split-skin graft to the secondary defect. Secondly, the texture of the skin is very acceptable for the hand and the bulk of the flap is not too great provided reasonable thinning has been undertaken. Thirdly, the posture of the patient is comfortable, the hand lying naturally over the inguinal region. Once the adhesive strapping has been removed, the male patients in particular seem to adopt the 'hand in pocket' position very readily. It is relevant to note that Brown et al recommended the iliac fossa as being the most comfortable site from which to lift direct flaps to the hand.[15] (Brown et al., 1945). Finally, routine cleansing of the wounds is easily performed and this, allied to the free circulation of air around the hand, prevents maceration and so minimizes the risk of infection.

Limitations of The Study

The sample size was not large to infer the findings in general population. All data were collected from a single tertiary care center. Long term follow up was beyond the study.

CONCLUSIONS

This study concluded that groin flap represents a significant advance in technique in upper limb reconstructive surgery. Overall groin flap may be a good option for reconstruction of defects on dorsum of the hand.

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