ORIGINAL ARTICLE

AN AUDIT OF PEDICLED FLAP RECONSTRUCTION SURGERIES

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ABSTRACT

Objectives: To analyse the indications, post-operative results and frequency of complications for pedicled flaps reconstructive procedures.

Material and Methods: This descriptive cross-sectional study was performed in the department of Plastic & Burns Surgery, Khyber Teaching Hospital from January 2014 to April 2016. All the patients who has undergone reconstructive surgeries irrespective of etiology were included in the study and their pre-operative evaluation, operative procedure details and post-operative course were observed.

Results: A total of 123 cases with male to female ratio of 3.2:1, mean age of 42.8+1.76 SD were included with malignancies as the most common cause and head and neck as the most common anatomical region for reconstructive surgery. Flap necrosis was observed in 5.7% (n=7) cases, including 4 cases of insignificant and 3 cases of significant necrosis. Wound infection noted in 6.5% (n=8) cases.

Conclusion: For most of the anatomic regions of the body especially in head and neck, upper and lower limb defects, pedicled flaps are still the most common and acceptable reconstructive option with good survival and complication frequencies without requiring microvascular skills.

Key Words: Flaps, reconstructive surgery, malignancy, trauma.

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INTRODUCTION

The modern day trauma and surgical resection of malignancies with tumour free margins can results in large skin and soft tissue loss requiring reconstructive procedures with different flaps to improve the quality of life and cure. Flap is a tissue unit mobilized on the basis of crucial vascular anatomy essential for its survival[1]. Historically the initial use of flaps is attributed to Sushruta Samhita (600 BC) who used pedicled forehead flaps for traumatic nasal reconstruction[2]. Then Tagliacozzi published his work on distally based arm flap for head and reconstruction in Venice in 1597[3]. Their work was rediscovered in 19th by an English surgeon Carpue by successfully reconstructing the nosed of two officers[4].

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Pedicled flap can be a random pattern flap based on the subdermal vascular plexus with a critical length to width ratio of 1.5-2:1 or an axial pattern flap which is designed on anatomically known vascular pedicle. On the basis of vascular anatomy, perforator flaps are the most sophisticated pedicles flaps. On the basis of composition, the pedicled flaps can be divided into facial, faciocutaneous, muscle, musculocutaneous, osseous or osteomyocutaneous flaps[1]. Wounds Reconstruction with flaps is indicated when better cosmesis, coverage of exposed vital structures or durability is required to withstand adjuvant radiotherapy and weight bearing. Sensations can be restored with the help of sensate flaps[5]. Early wound coverage with flap helps decrease wound infection chances, ensures timely adjuvant radiotherapy in tumours and has positive psychological effects[6]. The advantages of lesser donor site morbidity, reconstruction with best matching adjacent tissue, working in same operative field and no requirement of microsurgical techniques/equipment have made pedicled flaps reconstructive procedures a viable option for many soft tissue defects[7-8]. Aesthetically acceptable reconstruction of head and neck region cannot be overemphasised and thus loco-regional pedicled flaps are

the prime donors to help achieve the goal by providing optimal colour and texture matched tissue[9].

This institutional review is aimed to assess the indications, different options and complications of wound coverage with pedicled flaps in different anatomical regions with the objectives of decreasing the morbidity and financial burden of the patients.

MATERIAL AND METHODS

In this descriptive cross-sectional study, all reconstructive procedures performed with pedicled flaps from June 2014 to April 2016 were reviewed. After explaining the study protocol and informed consent, all patient who undergone reconstructive surgery with pedicled local, regional or distant flaps were included in the study irrespective of age, gender and etiology. Patients who did not agree with the study protocol were excluded. After preoperative evaluation, flap surface marking was performed. In upper and lower limbs, dissection was performed under tourniquet control with little exsanguination in the identification of pedicle. In areas where tourniquet was not applicable, dissection was dissection proceeded vasoconstrictive solution infiltration. Postoperatively, flap was monitored one hourly for 1st 24 hours, then four hourly for 72 hours for signs of vascular compromise. Pre-operative evaluation, operative procedure details and post-operative course, complications were noted. The complication of flap necrosis was classified as insignificant partial necrosis; when wound healed without secondary coverage procedure, significant partial necrosis; when secondary procedure was performed for coverage and complete flap necrosis. The data was organised and analysed with the help of a statistical software and stratifies for age, etiology, region of reconstruction and flap type.

RESULTS

In the current institutional review a total of 123 cases were included. The study population composed of 94 (76.4%) male and 29 (23.6%) female patients with age ranging from 7-80 years (mean 42.8 years ±1.76SD). Malignancies (Table 1) were the most common presentation as 63 (51.2%) followed by road traffic accidents in 22 (17.9%) in the study population. Reconstructive procedures were performed in 71 (57.7%) cases for head and neck defects followed by upper limb defects in 23 (18.7%) cases (Table 2). Flap necrosis was observed in 7 (5.7%) cases, including 4 cases of insignificant and 3 cases of insignificant necrosis. No cases of complete flap loss was observed. Wound infection was noted in 8 (6.5%) cases (Table 3).

Table 1: Etiological distribution of study population

Etiology	Percentages
Burns	108.1%
RTA	2217.9%
Malignancy	6351.2%
Other Trauma	1915.4%
Extravasation Injury	10.8%
Pressure Sores	21.6%
Exposed Orthopedic Implants	54.1%
Hidradenitis suppurativa	10.8%
Total	123 100%

Table 2: Region wise distribution of study population

Region	Frequency & %ages
Head & Neck	71 (57.7%)
Upper Limb	23 (18.7%)
Lower Limb	19 (15.4%)
Trunk	7 (5.7%)
Perineum	3 (2.4%)
Total	123 (100.0%)

Table 3: Complications other than flap necrosis

Complications	Frequency & %ages
Wound Dehiscence	1(0.8%)
Wound Infection	8(6.5%)
Donor Site Hematoma	1(0.8%)
Donor Site Seroma	1(0.8%)
Total	11(8.9%)
Pressure Sores	2(1.6%)
Exposed Orthopedic Implants	5(4.1%)
Hidradenitis suppurativa	1(0.8%)
Total	123 (100%)

A total of 71 flap reconstructive procedures (Table 4) were performed for head and neck region defects (Fig. 1, Fig. 2) with malignancies being the most common cause accounting for 51 (71.8%). Median forehead was the most common flap performed in 18 (25.3%) cases followed by nasiolabial and scalp flaps accounting for 12 (16.9%) and 11 (15.5%) cases respectively. Partial flap necrosis rate was 2 (2.81%) for head and neck region.

Out of the total 23 reconstructive procedures (Table 4, Fig.3) performed for upper limb defects, 19 (82.6%) were caused by various form of trauma including RTA, burns and others. Posterior interosseous artery (PIA) and first dorsal metacarpal artery were the most common flaps performed for upper limb defects each accounting for 5 (21.7%) followed by ulnar artery perforator flap in 3 (13.4%) cases with the partial necrosis frequency of 3 (13.04%). One of the patient had significant

Table 4: Anatomical region distribution of pedicled flaps

Flap Type	Head & Neck	Upper Limb	Lower Limb	Trunk	Peri-neum	Total
Scalp Flap	11	0	0	0	0	11 (8.94%)
Median Forehead Flap	18	0	0	0	0	18 (14.63%)
Standard Forehead Flap	1	0	0	0	0	1 (0.81%)
Temporoperietal Fascia Flap	1	0	0	0	0	1 (0.81%)
Nasiolabial Flap	12	0	0	0	0	12 (9.75%)
Estlander Flap	3	0	0	0	0	3 (2.44%)
Supraclavicular Flap	5	0	0	1	0	6 (4.88%)
LD (Latissimus Dorsi Flap)	0	2	0	2	0	4 (3.25%)
TRAM (Transverse Rectus Abdominus Musculocutaneous Flap)	0	0	0	1	0	1 (0.81%)
Pec. Major Flap	1	0	0	0	0	1 (0.81%)
Abdominal Flap	0	1	0	0	0	1 (0.81%)
Groin Flap	0	1	0	0	0	1 (0.81%)
Reverse Lateral Arm Flap	0	2	0	0	0	2 (1.63%)
Reverse Radial Forearm	0	1	0	0	0	1 (0.81%)
PIA (Posterior Interosseous Artery Flap)	0	5	0	0	0	5 (4.06%)
Ulnar Artery Perforator Flap	0	3	0	0	0	3 (2.44%)
First DMA Flap	0	5	0	0	0	5 (4.06%)
Atasoy Flap	0	1	0	0	0	1 (0.81%)
Reverse Sural Flap	0	0	7	0	0	7 (5.69%)
Proximally based Sural Flap	0	0	3	0	0	3 (2.44%)
Gastrocanemius Flap	0	0	6	0	0	6 (4.87%)
Soleus Flap	0	0	1	0	0	1 (0.81%)
Cervicofacial Flap	4	0	0	0	0	4 (3.25%)
Posterior Thigh V-Y Flap	0	0	0	0	1	1 (0.81%)
Post-auricular Flap	4	0	0	0	0	4 (3.25%)
Pre-auricular Flap	3	0	0	0	0	3 (2.44%)
Submental Artery Flap	1	0	0	0	0	1 (0.81%)
Cheek Advancement	3	0	0	0	0	3 (2.44%)
Anterior Tibial Artery Perforator Flap	0	0	1	0	0	1 (0.81%)
TFL (Tensor Fascia Lata)	0	0	0	0	1	1 (0.81%)
Cheek Transposition Flap	4	0	0	0	0	4 (3.25%)
Gracillis Myocutaneous Flap	0	0	0	0	1	1 (0.81%)
Parascapular flap	0	0	0	1	0	1 (0.81%)
TAP (Thoracodorsal Artery Perforator Flap)	0	0	0	1	0	1 (0.81%)
Bicep Femoris Myocutaneous flap	0	0	1	0	0	1 (0.81%)
Extended Deltopectoral flap	0	0	0	1	0	1 (0.81%)
Reverse Thoracoepigastric flap	0	2	0	0	0	2 (1.63%)
Total	71	23	19	7	3	123

Figure 1: Squamous cell carcinoma cheek excision and reconstruction 1A; Pre-operative picture of nodulouIcerative Squamous Cell Carcinoma right cheek, 1B; Immediate post-excision and reconstruction with cervicofacial flap, 1C; One Month post-operatively.

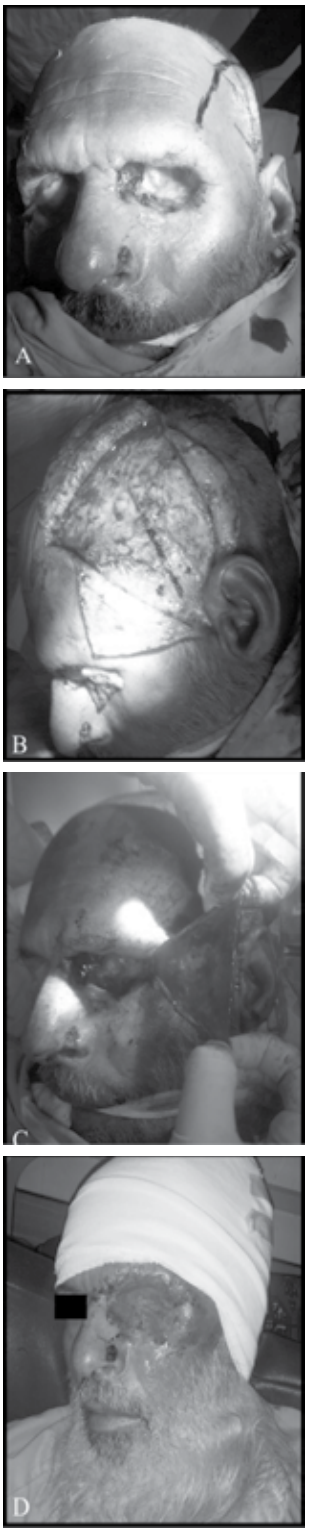

Figure 2: Reconstruction of a post-exenteration left orbital non healing wound with Temporoparietal Fascial Flap coverage, 2A; One year history of post-exenteration non healing wound left orbit, 2B; Per-operative view of Temporoparietal fascial flap elevation, 2C; Flap is tunnelled into the left orbit, 2D; One week post-operatively with viable flap and good Split thickness graft take.

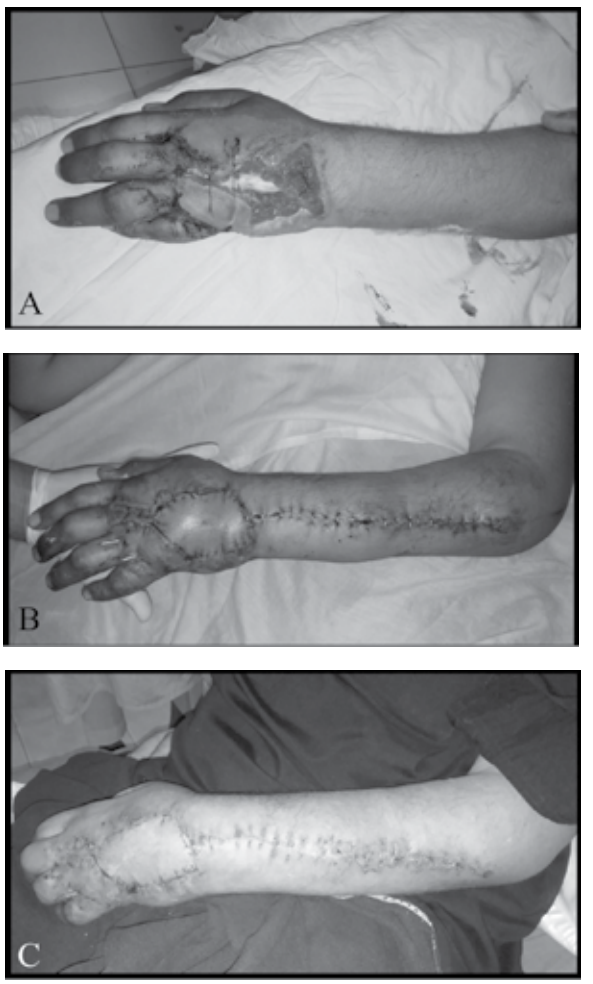

Figure 3: Reconstruction of dorsal hand wound with Posterior Interosseous Artery Flap coverage, 3A; One week post-operative view , 3B; One month post-operatively

partial necrosis and required additional reconstructive procedure. For 19 cases of lower limb reconstruction (Table 4), sural artery flap (reverse and standard) was the most common flap followed by gastrocnemius flap accounting for 10 (52.6%) and 6 (31.6%) patients. The partial flap necrosis was observed in 2 (11.8%).

The most common flap performed for defects of the trunk was latissimus dorsi (Table 4), performed in 2 (28.6%) out of 7 cases, no flap necrosis was observed for this group. Transverse rectus abdominus Flap (TRAM) was performed in one case (Figure 4) for immediate post-operative reconstruction of skin sparing mastectomy defect.

DISCUSSION

To expedite the physiological recovery, rehabilitative process and adjuvant radiotherapy, flap coverage provides a very good reconstructive strategy[10]. The

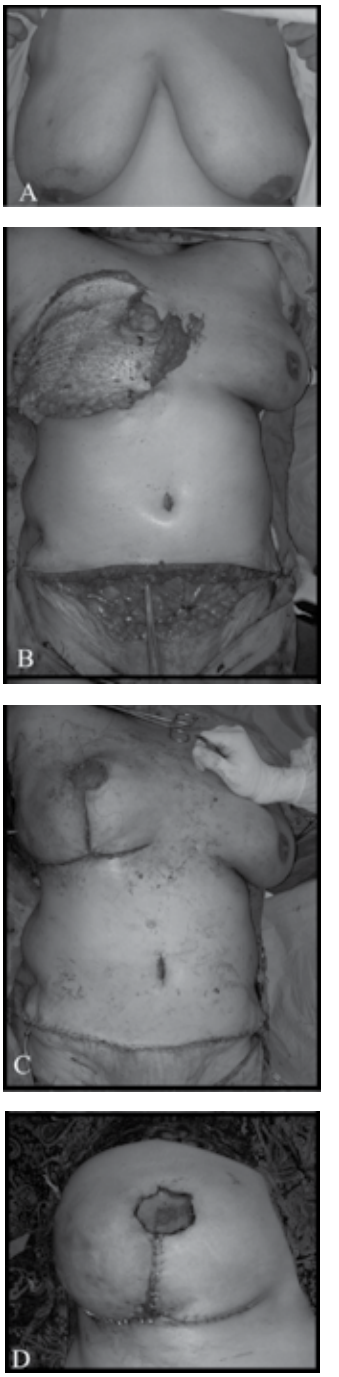

Figure 4: Immediate right breast reconstruction with contralateral pedicled Transverse Rectus Abdominus Muscle (TRAM) flap after skin sparing mastectomy with Inverted “T” incision for phyloids tumour, 4A; Pre-operative view of patient with phyloids tumour of right breast, 4B; Per-operative view of TRAM flap delivered in the Mastectomy wound, 4C; Per-operative view after wound closure and nipple areola free graft securing, 4D; One week post-operative view with good nipple areola graft take and insignificant skin sparing mastectomy flap necrosis at the infra-memory fold.

choice of flap selection is determined by simplicity, colour/texture match, reliability and minimizing donor site morbidity which can be best accomplished by pedicled flaps with lesser and easily manageable complications[11]. In the current study we analysed the indications, applications for different anatomical region and complications of pedicled flaps reconstructive procedure at our centre. Our study population was mainly composed of male patients with mean age of 42 years which is comparable to Watkinson[12] observations of male to female ratio of 1.7:1 and mean age of 64 years. The inclusion of trauma patients in our audit have produced younger mean age as compared to Watkinson's[12] observations of malignancy patients. Reconstruction of surgical wounds after malignancies excision was the predominant cause in head and neck population which is similar to the observations of Hidalgo[13] in his series. D'Arpa S[14] observed comparable results of malignancies as the most common cause for reconstruction (60%) and head and neck as the most common region (41.2%). Our flap necrosis frequency was found relatively low as compared to 7% reported by D'Arpa S[14] and Lannon DA[15] their series. Casal D[16] reported similar range of higher frequencies of flap necrosis (7.5% to 9.2%). Compared to our 2.8% partial flap necrosis rate for head and neck reconstruction, Karimi E[17] did not observe any flap necrosis in their free flap series with post-operative aspirin/enoxaparin postoperative anticoagulation. Heo YH[18] reported much higher variable necrosis frequencies of 8.6% in their series of anteriolateral craniofacial reconstruction. Compared to our partial flap necrosis rate of 13.04% for upper limb flap reconstructions, Naduthodikayil P[19] showed partial necrosis frequency of 9.1% for paraumblical perforator flap reconstruction of upper limb with a small sample size. A much lower partial flap necrosis rates of 3.5% were reported by Wang Z[20] in his series of forefood free flap reconstruction compared to 11.8% of our study population. In contrast to highest necrosis rates for upper limb, Casal D[16] observed it for head and neck reconstruction.

The lack of stratification for risk factors of flap necrosis i.e. smoking, comorbidities, atherosclerosis, collagen vascular diseases and peri-operative anticoagulation is the shortcoming of our study. Regular institutional based surgical audit with better study design is recommended to improve the quality of the flap coverage reconstruction.

CONCLUSION

For abalative and traumatic defects of all anatomical regions of the body especially head/neck, upper and lower limbs, pedicled flaps are still the most commonly performed reconstructive procedures with acceptable success, postoperative complication and flap necrosis frequencies without the need of sophisticated microsurgical techniques and equipment.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Khan AM: Performed the procedures and provided data.

Khan M: Idea conception, co-ordination, methodology, data collection and research.

Ullah H: Data analysis, review.

Haider SM: Performed surgeries, compiled results.

Aziz A: Bibliography, helped in data analysis.

Tahir M: Performed the procedures, provided data and supervision

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.