

## Techniques and Applications of Free Style Gluteal Perforator Flaps in Sacro-Perineal Reconstruction

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### ABSTRACT

Free style local perforator flaps were used for reconstruction of defects in the sacro-perineal area in 7 males and 2 females (range: 29-57 years). The cause of defects was pressure sore in 6 patients, Fournier gangrene in 1 patient, RTA in 1 patient, and large peri-anal abscess in 1 patient. Eleven flaps their size ranged from  $7 \times 11 \text{cm}^2$  –  $18 \times 27 \text{cm}^2$  were elevated for reconstruction of these defects which involve the sacrum in 5 patients, the Ischium in 2 patients, and the perineum in 2 patients. All flaps were based on perforators with their number ranged from 1-5. Five flaps were propelled up to 180 degrees, 4 flaps were rotated, 1 V-Y flap advanced and 1 rhomboid flap transposed. The follow-up period ranged from 4-22 months. All flaps healed completely except in one patient where marginal flap necrosis was developed, and in another patient partial flap failure occurred.

### INTRODUCTION

Perforator flaps terminology was first introduced in the field of reconstructive microsurgery in the late nineteen eighties [1]. From the date of first report in literature about perforator flaps so far, innovations were made in their methods of transfer and also their designs. They were transferred at first as free flaps and later on as local flaps [2-5]. According to this local perforator flap modifications of the already described local flap designs which were based on either major arteries or random pattern subcutaneous vascular pedicles, are now based on perforators. This local flap movement based on perforators permitted flexibility in flap transposition and inset. The rotation, v-y advancement and Propeller flaps are examples of flaps that witnessed modification following skin perforators description [6-9]. Another innovation was in the lack of restrictions in perforator flaps design. This refers to the concept of free style perforator flaps where preoperative auditing of skin perforators by Doppler sonography is the corner stone in their design. This allows designing of multiple skin flap over the body surface around any audible perforator.

The work here studies the application of free style local perforator flaps from the gluteal region in reconstruction of sacro-perineal defects. According to the case different flap designs, inclusion of different number of perforators, and also different modes of local transfer were used.

### MATERIAL AND METHODS

Between December 2007 to March 2010, 9 defects in the lower back including sacral, Ischial, and perineal regions were treated by local perforator flaps (Table 1: Patient's data). There were 7 males and 2 females. Their age ranged from 29-57 years (mean: 43.8 years). The defects were sacral in 5 patients, Ischial in 2 patient, and perineal in 2 patients with one of them have extension of wound into the ischiorectal fossae (Case 9). The etiology of the defect was pressure sore in 6 patients, Fournier gangrene in 1 patient (Fig. 2A), RTA in 1 patient, and a large peri-anal abscess complicated by skin necrosis in 1 patient (Case 6). The number of flaps elevated was 11 with 2 patients (Case 4, 9) required double flap coverage. The flap size ranged from  $7 \times 11 \text{cm}^2$  to  $18 \times 27 \text{cm}^2$  (mean: 11.5:19.8cm width: Length ratio). The number of perforators in the flaps ranged from 1-5 (8 flaps were nourished by 1 perforator, 1 flap by 2 perforators, 1 flap with 3 perforators, and lastly 1 flap with 5 perforators). Five flaps were propelled up to 180 degrees to cover the defect, 4 flaps were rotated and advanced, 1 flap was advanced in a V-Y fashion and 1 flap was designed in a rhomboid pattern and transposed.

#### *Surgical techniques:*

The area in close proximity to the defect is scanned by using 5-MHz unidirectional Doppler probe (Huntleigh Mini Dopplex, HNE Diagnostics, Cardiff, UK). The perforators are marked (Figs. 1A, 2B) and the flap is designed so that the perforators are located 2-4cm from the edge of the flap

base. Also the flaps were designed in a manner that permits direct closure of donor site without affecting wound coverage and for this purpose the side of the skin beside the defect with lax skin was selected. Usually more than one perforator were primarily plotted in the base of the flap.

Flap dissection was done under loupe magnification 2.5X and it was started from the flap tip towards its base. The flap dissection was under the fascia and once the flap base is approached perforators are skeletonized by doing intramuscular dissection. To get more length, dissection of the

mother artery if possible was carried out. Usually more than one perforator was dissected. However to allow wide arc of flap rotation single sizable perforator was used to nourish the flap in most cases provided this single perforator is enough to feed the flap. This was tested by clamping the other perforators and then checks the flap vascularity. Lidocaine 2% was always irrigated during perforators dissection to avoid spasm. When finishing flap dissection it is sutured in place with insertion of either Penrose or suction drain. Limited subcutaneous dissection of the donor site was then done to allow direct closure without tension.

Table (1): Patients data.

Cases	Age/ Sex	Defect site	Cause	No. Flaps	No. Perf.	Flap size (cm)	Way of transfer	Remarks	Complications	Follow-up (m)
1	39/F	Sacral	Pressure sore	1	1	11x21	Propeller	None	Marginal flap necrosis	8
2	29/M	Sacral	Pressure sore	1	1	12x23	Propeller	None	None	5
3	39/M	Ischial	Pressure sore	1	1	7x11	Propeller	None	None	5
4	52/M	Sacral	Pressure sore	2	3	18x27	Rotation- advancement	Recurrence in the left ischium during follow-up	None	22
5	53/F	Ischial	Pressure sore	1	1	9x12	V-y advancement	None	None	10
6	43/M	Perineal	Large peri-anal abscess	1	2	9x18	Propeller	None	Wound infection-partial flap necrosis	7
7	57/M	Sacral	Pressure sore	1	1	10x17	Propeller	None	None	4
8	47/M	Sacral	RTA run over	1	1	8x14	Transposition	Rhomboid design of the flap	None	9
9	36/M	Ischiorectal fossae & Perineal	Fournier gangrene	2	1	14x24 14x24	Rotation- advancement	Segmental deepithelialization to fill the fossae	None	8

## RESULTS

The follow-up period ranged from 4 to 22 months (mean: 8.6 months). One patient reconstructed for sacral pressure sore developed an Ischial sore during the follow up period (Case 4). Good results were obtained in all patients. All flaps healed completely except in 1 case (Case 1) developed marginal flap necrosis, and another case (Case 6) developed wound infection and partial flap failure. In the case with marginal necrosis wound was healed by dressing and in the case of partial flap failure frequent dressing was done and followed by skin graft.

## Case Reports:

### Case 2:

Male patient 29 years old presented by sacral bed sore following RTA, spinal cord injury and subsequent paraplegia. The sacral defect was around 13 x 21cm<sup>2</sup>. Doppler scanning of the area around the defect was done. The flap was then designed with taking in consideration two factors. First: The flap base includes a large number of perforators with high intense sound. Second: A supple area of skin that permits direct closure of donor site was selected (Fig. 1A). With the patient in supine position bursectomy and wound debridement was

then done without saline adrenaline injection to avoid perforators spam. Flap dissection was then carried out from its tip towards its base and 2 perforators were dissected (Fig. 1B). The flap was then propelled 180 degrees (Fig. 1C) and sutured in place after insertion of suction drain. The flap survived completely without any partial necrosis (Fig. 1D).

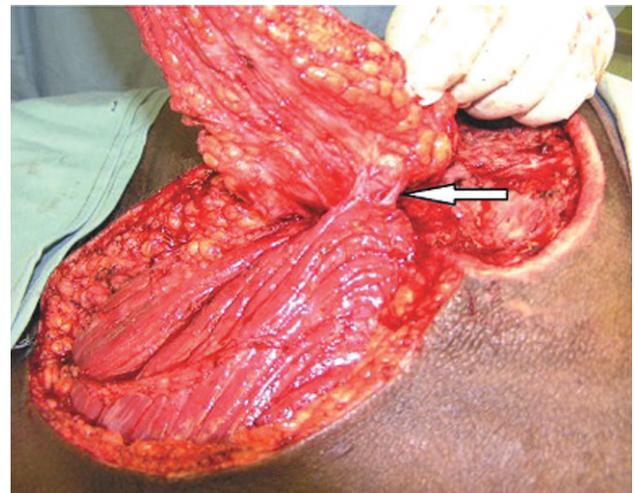
**Case 9:**

36 years old male patient presented by Fournier gangrene encroached over the perineum and ischio-rectal fossa (Fig. 2A). Serial debridement of the dead necrotic tissues was carried out by the general surgeon who also has done colostomy for the patient as the necrosis affected the peri-anal

muscles. After wound improvement bilateral elliptical shaped flaps from the Infragluteal region were designed based on perforators beside and lateral to the Ischial tuberosity (Fig. 2B). Flaps were elevated and a single perforator supplying each flap which was found coming from the inferior gluteal vessels was dissected (Fig. 2C). Perforators dissection was done in a sort to allow rotating the flap in any directions. Part of the flaps was deepithelialized (Fig. 2D) and used to fill the defect in the ischio-rectal fossae and the flap was then sutured around the anal verge with direct closure of donor site (Fig. 2E). The flaps survived completely (Fig. 2F) and the patient was then transferred to proctology unit to assess the anal sphincters for possible reconstruction.



(A)



(B)



(C)



(D)

Fig. (1): (A): Preliminary design of bilateral flaps 11 x 21cm<sup>2</sup> around audible perforators (Arrows) beside sacral bed sore defect. (B): Two perforators were dissected in the base of the flap (Arrow). (C): The flap is propelled 180 degrees to cover the defect. (D): Postoperative photograph after two weeks showing viability of the flap.



Fig. (2): (A): Perineal Fournier's gangrene with involvement of ischioanal fossae. (B): Design of bilateral elliptical flaps 14 x 24cm. The perforators (bilateral arrows) are located lateral to the ischium. (C): Single perforator supplying the flap bilaterally (arrow) is dissected 3cm from the mother artery (triangle). (D): Partial de-epithelialization of the flaps was done to fill the defect in the ischioanal fossa. (E): Immediate postoperative photo after flap inset around the anal ring. (F): Late postoperative photo 5 months after surgery showing sound wound coverage.

## DISCUSSION

Following anatomic study of skin perforators and the introduction of angiosomes concept of skin vascularisation [10], many authors [1,3,11] have their clinical input based on this anatomic study and a new terminology in reconstructive surgery called perforator flaps have been evolved. The free style concept of perforator flaps harvesting was introduced later [12,13]. In this concept complementing of anatomic studies and technology was seen. Just by usage of Doppler sonograph; we can scan the skin perforators and then preliminary flap design around the audible perforators is then carried out. Flap harvest can then be done easily by dissection under the skin searching for these perforators which are also dissected. These perforators of course emerge from mother arteries which are dissected on demand. The final design of the flaps can be modified after that. According to this free style concept of perforator flaps harvesting many authors presented their work illustrating their application in different anatomic areas with different designs [8,9,14].

The internal iliac artery is the main trunk giving skin perforators to the gluteal region through its main branches; the superior gluteal, inferior gluteal, lateral sacral, and internal pudendal. Also there is a share from the fourth lumbar artery [11,15]. This pattern of vasculature was considered during perforators mapping in the cases presented here. Perforators near big sub-branches were usually selected so in case where there is requirement for more length in the vascular pedicle the mother artery is dissected. This study revealed that minimal perforators dissection and even mother artery partial dissection is very beneficial. First it allowed peaceful inset of the flaps without kinking of vessels. Second it allowed great flexibility in advancing the flap and also rotating it clockwise or counter-clockwise from 0 up to 180 degrees without compromising flap vascularity (Figs. 1C, 2C). This is in comparison to Seyhan [5] who preferred to rotate the flaps in fewer degrees and had maximum range of flap rotation up to 145 degrees to avoid flap compromise.

The number of perforators in the flap base is a matter of contention. Some authors were successful in raising perforator flaps on single perforators with good results [11]. Seyhan [5] recommended inclusion of second perforator as a life boat in case of inadequacy of the main perforator. Yildirim [8] noticed temporary venous insufficiency in some of his cases in the immediate postoperative period and he claimed that this was present in the large

flaps and in flaps that contain only one perforator. He also recorded one total flap necrosis due to inclusion of one perforator which was extremely dissected inside the muscle to help advance the flap for wound coverage. In the cases presented here 8 flaps were elevated on single perforator with only one flap (Case 1) developed marginal flap necrosis at the flap base; this margin was around the edge of pressure sore. Another flap was elevated on 2 perforators developed partial flap failure due to infection. So the number of perforators is not the reason for flap congestion and even failure, however certain surgical precautions to avoid complications were considered here during surgery and also some points from reading the results are concluded. First: Single sizable perforator without torsion during inset is better than multiple perforators with any degree of torsion. Second: The perforators were freed for about 1-2 cm and even very small segment of the mother artery was dissected if possible. Third: Avoiding any degree of stretch on the perforators. For prevention of this stretch any flap design was done so that the perforators are situated at least 2-4cm distal to the edge of the flap base (Fig. 1A). This last maneuver was found to be very beneficial when the flap was advanced in a V-Y fashion or rotated in propeller fashion. In case of advancement, this skin segment from the edge of the flap base to the marked perforators will cover the recipient site before any stretch is applied over the perforators to advance the flap. In case of propeller flaps this segment was kept over the donor site and sutured by three-in-one suture technique so that this suture catches the flap and avoids sheering movement and subsequent perforator stretching. Fourth: A healthy skin around the defect should be selected for perforators mapping and skin design especially in bed sore patients.

The perforator flaps was found by many authors [16,17,18] to have less donor site morbidity. This is of great importance especially in wheelchair bound bed sore patients as they have a high incidence of recurrence. This recurs to the preservation of underlying muscles, elevating wide territory of the skin for covering the defect, and according some authors [5,19] the validity to re-elevate perforator flap over previously used other conventional fasciocutaneous flaps like V-Y flap. Also direct closure of donor site without tension is a reduction of donor site morbidity [18] on condition that it does not affect defect coverage. Flaps elevated in the work here were designed in a fashion that permits direct closure of the donor site and for this purpose selection of a redundant skin around the defect was used.

The territory of the skin supplied by one perforator is very variable. There are many factors in that issue like the size and number of perforators, the anatomic region, presence or absence of vascular diseases, and the general health of the patient especially chronic diseases. These factors are of utmost importance especially in bed sore patients who have variable intrinsic and extrinsic factors that predispose to ulceration. This includes lack of nutrition, chronic illness, altered level of consciousness, chronic ischemia, shearing forces, and denervation atrophy of subcutaneous tissues including vessels attenuation [20,21]. In all cases these factors were appreciated to attain reconstruction without complications and also for future reconstruction in case of ulcer recurrence. Multiple perforators were plotted preoperatively and sometimes multiple islands of skin were selected around the defect, and after dissection of perforators the most sizable one and sometimes inclusion of more than one perforators was done. According to those principles bilateral inferior gluteal artery perforator flaps were elevated each based on one sizable perforator (Case 9). In this case there was requirement to fill a bilateral gap in the ischiorectal fossae. The flaps were deepithelialized at its tip for this purpose without any vascular compromise or failure.

Propeller flaps were an example of flaps subjected to modifications following invention of perforator flaps. The old version [6] which was designed across the longitudinal axis of burn scar and vascularized by subcutaneous vascular pedicle and rotated for only 90 degrees to release the scar, can now be vascularized by perforators and rotated up to 180 degrees [9,22,23].

Bravo and Schwarze [9] proposed a classification scheme for local perforator flap transfer. These include single perforator based that allows flap propelling up to 180 degrees, multiple perforator based that allows rotation and advancement with maximum 145 degrees, and lastly peninsular pattern with inclusion of one or more perforators and skin bridge in the flap base. He also reported that the third type is not pure perforator flap as it is double vascularized. The cases presented here include all those subtypes. The author agrees with this classification scheme as it gives a freedom in flap elevation and transfer.

#### Conclusion:

Perforator flaps represents a reliable alternative for reconstruction of the sacro-perineal region. When free style concept of perforator flaps harvesting is applied more reliability is achieved.

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