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Versatility of Gluteal Arteries Perforator Flaps (for Local Coverage) Relative to Defect Size, Site, and Different Pathological Conditions

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ABSTRACT

Background: Superior and inferior gluteal artery perforator flaps have evolved in the last few decades for both free and local tissue transfer because of having the advantages of being voluminous with a relatively inconspicuous donor site. Therefore focusing on the details of such a reconstructive procedure would be of importance when thinking of skin defect coverage in the lower back, gluteal, and upper thigh areas.

Patients and Methods: This study was done on 14 cases, 10 of them had defects due to pressure sores, and 4 cases due to other inflammatory and neoplastic conditions. All cases were done by the same surgical team with a follow-up period ranging from 2 to 18 months.

Results: Thirteen out fourteen flaps (92%) passed completely and uneventfully with no need for additional surgery throughout eighteen months of follow-up. However, two cases developed wound dehiscence that required secondary sutures to one of them, two cases developed seroma, and one case developed partial flap loss which re-advanced by V-Y technique.

Conclusion: The superior and inferior gluteal artery perforator flaps are versatile versatilereconstructive coverage to gluteal defects of different size, site and pathology. They are easy to perform; suitable for large defect reconstruction of the lower back, buttock, and upper thigh areas.

Key Words: *Gluteal arteries – Perforators – Reconstruction.*

INTRODUCTION

Reconstruction of large gluteal and sacral soft tissue defects has been seldom discussed in the literature. It ischallenging due to the limitation of local flap options and posterior location at a site of pressure and shear. Previously described techniques involving local random flaps are limited and can be particularly restricted in cancer patients such as sarcoma patients **[1]**. However, functionally a good quality tissue has to be provided and the use of local tissue is the ideal for like-with-like replacement **[2]**.

We have many welldescribed standard approaches, developed from years of cumulative experience in dealing with pressure sores, trauma and other injuries to the area. In contrast to reconstruction of a large sacral soft tissue defect, options for reconstruction ofa large gluteal soft tissue defect have seldom been discussed in the literature **[3]**.

The transfer of gluteal skin was described in 1975 by Fujina et al., **[4]**. Koshima and Soeda's in 1989 were the first to introduce perforator flaps on a deep fascia perforator arising from the deep inferior epigastric artery **[5]**. It has the advantage of both preserving the muscle function in the donor site and avoiding its bulkiness in the recipient area. In addition to the benefit of having a large axial vessel **[6]**.

The gluteal region is highly vascular containing about 5 perforators divisions in an area of 100cm^2 **[7]**. The buttock integument is mainly supplied by both the superior and inferior gluteal arteries. The superior gluteal artery (diameter 4mm) is the a terminal branch of the posterior trunk of the internal iliac artery, it enters the buttock at the upper border of the piriformis muscle at which it is divided into a deep and a superficial branch, the later which is of importance here is subdivided into three branches; posterior, intermediate and anterior branches. The superior gluteal artery supplies approximately 40% of the gluteal skin through 5-13 musculocutaneous perforators, with diameters ranging from 0.5-0.9mm, with around 14-24cm^2 of skin area supplied. The inferior gluteal artery arises from the anterior division of the internal iliac artery and enters the buttock region at the lower border of the piriformis muscle, it divides into a medial and lateral branches. The inferior gluteal artery (3mm diameter) supplies approximately 60% of the gluteal skin through 9-15 perforators, with diameters ranging from 0.5-0.7mm, with around 15-21cm^2 of skin area supplied **[7]**.

The aim of this article is to emphasize on the ease and versatility of the gluteal artery perforator flaps in reconstruction of various defects, with variable sizes and pathologies in the lower trunk and buttock area. In addition to focusing on the importance of teaching it to the junior plastic surgeons to use it as an easy tool for reconstruction of various defects in the aforementioned areas.

PATIENTS AND METHODS

From 2016 to 2018, a prospective clinical study was conducted on 14 patients (11 men and 3 women) sustained different soft tissue defects of the gluteal region. The age of the patients ranged from 19 to 62 years with an average age of 37 Years. The etiology of the defects was pressure ulcers (4 sacral, 4 ischial, and 2 trochanteric), following tumor excision as dermatofibrosarcoma protuberans that it was done by the plastic surgery team (3), and one defect following excision of hidradenitis suppurativa as shown in Fig. (5). The size of the defects ranged from 7X5 to 15X15 cm^2 (Table 1). An informed consent was obtained including detailed explanation for the intended procedure, its expected advantages, and possible complications. The ethical research committee of our institution approved the protocol of the study. All defects were operated by the same surgical team in Ain Shams University Hospitals, with a follow-up period ranged from 2 to 18 months.

Table (1): Summary of Results.

Patient Number	Age	Sex	Site of defect	Size of defect	Pathological conditions	Flap used SGAP or IGAP	Complication	Follow-up
1	25	F	Sacral	12x10	Pressure Ulcer	SGAPF	Wound dehiscence	8 months
2	28	M	Sacral	15x9	Pressure Ulcer	SGAPF	Wound dehiscence	6 months
3	40	M	Sacral	11x7	Pressure Ulcer	SGAPF	None	2 months
4	31	M	Sacral	13x10	Pressure Ulcer	SGAPF	None	6 months
5	50	F	Ischial	10x7	Pressure Ulcer	IGAPF	None	4 month
6	62	M	Ischial	15x10	Pressure Ulcer	IGAPF	Partial flap loss	9 months
7	45	M	Ischial	8x6	Pressure Ulcer	IGAPF	None	17 month
8	54	F	Ischial	12x8	Pressure Ulcer	IGAPF	Seroma	6 months
9	42	M	Trochanteric	9x7	Pressure Ulcer	SGAPF	None	3 month
10	19	M	Trochanteric	7x5	Pressure Ulcer	SGAPF	Seroma	9 months
11	37	M	Ischial	15x8	Hydraadenitis Supporativa	IGAPF	None	1 year
12	43	M	Sacral	15x15	Soft tissue Sarcoma	SGAPF	None	1 year
13	60	M	Sacral	10x10	Dermatofibrosarcoma protuberans	SGAPF	None	18 months
14	35	M	Ischial	15x13	Squamous Cell Carcinoma	IGAPF	None	6 months

Marking and flap design:

As shown in Fig. (1) a line was drawn between the posterior superior iliac spine (PSIS) and the ischial tuberosity (IT). Another line was drawn from the greater trochanter and extended to bisect this line. This second line represents the surface anatomy of the piriformis muscle, above it lies the perforators of the superior gluteal artery (SGA), and below it lies those of the inferior gluteal artery (IGA). The perforators were then identified by the hand held doppler where the ones with the higher sound intensity were marked. In case of SGAP flap the skin paddle to be harvested was then marked around the perforators of the superior gluteal artery (SGA) as shown in Figs. (2,3), and in case of IGAP flap it was drawn around those of the inferior gluteal artery (IGA) as shown in Fig. (4). More than one perforator could be included especially when the arc of rotation required is not too wide.

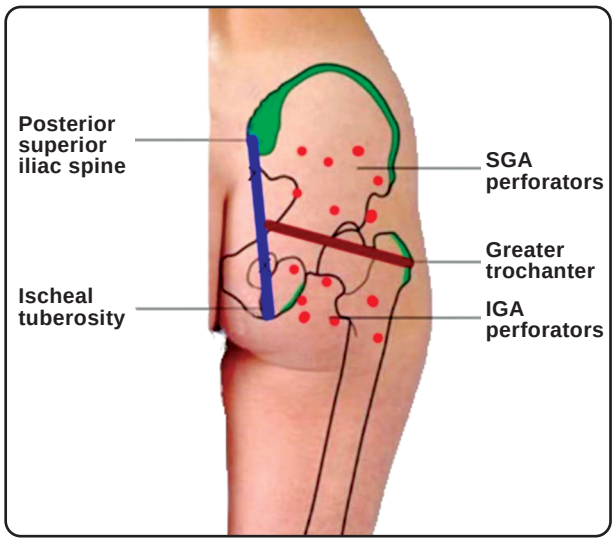

Fig. (1): Blue line connecting PSIS with IT, bisected by a brown line representing the piriformis muscle. Above which are the SGA perforators, and below it are those of the IGA.

Surgical technique:

All patients were operated under general anesthesia, and positioned to the prone on the operating table. All defects were either surgically created (excision of tumors) orprepared (excision of bursa in pressure ulcers). Measurement of dimensions of the created defect was carried out in order to plan the intended dimensions of the flap. Marking of the desired flap wasperformed to be centered on the chosen perforator that was identified by the hand held Doppler. Incision was made first at the lateral and inferior margins of the designed flap down to the fascia, and dissection was carried out in a subfascial plane from lateral to medial as it is easier to reach the right avascular plane. When a reliable one or two perforators were clearly visualized, incision and dissection of the whole flap wascompleted all around, then intramuscular dissection using loupe magnification and microsurgical instruments was done around these perforators until it was giving the arc of rotation required for flap insetting. Dissection to the source inferior or superior gluteal arteries was not necessarily required when the flap could be readily mobilized.

Closure was then done in two layers; subcutaneous by 3-0 vicryl, and skin by 3-0 prolene sutures with insertion of a suctiondrains. The wound was covered by light conventional dressing with a window allowing further flap monitoring. Postoperatively, the patient was allowed to lie in prone position for a period of 3 weeks.

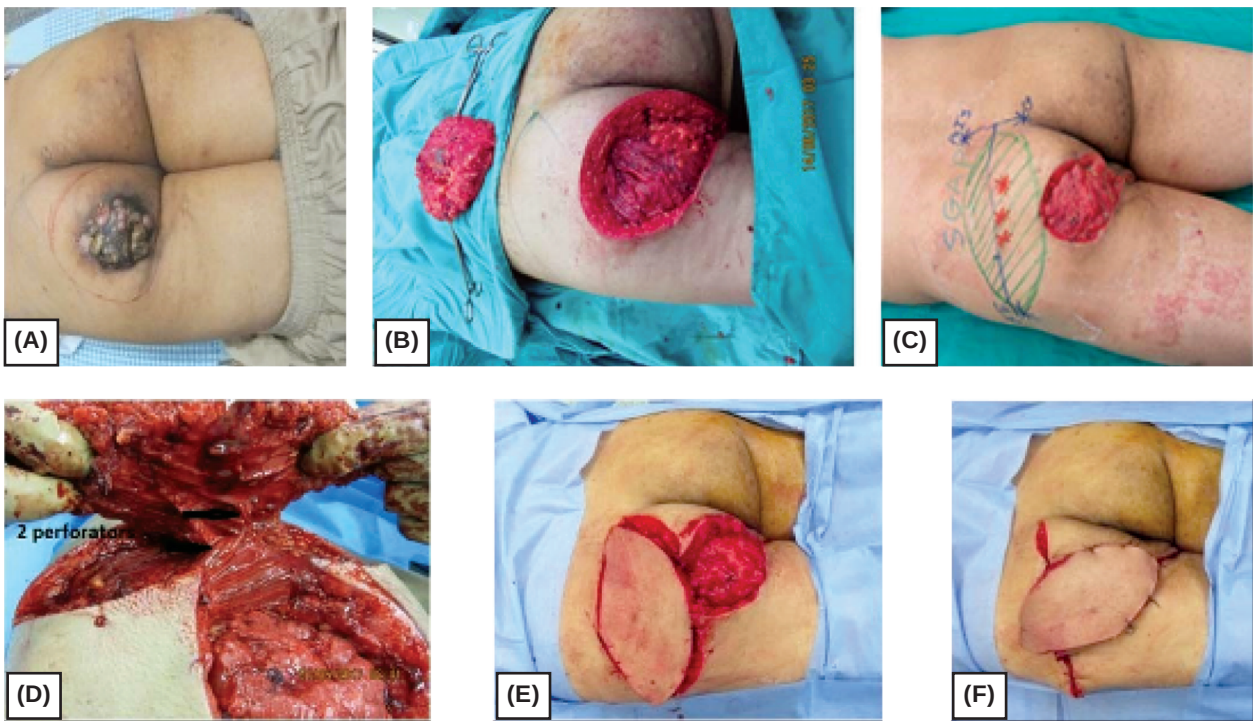

Fig. (2): 35 years old male patient with squamous cell carcinoma underwent excision in one stage then reconstruction for a 15x13 defect by SGAP flap one week later after paraffin section results. (A): The squamous cell carcinoma before excision. (B): Excision with 3cm safety margin. (C): Pre-operative marking of SGAPF. (D): Flap dissected and two perforators are skeletonized. (E): Picture relating site of the flap harvested to the defect. (F): Flap rotated 90º and inset to close the defect completely and the donor site partially.

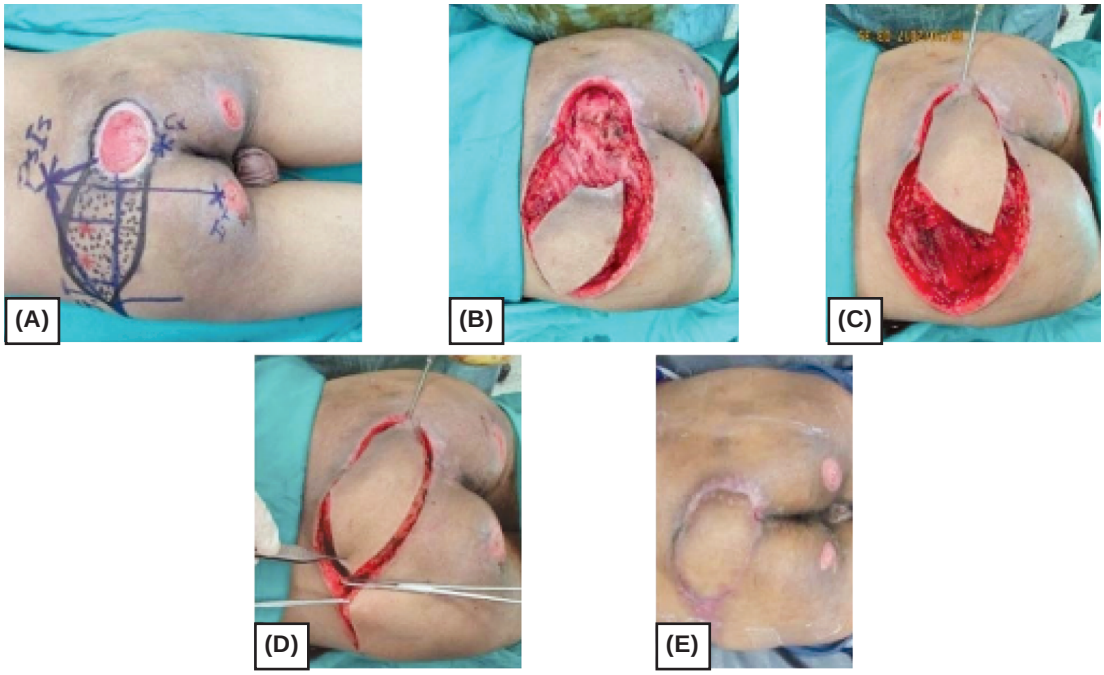

Fig. (3): 31 years old male patient with sacral pressure sore with a final defect 13x10 underwent reconstruction by SGAP flap. (A): Pre-operative marking of the SGAPF. (B): Flap dissected without mobilization, showing its relation to the defect. (C): Flap moved to close the defect. (D): Picture showing easy donor site closure. (E): Six month post-operative after complete flap healing.

Fig. (4): 45 years old male patient with an ischial pressure sore 8x6 underwent reconstruction by IGAP flap. (A): Pre-operative marking for the IGAPF. (B): Post-operative picture after flap inset and donor site closure. (C): One week post-operative with near complete healing.

Case 4: 32 years old male patient presented with gluteal hidradenitis suppurativa on both gluteal region but it was severe on the left side.

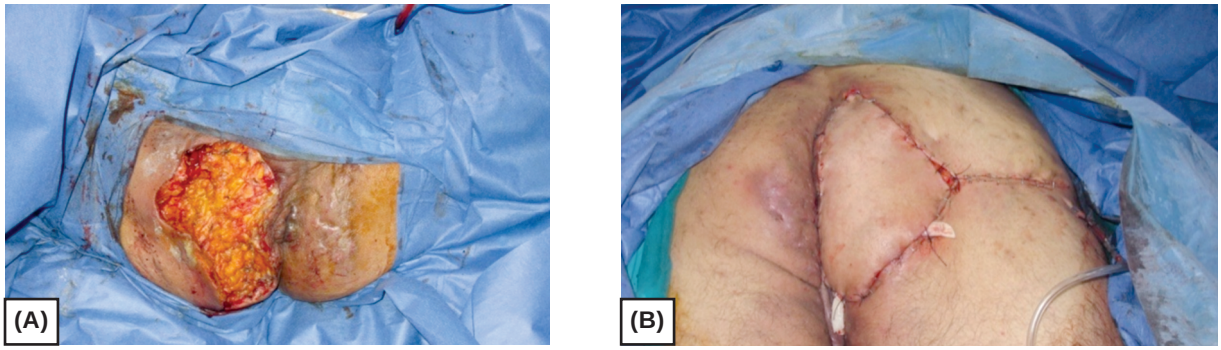

Fig. (5): 32 years old male patient with hidradenitis suppurativa at the gluteal region underwent reconstruction by SGAP flap. (A): After excision of the infected skin. (B): Post-operative picture after flap inset and donor site closure.

RESULTS

With an average of eighteen months Follow-up, all flaps survived without complete loss. However, 2 flaps (14.2%) showed wound dehiscence which required secondary sutures to one of them while the other one healed by secondary intention. Two flaps (14.2%) developed seroma which was treated by frequent syringe evacuation. Flap congestion (7.1%) followed by partial necrosis and loss of less than one third of the flap was reported in one case. Additional advancement of the previously performed V-Y flap was performed. A total of 14 cases with different pathologies underwent reconstruction by gluteal arteries perforator flaps. Eight cases underwent reconstruction by superior gluteal artery perforator flaps and six cases by inferior gluteal artery perforator flaps. These flaps were used to reconstruct different pathologies as ten cases with pressure sores, three cases with malignant tumors (Dermatofibrosarcomaprotuberense-squamous cell carcinoma-soft tissue sarcoma) and one case with hidradenitis suppurativa. As regarding sites, it differed from sacral, upper gluteal, ischial and trochanteric areas. The flaps dimensions range from 7 * 5cm up to 15 *15cm. Two flaps (14.2%) showed wound dehiscence one required secondary sutures and the other healed by conventional dressing and secondary intention. Two (14.2%) had seromas which were frequently evacuated by syringe suction. Partial lossafter congestion (7.1%) (less than one third of flap size) occurred only in one flap to which a previously formed v-y advancement flap was done to close an ischial pressure sore and it needed an additional procedure for closure. There was no complete loss of flap. So thirteen out fourteen flaps (92%) passed completely and uneventfully with no need for additional surgery throughout eighteen months of follow-up.

DISCUSSION

The gluteal artery perforator flap (GAP) flaps have been described in the last few decades more often in free tissue transfer especially for breast reconstruction. However, it is considered a very good option for local large defects reconstruction. Many articles have mentioned their use in pressure sores, but they were not commonly described with other various pathologies with different sizes and in the same area. In this study we focused on their use with relative success with various pathologies with different sizes in buttock area reconstruction. J.P. Higgins et al., in 2002 stated that it is better to use the SGAP flap for reconstruction of both trochanteric and sacral pressure sores, while for ischial pressure sores IGAP flap would be a better option **[8]**. They also noticed that sparing the muscle in the donor area lead to less wound dehiscence. There was a study done in Turkey between 1998 and 2002 on 35 flaps **[9]** showed almost similar results, however it was only done on pressure sore patients not including other pathologies. A study in Switzerland in 2006 used the IGAP for reconstruction of sacral pressure sores and perineal defects besides the ischial pressure sores. This study included a cadaveric part that proved the presence of 1 or 2 perforators arising from the descending branch of the IGA that emerges below the lower border of the gluteus maximus which could both save the tedious intramuscular dissection and preserves the descending branch of the of the IGA sparing it for further reconstruction in case required **[10]**. Chin-Tab Lin et al., in China have done their study on 30 patients with sacral defects and chose the medial perforators of the SGAP respecting its anatomical proximity to the defect which was pressure sores in 28 cases and pilonidal sinus in two cases. They only dissected 1cm from the perforators which was usually enough for flap setting claiming that this decreases the operation time significantly. Their largest flap measured 12x14 while our study showed that we could harvest larger flaps up to 15x15cm. They also noticed immediate postoperative flap congestion. They also pointed to the preference of verpaele et al. **[12]**, for the use of the lateral perforator which allows for having a longer pedicle with minimal torsion **[11]**. In this study, we evaluated the reliability of GAP flaps on fourteen cases with different pathologies, sites and sizes and we found that these flaps were reliable, durable (bulky soft tissue in a pressure area), simple and easy to execute. It should be taken into consideration while reconstruction of such defects in the sacral and gluteal regions. In dealing with a large defects, Gluteal artery perforator flaps are considered to be superior to the random local flaps (in which we are limited by flap length and width), However recurrent cases with multiple scarring and fibrosis at the anatomical sites of perforators carry a risk of performing such flaps due to affection of their vascularity and this can be considered as a limitation of doing these flaps.

Conclusion:

The superior and inferior gluteal artery perforator flaps are versatile regarding size, site, and pathology of the defect, and considered relatively easy to perform. They should be considered in a large defect reconstruction of the lower back, buttock, and upper thigh areas. They are a much

better option than the frequently used random flaps, and other flaps as tensor fascia lata which should be preserved as a last resort in more complicated cases.

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