

## Profunda Femoris Artery Perforator-Based V-Y Advancement Flap in Reconstruction of Ischial Pressure Sores

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### ABSTRACT

Ischial pressure sore is the most common form of pressure sores in sitting paraplegic patients. It tends to have the highest rate of recurrence. Flap design for reconstruction should allow coverage of the ulcer without exhausting all donor areas. The search for flaps that spare a lot of donor areas led to the discovery of new perforator flaps. The aim of this study was to evaluate the applicability of the profunda femoris artery perforator-based V-Y advancement flap in reconstruction of ischial pressure sores. Nine ischial pressure sores in seven patients were reconstructed using this flap. Eight flaps survived completely with small area of wound dehiscence in one of them. One flap had partial necrosis (10% of the surface area of the flap). It can be concluded from this study that, the profunda femoris artery perforator-based V-Y advancement flap can efficiently be used to reconstruct ischial pressure sores.

### INTRODUCTION

The ischium is the most common site that shows pressure sore in patients with spinal cord injuries. This fact was derived from a study done in 1964 by Dansereau and Conway [1] and included the largest series of patients with pressure sores up till now (649 patients with 1604 pressure sores). Lindan et al. [2] in 1965 documented the distribution of pressure throughout the body in the supine, prone and sitting positions and found that the greatest pressure up to 75mm Hg developed over the ischial tuberosities.

The spectrum of flaps used for ischial coverage includes the gluteus maximus muscle flap [3,4], gluteus maximus island myocutaneous flap [5-7], posterior thigh (inferior gluteal thigh) flap [8], posterior thigh fasciocutaneous flap [9,10], lateral thigh fasciocutaneous flap [11], thigh transposition skin flap [12], posteromedial thigh fasciocutaneous flap [13], hamstring myocutaneous flaps [14-18], tensor fascia lata flap [19-21], gracilis myocutaneous island flap [22-24] and rectus abdominis flap [25,26].

Traditional V-Y advancement fasciocutaneous flaps used for coverage of ischial pressure sores

were described by Rubin et al. [10], Hayashi et al. [27] and Tuncbilek et al. [28]. The main disadvantage of the standard V-Y advancement flaps is the limited mobility [29]. To overcome this limitation Yildirim et al. [30] used the perforator-based V-Y advancement flaps at different anatomical regions (ischium was not included) to combine the advantages of perforator flaps and V-Y advancement flaps.

Many perforator flaps (gluteal and infragluteal perforator flaps) have been introduced as a valuable option for coverage of ischial pressure sores [31-34]. Ahmadzadeh et al. [35] anatomically studied the profunda femoris artery perforator flap and suggested its applicability to the ischial pressure sore reconstruction.

The aim of this study was to evaluate the applicability of the profunda femoris artery perforator-based V-Y advancement flaps in reconstruction of ischial pressure sores.

### PATIENTS AND METHODS

Nine profunda femoris artery perforator-based V-Y advancement flaps were performed in seven patients presented with ischial pressure sores. The operations were all performed by a single surgeon; the author. Patient data are seen in Table (1). All cases were primary cases that were not operated upon for ischial pressure sores previously.

#### *Surgical procedure:*

The patient is operated upon while in the lithotomy position. Urethral catheter was inserted to follow-up fluid balance intra-operatively and to avoid wetting of the suture lines by urine post-operatively. Marking of the ulcer and the planned V-Y flap was performed. The V-Y flaps used in this current study were designed like the extended V-Y flaps described by Pribaz et al. [36] and Terashi et al. [37].

The V-Y flaps were positioned over the profunda femoris perforators, according to Rubin et al. [10] (extends from midway between ischial tuberosity and greater trochanter down the mid-axis of the thigh to the popliteal fossa) and according to Ahmadzadeh et al. [35] (extends from the ischium to the lateral femoral condyle). The 1<sup>st</sup> profunda femoris artery perforator was found on the lateral aspect of the flap on the axis mentioned by Rubin et al. [10] where it crosses the inferior gluteal fold, while the other perforators were found on the center of the flap on the axis mentioned by Ahmadzadeh et al. [35]. Fig. (1) shows the preoperative drawings of the flap and the two axes. Fig. (2) shows the intraoperative identification of two perforators.

The ulcer (bursa) was excised en bloc. The ischial tuberosity was contoured to broaden the

pressure point. Total and subtotal ischiectomies were avoided. The margins of the flap were incised down to and incising the underlying fascia. Dissection continued in subfascial plane towards the axis of the flap so that the pedicle of the flap is formed of multiple perforators. Dissection stopped when the required mobilization of the flap was achieved. In most cases there was no need to completely skeletonize the perforators. Advancement of the flap with the transposition of its two extension limbs was done and sutured to the ischial defect left after excision of the ulcer. The donor site was closed directly to form the lower limb of the Y. Retention suture was placed through plastic supports to help prevent the “Y” junction from dehiscence. Suction drain was used to drain the ischial defect and the donor site of the flap. The suction drains were left in position for two weeks.

Table (1): Patient data

Patient	Age/Y	Sex	Pressure sore	Unilateral or bilateral	Cause	Pathology
1	25	Male	Ischial	Unilateral	Paraplegia	Spinal cord injury
2	27	Male	Ischial	Unilateral	Paraplegia	Spinal cord injury
3	30	Male	Ischial	Bilateral	Paraplegia	Spinal cord injury
4	18	Female	Ischial	Unilateral	Paraplegia	Spinal cord injury
5	70	Male	Ischial and sacral	Unilateral	Paraplegia	Compression of spinal cord by tumor
6	21	Female	Ischial	Bilateral	Paraplegia	Spinal cord injury
7	57	Male	Ischial	Unilateral	Paraplegia	Spinal cord injury



Fig. (1): Marking of the flap while the patient in lithotomy position. The axis of perforators mentioned by Rubin et al. [10] (R) and that mentioned by Ahmadzadeh et al. [35] (A) together with the inferior gluteal fold (IGF) are shown.



Fig. (2): Intraoperative photo after elevation of the flap. Two perforators are seen in the photo. One of the perforators is seen on the lateral aspect of the flap while the other on the center of the flap.

## RESULTS

The flaps were advanced and inset in their position in the ischial defects without any tension. The donor defects were closed directly without difficulty. Mild congestion appeared at the end of surgery in all cases but resolved spontaneously. There was not any total flap necrosis or any infection. Partial necrosis of 10% of the surface area of



Fig. (3): Pre-operative photo for ischial ulcer in case number 4 while the patient is in lithotomy position.



Fig. (4): Post-operative photo for case number 4 while the patient is in lithotomy position. Profunda femoris artery perforator-based extended V-Y flap is seen inset with direct closure of its donor site.



Fig. (5): Pre-operative photo for ischial and scaral ulcers in case number 5 while the patient is in lithotomy position.



Fig. (6): Post-operative photo for cases number 5 while the patient is in lithotomy position. Profunda femoris artery perforator-based extended V-Y flap is seen inset with direct closure of its donor site. No management was done for sacral pressure sore at this time.

## DISCUSSION

The ischial pressure sore occurs in seated patients. These patients tend to have a high recurrence rate because they tend to return to the seated position after healing. Conway and Griffith [38] reported on the treatment of 100 ischial pressure sores and found that regardless of the type of treatment (non-operative or operative) the recurrence rate was

75% to 77%. The optimal approach to ischial pressure sore coverage should include utilization of the most reliable flap to achieve a healed wound while preserving as many future flap options as possible [39].

Fasciocutaneous flaps preserve the underlying muscle as a future option for ischial pressure sore recurrence, do not impair ambulatory function and

are overall more resistant to pressure [40,41]. However, there is no doubt that muscle flaps should be used in extensive pressure sores with deep-tissue pockets, infected wounds or osteomyelitis [42-45].

In this current study, the flaps were designed as V-Y advancement flap to gain the advantages of the V-Y design. These advantages include; the proximal and well vascularized portion of the flap is inserted into the area of the excised pressure sore and the flap can potentially be re-advanced if a recurrent pressure sore should develop, the donor site is closed directly with minimal donor site morbidity and good color and texture match is achieved [27,30].

The main disadvantage of the standard V-Y advancement flap was its limited mobility. This makes flap under tension, which may lead to either impairment of the vascularity or disruption of the flap. The risk increases if the flap was elevated from a mobile part like the posterior thigh than from immobile part like the gluteal region [39].

To avoid this drawback the flap in this study was elevated while the patient in the lithotomy position during surgery to put the flap at minimal tension postoperatively (Mancoll & Phillips [46] used the jackknifed flexed position for the same purpose), V-Y flaps were designed as extended V-Y flaps as described by Pribaz et al. [36] and Terashi et al. [37] and the flap was elevated as perforator-based V-Y advancement flap (as described by Yildirim et al. [30]) but from the posterior thigh.

Addition of extension limbs onto the advancing edge of the V-Y flap and using them as transposition flaps [36,37] allowed closure of large defects with minimal tension. Despite using flaps from posterior thigh (which is mobile part) to reconstruct the ischial pressure sores exerts more tension on the repair [39] than using flap from the gluteal region (which is fixed part), it is my opinion to leave the flaps from the gluteal region to reconstruct the sacrum and the flaps from the posterior thigh to reconstruct the ischium.

In this current study the recommendation of Vasconez et al. [47-49] to remove minimal amount of the ischium in the debridement of ischial pressure sore was followed. Subtotal or total ischiectomy is associated with formation of a contralateral ischial ulcer in unilateral cases and with the formation of perineal ulceration that can be complicated by the formation of urethral fistulas [50].

Flaps from the posterior thigh have been based on either the descending branch of the inferior

gluteal artery [8,51-53] or the profunda femoris artery [10,11,14,54-56]. Anastomosis exists between the two systems [57].

Whereas Hurwitz et al. [8], Frick et al. [58] and Paletta et al. [55] found the descending branch of the inferior gluteal artery in 100 percent of their cadaver dissection (posterior thigh specimen), Cormack and Lamberty [59] found it in only 25 percent of their dissections (posterior thigh specimen) and Rubin et al. [10] found it confined to the skin of the gluteal region and absent in posterior thigh specimen. Cormack and Lamberty [59] concluded that the dominant blood supply to the skin of the posterior thigh was from musculocutaneous and fasciocutaneous branches of profunda femoris perforating arteries. These data encouraged us to use the V-Y design based on profunda perforators while neglecting the vascularization from the descending branch of the inferior gluteal artery.

Rubin et al. [10] and Ahmadzadeh et al. [35] evaluated the anatomical basis of the posterior thigh fasciocutaneous and perforator flap. Septocutaneous and musculocutaneous perforators originated from the main four perforating branches of the profunda femoris artery. Most perforators could be found on a line extending from midway between ischial tuberosity and greater trochanter down the midaxis of the thigh to the popliteal fossa [10] or from the ischium to the lateral femoral condyle [35].

The most proximal perforators in both studies were located at the inferior gluteal fold and the most distal perforators were found on average 10Cm proximal to the lateral femoral condyle.

The perforator-based V-Y advancement flap used in this current study was designed so that it includes both axes of perforators. Dissection of the flap can be carried out in subfascial or suprafascial plane as mentioned by Yildirim et al. [30] to explore the perforator vessels but the subfascial plane was preferred in this current study. Dissection around these perforators was done as required with no need to completely skeletonize these perforators in most of our clinical cases.

Rubin et al. [10] when they designed the posterior thigh fasciocutaneous flap, left a lateral skin bridge at least 10Cm inferior to the ischial tuberosity to ensure that the fasciocutaneous branches of the 1<sup>st</sup> and 2<sup>nd</sup> profunda perforators were preserved if direct inspection of the perforators was not undertaken. They stated that the back-cut can be extended and the flap islanded if necessary for mobility of the flap provided that the profunda

perforators were preserved. This is typically what was done in this current study.

The mild congestion observed at the end of surgery in this current study is similar to that observed by Yildirim et al. [30] who said that the flaps need a period of time to tolerate venous outflow decreasing and that it is a normal behavior for perforator-based flaps. Similar to Yildirim et al. [30] the congestion resolved within two days in all cases except in case number 7 where the congestion lasted more than two days and progressed to necrosis in 10% of the surface area of the flap. The cause of this congestion that led to partial necrosis may be the complete skeletonization of the perforators in case number 7.

It is to be concluded from this study that, the profunda femoris artery perforator-based V-Y advancement flap can efficiently be used to reconstruct ischial pressure sores. It combines the advantages of the V-Y flaps and the perforator flaps. It leaves many other flap options for reconstruction in case of recurrence.

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