

The Use of Perforator-Plus Fasciocutaneous Flaps For Sacral Pressure Ulcer Reconstruction

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Abstract

Pressure sores represent a major burden on the healthcare system worldwide. Approximately 3 million cases occur annually, with a treatment cost up to \$40,000 per pressure sore. Despite their prevalence, reconstruction of pressure sores continues to be challenging due to their high rates of recurrence. In this case report, we introduce our approach using the gluteal artery-based “perforator-plus” fasciocutaneous flap. This approach reduces donor site morbidity, enhances patient mobility, and preserves muscle function. In addition, it offers the potential for re-advancement, making it a particularly attractive option for this clinical entity.

Keywords

Fasciocutaneous flaps, perforator flaps, pressure ulcer, Antiretroviral therapy, Reconstruction

Introduction

Pressure sores represent a major burden on the healthcare system worldwide. Approximately 3 million cases occur annually, with a treatment cost up to \$40,000 per pressure sore.^{1,2} Despite their prevalence, reconstruction of pressure sores continues to be challenging due to their high rates of recurrence.³ This high recurrence rates necessitates the use of surgical techniques that minimize donor site morbidity, and preserve future reconstructive options. Historically, pressure ulcers have been reconstructed with myocutaneous flaps.^{4,5} However, recent studies have demonstrated comparable, if not superior, long-term outcomes using fasciocutaneous flaps.^{6,7}

Since gluteal perforator-based fasciocutaneous flaps were introduced by Koshima *et al* in 1993,⁸ a trend towards their preferred use to sacral and ischial ulcer reconstruction has developed. This is

especially important for ambulatory patients, to whom preservation of donor site muscle function is essential. In 2005, the concept of the “perforator-plus” flap was introduced.⁹ Subsequently, this concept has been used successfully for reconstruction of various surgical defects.¹⁰⁻¹²

In this case report, we introduce our approach using the gluteal-based “perforator-plus” fasciocutaneous flap for reconstruction of sacral pressure ulcers. This approach reduces donor site morbidity, enhances patient mobility, and preserves muscle function. Additionally, it offers the potential for flap re-advancement,^{13,14} making it a particularly attractive option for this challenging clinical entity.

Surgical Technique

Preoperatively, the surface markings of the piriformis muscle were made by drawing a line between the posterior superior iliac spine (PSIS) and the greater trochanter of the femur, with a second horizontal line drawn between the greater trochanter and a point midway between the PSIS and the coccyx (black line, **figure 1**). Using these anatomical landmarks as guide, a hand-held Doppler probe was used to locate the cutaneous perforators (red dots, **figure 1**). After excision of the sacral pressure ulcer, markings were then made for both a superior gluteal artery perforator (SGAP) rotation flap, and an SGAP island flap before proceeding with reconstruction (black curved solid line on left, and red dashed markings respectively, **figure 1**). Dissection began with an excision cranially and medially, adjacent to the defect (**figures 2 and 3**). Undermining was carefully extended infero-laterally in an exploratory fashion to identify the dominant superior gluteal artery perforator(s). At this point in the surgery, a branch point in our proposed algorithm is reached. Depending on the presence and the quality of the perforators encountered, the flap is subsequently be elevated as: 1) a perforator-based island flap; 2) a random rotation flap; 3) a dual-blood supply “perforator-plus” flap; or, 4) converted into a perforator-based island flap (**figure 4**).

Case Report

A 67 year old male who was otherwise healthy and ambulatory underwent wide curative excision for a sacral eccrine adnexal carcinoma, which resulted in an 8 x 8 cm soft tissue defect (**figure 2**). Markings were made, as described above. The superior gluteal incision was made, and subfascial dissection proceeded in a cephalad-to-caudad, and medial-to-lateral fashion to identify perforators originating from the superior and inferior gluteal systems. Two dominant, and one small superior gluteal artery perforators were preserved. Both dominant perforators measured 2 mm in diameter, and demonstrated visible arterial pulsation. Sufficient flap mobility was obtained from the superior gluteal incision and perforator dissection. Flap islanding was therefore unnecessary. The resulting

fasciocutaneous, “perforator-plus” flap was rotated clockwise for a tension-free reconstruction of the sacral defect (**figure 3**). The patient is currently 1 year postoperative, with a stable sacral reconstruction.

Discussion

Reconstructive goals for gluteal region defects follow the same conventional reconstructive goals, regardless of etiology: 1) coverage of the soft tissue defect; 2) restoration of physical contour; 3) provision of reliable coverage resistant to infection and pressure; 4) minimal donor site morbidity; and, 5) preservation of future reconstructive options.

Even after the popularization of perforator based fasciocutaneous flaps by Koshima and Kroll, myocutaneous flaps have been considered to be the gold standard to treat pressure ulcers due to their rich vascularity, as the muscle flap is used to deliver increased blood supply, nutrients, and antibiotics to the wound bed.^{13,14} However, recent studies have challenged the necessity of muscle inclusion. Perforator-based fasciocutaneous flaps provide enough tissue to cover dead space, have a reliable axial blood supply, and allow adequate closure with minimal donor site morbidity, while the short-term functional and esthetic results of perforator fasciocutaneous flaps proved superior to myocutaneous flaps.¹⁵

The reconstruction of sacral defects should have a simple design, reliable vascularity, minimal donor site morbidity, and be potentially reusable. The “perforator-plus” rotation flap concept is an excellent concept for wounds in the gluteal region. The “perforator-plus” rotation flap has dual blood supply from the subdermal plexus on the flap base, and from the perforator pedicle. This rotation flap can be re-elevated and re-advanced using the same incision in the event of an ulcer recurrence¹⁴. In this case report we approached the reconstruction using a perforator-based rotation flap design with a large radius. We started by utilizing half the marked incision. This provides enough exposure to dissect the pedicle and assess the pedicle's length and mobility of the flap. When the pedicle caliber and length is adequate, the remainder of the incision is made and the flap is used as a “perforator-plus” flap. In addition to its superior vascularity, this flap option is easily re-advanced in case of recurrence. In this approach if the pedicle length does not allow for sufficient mobility, the flap can be converted into an island-type perforator flap. If the perforator cannot be identified during the initial surgery, or during re-advancement, the flap can be converted into a random traditional rotational flap.

In this approach, the gluteus muscle is spared. This is of functional value in active and mobile patients, as in this case. During initial pressure sore reconstruction, the use of muscle flaps is controversial. First, the pressure points in the human body are covered by skin and subcutaneous tissue, and muscle coverage

not provide any additional benefit. Second, muscle tissue is less resistant to ischemia, and the muscle under goes postoperative atrophic changes shortly after surgery. Finally, preservation of the muscle leaves an additional option for future reconstruction in the case of recurrence or necrosis.

Based on our experience, we suggest this approach for sacral wound reconstruction. Utilization of the “perforator-plus” fasciocutaneous rotation flap concept provides sufficient tension-free coverage, with adequate vascularity and versatility, as the flap can be converted into either an islanded flap or a random rotational flap if necessary.

Conclusion

The “perforator-plus” approach is a valuable addition to the treatment of sacral pressure ulcers. This concept can be applied to nearly any sacral or gluteal wound, and has the potential to become the standard approach for other flap reconstructions.

Figures

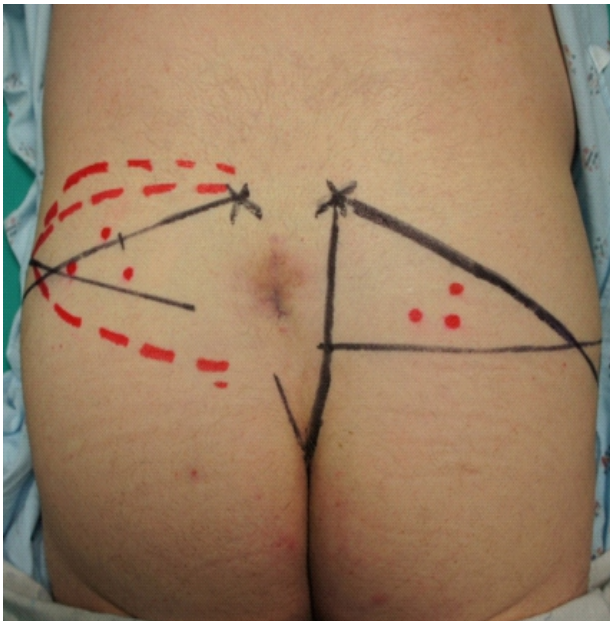


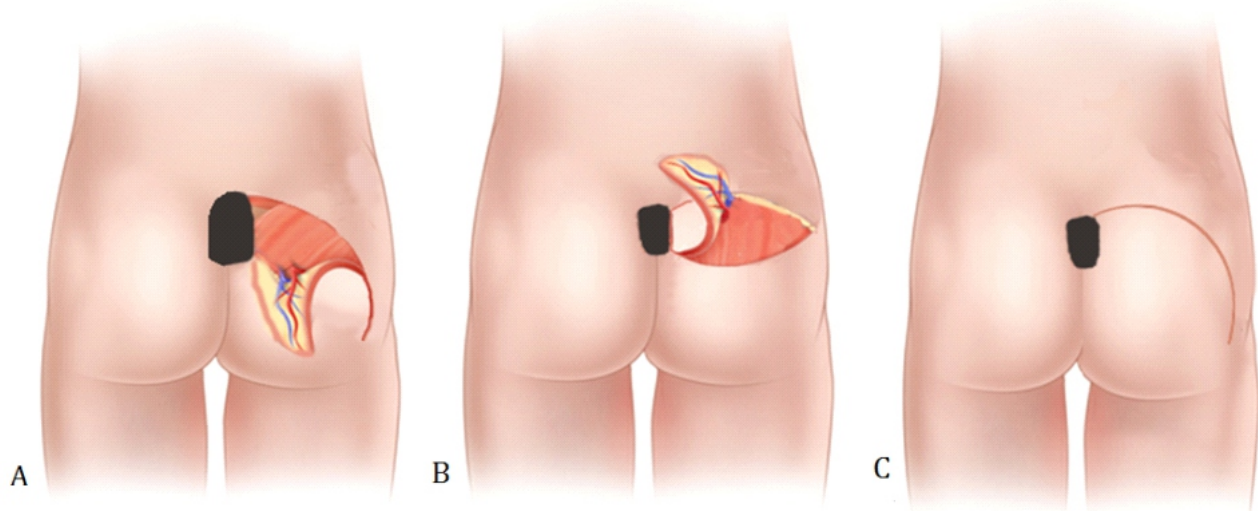
Figure 1: Initial flap surface markings



Figure 2: Flap design after created of sacral defect



Figure 3: Flap rotation and soft tissue closure



A: A perforator plus based on the SGAP is used for the sacral wound reconstruction after identifying the perforator and its adequate length.

B: The flap is turned into an island flap based on the SGAP for reconstruction of the sacral wound when the pedicle does not allow enough mobility.

C: The sacral wound is reconstructed with a random fasciocutaneous when no pedicle is identified.

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