

Application of gluteus maximus fasciocutaneous V-Y advancement flap combined with resection in sacrococcygeal pressure ulcers

A CONSORT-compliant article

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Abstract

Background: Traditional gluteus maximus myocutaneous flaps have generally been used to fill tissue defects after resection of sacrococcygeal pressure ulcers. However, postoperative complications were gradually revealed as increasing operations were performed. This study aimed to introduce the innovative application of gluteus maximus fasciocutaneous V-Y advancement flaps for repairing tissue defects and to comparatively analyze the differences between the innovative and traditional flaps.

Methods: A total of 32 cases were included in this study. All the PU lesions were removed by resection. Sixteen cases used the gluteus maximus myocutaneous flaps, and the remaining 16 cases used gluteus maximus fasciocutaneous V-Y advancement flaps to fill the tissue defects after surgery. Comparative analysis between the gluteus maximus myocutaneous flaps and gluteus maximus fasciocutaneous V-Y advancement flaps was used to evaluate the 2 flaps based on the mean operating time, postoperative infection, paresthesia, appearance of flaps, and recurrence.

Results: The gluteus maximus fasciocutaneous V-Y advancement flaps required a reduced operating time and a more simple operation compared with the gluteus maximus myocutaneous flaps. Although the infectious risk of the gluteus maximus fasciocutaneous V-Y advancement flaps was reduced compared with the gluteus maximus myocutaneous flaps, the gluteus maximus myocutaneous flaps have a better appearance compared with the gluteus maximus fasciocutaneous V-Y advancement flaps. Most importantly, no flap necrosis was noted, and the recurrence rate during follow-up was reduced in cases using the gluteus maximus fasciocutaneous V-Y advancement flaps.

Conclusion: The combined application of gluteus maximus fasciocutaneous V-Y advancement flaps with surgical resection can reduce the postoperative complications and aid in the treatment of sacrococcygeal pressure ulcers.

Abbreviations: GMFs = gluteus maximus fasciocutaneous V-Y advancement flaps, GMMs = gluteus maximus myocutaneous flaps, PUs = pressure ulcers.

Keywords: gluteus maximus myocutaneous flaps, sacrococcygeal pressure ulcers, V-Y advancement flaps

1. Introduction

Pressure ulcers (PUs) are wounds that develop in the upper layers of the skin as the result of sustained, externally applied pressure,

and these wounds grow in size both radially and into the deeper tissue layers.^[1,2] Clinically, PUs can cause severe pain, physical, and psychological discomfort and restrictions in activities, often leading to prolonged hospitalization, utilization of the health care system and mortality.^[3,4] PU severity is assessed using various staging or grading systems, the most common of which is the National Pressure Ulcer Advisory Panel staging system (Fig. 1).^[5] PUs can range from stage 1 with intact skin to stage 4 with full-thickness tissue defects and exposed bone, tendon, or muscle.^[6] In particular, patients with stage 3 or 4 PUs have a markedly increased risk of death.^[7]

Currently, the treatment for PUs involves various approaches, such as support surfaces, nutritional supports, wound dressings, and surgical operation.^[8] The most common and effective treatment for stage 3 or 4 PUs is lesion resection^[9]; however, the optimal method to repair the tissue defects after excision remains debated. The gluteus maximus myocutaneous flaps (GMMs) has historically been used in the treatment of tissue defects, although the occurrence of postoperative complications was gradually revealed as an increasing number of operations were performed.^[10] More importantly, no absolute treatment protocol is available for stage 3 or 4 PUs. In this study, we aimed to present the innovative application of gluteus maximus fasciocutaneous

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Figure 1. National Pressure Ulcer Advisory Panel pressure ulcer stages. A staging scale for pressure ulcers of increasing severity: the designation of stages 1 through 4 is based on the depth of ulceration and the structures that are affected. (All the photos in this figure were obtained from the official website of the National Pressure Ulcer Advisory Panel, NPUAP, and a previous study [DOI: 10.3238/arztebl.2010.0371]. The photos were used and reprinted with permission.* Not pictured.)

V-Y advancement flaps (GMFs) for repairing tissue defects and to comparatively analyze the differences between the traditional and innovative flaps.

2. Methods

A total of 32 patients (male: 18, female: 14) were diagnosed with PUs (stage 3: 22, stage 4: 10) from January 2013 to December 2015. These patients were 55 to 89 years old and had a disease course ranging from 3 months to 2 years. Of the 32 patients, there were 5 cases of cerebral trauma, 12 cases of spinal fracture, 6 cases of lumbar disc herniation, 4 cases of spinal stenosis, 3 cases of hepatic coma, and 2 cases of spondylolysis of the fourth lumbar. According to the wound area of the PUs, 5 cases showed a lesion of 6 to 8 cm in diameter, 14 cases showed a lesion of 8 to 10 cm in diameter, 10 cases showed a lesion of 10 to 12 cm in diameter, and 3 cases showed a lesion of larger than 14 cm. All 32 patients were divided into 2 groups (16 cases/group). Group A received neighbor island GMMs, while GMFs were applied in Group B.

All of the patients underwent exercises, such as maintaining a lateral or prone position, to avoid continued oppression of the flaps on admission. Based on individual health status, nutritional support, including human serum albumin, was provided to sectional patients with hypoproteinemia preoperatively. Four out of 32 patients had wound secretions, and the bacteria culture results of the wound secretions were negative. All patients provided informed consent. The details of the surgery, treatment principle, efficacy, possible complications, and precautions were explained to the patients preoperatively, and all operations were performed by the same surgeon and under spinal anesthesia.

A typical PU (stage 3, elliptical lesion) case was chosen to demonstrate the GMF operating procedure. An incision was made along the lesion edge (2 cm beyond the margin) (Fig. 2). The

lesion, which involved full-thickness skin and tissue, was completely removed, and the sacrococcygeal muscular layer was directly exposed. The size of the gluteus maximus fasciocutaneous flap was based on the wound site after PU resection. One incision that was interlinked with the wound was created at the top of the wound and continued to the rear of the greater trochanter of the femur. The depth of the incision reached the deep fascia layer or preferably the gluteus maximus muscular layer. The other incision was initiated at the bottom of the wound and intersected with the first incision at the rear of the greater trochanter of the femur. Then, the large and lateral grade V-shaped gluteus maximus fasciocutaneous flap was achieved (Fig. 3). The V-shaped flap was then advanced to the wound site

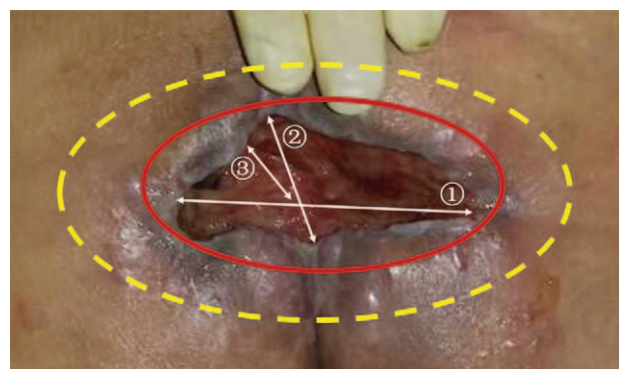


Figure 2. The patient with sacrococcygeal PUs (stage IV). The red circle indicates the range of the PU wound. ① indicates that the length of the PU wound is 7.8 cm. ② indicates that the width of the PU wound is 5.2 cm. ③ shows that the depth of the PU wound is 4.7 cm. The yellow dotted circle indicates the pre-incision area.

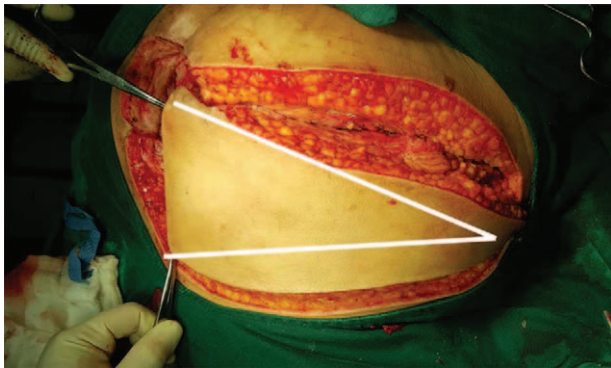


Figure 3. The external view of the gluteus maximus fasciocutaneous V-Y advancement flap. The white line indicates the large and lateral grade “V” shape gluteus maximus fasciocutaneous flap.

for covering (Fig. 4A). If the size of the wound was small, the flap could be sutured directly. If the size of the wound was large, the muscle starting points of the flap adhering to the sacrum could be released for better shifting (Fig. 4B). If the size of the wound was very large, the bilateral V-shaped gluteus maximus fasciocutaneous flap could be replaced for a unilateral V-shaped flap.^[11] Finally, the GMF was achieved by interrupted suture (Fig. 4C). The GMM operating procedure was based on that reported in the literature^[12] and is not described in this study. Each patient received a negative pressure drainage vessel in the subcutaneous layer after interrupted suturing (Fig. 5).

All of the patients were maintained in a lateral or prone position on the bed, and the same broad-spectrum antibiotics were administered for 72 hours postoperatively. The negative pressure drainage vessels were removed on the third day after the operation according to the drainage volumes. Bacterial cultures were performed based on the presence of wound secretions. The status of the flaps was observed carefully for 2 weeks until the stitches were removed. After leaving the hospital, the patients were followed up every 6 months by phone.

Ethical Considerations: the study complies with the ethical rules for human experimentation that are stated in the 1975 Declaration of Helsinki, including approval by the institutional review board.

3. Results

Between 2013 and 2015, 32 patients with sacrococcygeal PUs underwent resection combined with GMMs or GMFs in the



Figure 5. An image from the first day postoperatively. Subcutaneous congestion and tissue swelling are visible in the image (the picture in the upper left corner is an enlarged image of the “white circle”).

department of trauma and microsurgery of our hospital. The comparisons between GMMs and GMFs are presented in Table 1. The mean operation time of Group A was approximately 3.5 hours, which was 1.5 hours longer or approximately 2-fold compared with that of Group B.

The 2 groups were administered the same antimicrobial therapy for 72 hours postoperatively for the purpose of preventing infection. The wound secretion of each patient was collected for bacterial cultures and drug allergy testing after the negative pressure drainage vessels were removed. Group A showed infection with 3 types of bacteria, and the number of cases was 6 (37.5%). Group B showed infection with 2 types of bacteria, and the number of cases was 2 (12.5%). All infected patients were cured using targeted antibiotics according to the results of drug allergy testing.

One case in Group A showed dysesthesia in the flap area, and 1 patient in Group B reported numbness or even mild 2-point discrimination disorder in the flap area. However, hypoesthesia disappeared during the 1-year follow-up.

In Group A, 5 cases experienced rash, blister and hematoma in the flap area (31.25%). Two cases experienced pigmentation at the margin of the flap, and 1 case developed flap necrosis (a large amount of perse and serous exudate appeared at the remote area

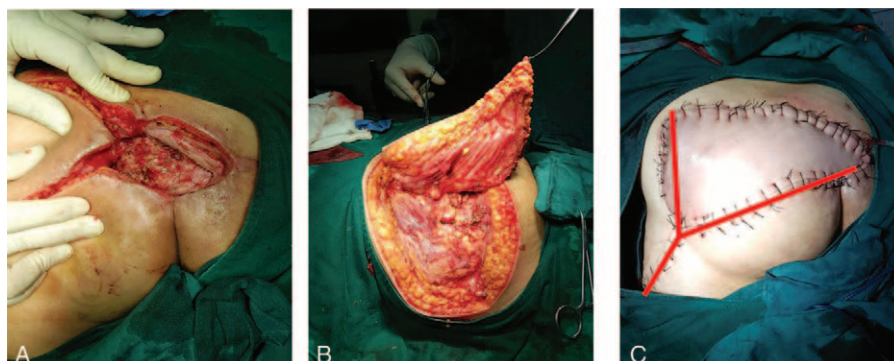


Figure 4. Images from the operating procedure. The red line in picture C shows the appearance of the “Y” shape by the reconstruction of the gluteus maximus fasciocutaneous flap.

Table 1
The comparative analysis between the GMMs and GMFs.

Contents	Group A	Group B
The mean operating time, h	3.48±0.17	2.05±0.21
Postoperative infection*		
<i>S. aureus</i>	3	1
<i>P. aeruginosa</i>	1	0
Klebsiella	2	0
<i>S. faecalis</i>	0	1
Paresthesia*		
Dysesthesia	1	0
Numbness	0	1 [†]
Disorders of 2-point discrimination	0	1 [†]
Appearance of flaps*		
Rash	2	6
Blister	1	4
Hematoma	2	0
Pigmentation	2	1
Flap necrosis	1	0
Recurrence*		
6-mo follow-up	0	0
1-y follow-up	2	0

*The units of these items are the number of cases.

[†]The case with hyperesthesia and disorders of 2-point discrimination is the same case.

of the flap at the fifth day after the operation. A partial region of flap started to blacken and harden on the tenth day, and flap necrosis was diagnosed on the second weekend). The patient with flap necrosis received reoperation with the GMF and showed a complete recovery after 2 weeks. In Group B, 10 cases experienced rash, blister, and hematoma in the flap area (62.5%). One case experienced pigmentation at the margin of the flap, but no flap necrosis was noted.

During the 6-month follow-up period, no recurrence was noted in either group. However, during the 1-year follow-up period, 2 cases of recurrence were noted in Group A.

4. Discussion

PU are described as “localized injury to the skin and/or underlying tissue, usually over a bony prominence, as a result of pressure or pressure in combination with shear.”^[5] Pressure, shear, friction, and microclimate interact as extrinsic factors in the development of PUs.^[13,14] Thus, how to relieve these extrinsic factors in advance is a key point in preventing PUs. Although a large number of studies in developed countries have assessed prophylactic and pressure-reducing measures, the PU rates continue to escalate at an alarming rate.^[15] As a common disease, the prevalence of high-grade PUs (stage 3 and 4) has been reported to be as high as 3% and may reach 4% among elderly persons receiving nursing care in institutions.^[16] In summary, the treatment of PUs, especially those of stage 3 or 4, is very important, and optimal methods are urgently needed.

Based on recent studies, many forms of treatment have been suggested for PUs, such as the use of air-fluidized beds, protein supplementation, radiant heat dressings, and electrical stimulation.^[15] However, the worldwide accepted treatment of stage 3 or 4 PUs is wide local excision with a safe margin, with treatment administered as soon as possible.^[17] Stage 3 or 4 PUs typically exhibit a long duration of disease and are accompanied by chronic inflammation and multi-infection.^[18] Thus, if conservative treatment is adopted, inflammation may persist, and the infection could become aggravated.

Currently, PU resection is effortless and easy for surgeons as a standard operation; however, we should also consider difficulties in wound recovery and the filling of tissue defects if the surgical area is too large, given that PUs are typically located in areas frequently utilized for sitting and lying. Moreover, PU patients must simultaneously seek effective treatments for the recovery of a normal appearance. Therefore, surgeons should take comprehensive considerations based on the principles of PU surgery and plastic surgery.^[19] The most common method to solve the problem of wound recovery is flap prosthetics.^[20] Various flaps (generally accompanying Z-plasty and W-plasty), such as myocutaneous, fasciocutaneous, and subcutaneous flaps, and even some peculiar flaps, such as island flaps, perforator flaps, V-Y flaps, and distally based flaps, are applied in plastic surgery.^[21,22] Based on a large number of flap operations, clinical experience indicates that the use of GMMs or fasciocutaneous flaps to fill sacrococcygeal tissue defects is effective and can improve appearance.^[23] V-Y flaps are generally used for small tissue defects, such as fingertip defects.^[24] We are the first to report the use of the GMF combined with resection for the treatment of sacrococcygeal PUs and to analyze the differences between traditional myocutaneous flaps and advancement fasciocutaneous V-Y flaps.

In this study, the GMM operation was more time-consuming than that for GMF. In the GMM operation, the superficial branch of the superior gluteal artery should be accurately identified as the vessel pedicle for the blood supply of the myocutaneous flaps. During the operation, the superior and inferior gluteal artery and nerve should be exposed at different levels.^[25] In addition, the dissection of the gluteus maximus is complicated (including many vessels and nerves branches and anastomoses).^[26] Thus, the vessels and nerves can be easily injured unless a demanding and delicate operation is performed. More seriously, myocutaneous flap necrosis will likely occur when the vessel pedicle reverses or is blocked (thrombus) postoperatively.^[27] Thus, the GMM operating time is long, and the operation difficulty is high. However, the GMF blood supply is multichannel because it depends on the abundant fascia, dermal capillary network, and subcutaneous arterial network.^[28] Thus, the GMF operation is favorable and rapid if the fasciocutaneous V-Y flap design is accurate and appropriate.

Obviously, the longer the operation time, the higher the risk of infection.^[29] Table 1 shows that the number of infections in GMM cases was greater than that in GMF cases. From another perspective, Calderon^[30] reported no significant differences in the ability to resist infection between myocutaneous and fasciocutaneous flaps, although the ability to resist infection in the deep layers of fasciocutaneous flaps was enhanced compared with myocutaneous flaps. Thus, fasciocutaneous flaps can be used for stage 3 or 4 PUs supportively.

Temporary paresthesia was noted in the flap area of GMMs and GMFs because local tiny nerve branches were injured during the operation. The injured or fractured peripheral nerves can regenerate with a growth rate of 0.5 to 1 mm/d.^[31] The number of cases with rash and blister in the GMM group was reduced compared with the GMF group, whereas the number of hematoma cases in the GMM group was greater than that in the GMF group. Apparently, the myocutaneous flaps involve deep layers and have approximately the same surface area as the PU wound, whereas the fasciocutaneous flaps involve only shallow layers and have a greater surface area than PU wound.^[32] The larger the surface area, the more difficult it is to create a tension-free suture; thus, rash and blisters form more easily.

Conversely, the deeper the tissues involved, the more difficult the drainage; as a result, a hematoma can form more easily, and flap necrosis may occur.

Finally, pigmentation was noted in 3 cases after leaving the hospital, but this was not reported in the remaining 29 cases. By means of follow-up, the 3 cases reported Teding Dianci Pu (TDP) treatment because the sacrococcygeal region became cold when maintained in the prone or lateral position on the bed for a long time. Use of TDP treatment can result in local pigmentation upon direct exposure to the illuminant.^[33] At the 1-year follow-up, there were 2 recurrences in the GMM group, whereas no recurrence was noted in the GMF group. The reasons for recurrence include advanced age, immobility, poor nutrition, and nursing. The intrinsic problems associated with GMMs warrant further study by plastic surgeons.

5. Conclusions

In summary, the fasciocutaneous V-Y advancement flap is more suited for the repair of sacrococcygeal tissue defects after PU resection. The surgical procedure for fasciocutaneous V-Y advancement flaps is more simple and time-saving than that for myocutaneous flaps. In addition, this procedure reduces infection, flap necrosis, and recurrence in patients with sacrococcygeal PUs. Thus, believe that fasciocutaneous V-Y advancement flaps represent a treatment method that is easily learned and practical.

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