

Three-Dimensional Gluteus Maximus Flap in Recurrent Deep Ischial Pressure Injuries after Previous Fasciocutaneous Flap Reconstruction

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ABSTRACT

Background: Pressure injuries present a substantial burden on hospitals and healthcare facilities. The presence of multiple flaps and techniques for reconstruction of ischial pressure injuries is associated with high recurrence rates denoting that there is no ideal flap, especially in large and deep cases. The main cause for recurrence is that the fasciocutaneous flaps that are used for reconstruction target a two-dimensional skin defect and neglects the deep 3rd dimension.

Patients and Methods: This retrospective study was conducted on thirty patients who suffered 38 recurrent deep ischial pressure injuries (Grade IV) and managed with a combined gluteus maximus mobilization with simple fasciocutaneous rotation/advancement flap between July 2019 and July 2021. Post-operative complications were recorded.

Results: The average defect size after debridement ranged between 7.53 ± 2.1 SD cm in height and 6.61 ± 2.2 SD cm in width. While the mean operative time ranged around 73.94 ± 17.6 SD min. The mean hospital stay was 8.24 ± 1.5 SD days. One patient had early superficial wound dehiscence at the tip of the rotation flap and was managed conservatively.

Conclusion: The three-dimensional gluteus maximus flap is a backup option for the management of recurrent ischial pressure injuries with a simple fasciocutaneous rotation/advancement flap to obliterate the dead space in recurrent cases. This option with a compliant education program can provide a simple and durable solution for serious ischial pressure injuries with low complications and recurrence rates.

Key Words: Ischial pressure injury – Gluteus maximus muscle – Rotation flap – Three dimensions.

Conflict of Interest: The authors declare that they have no conflict of interest to disclose.

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Ethical Considerations and Consent: Informed consent of all the patients regarding photography and maintaining all ethical considerations regarding the proposed surgical procedure and possible complications. The rates of revision for recurrence or complications were discussed during the patient's examination. Our study ensures confidentiality regarding all the data that will be taken from the participants. All research participants were free to be enrolled in the study after explain-

ing all the options for management according to their situation. This study was approved by our Institutional Research Board (IRB R.22.04.1699.R1).

INTRODUCTION

Pressure injuries present a substantial burden on hospitals and healthcare facilities because of their chronic nature and the long course of multidisciplinary treatment [1]. The principal cause of pressure injuries is spinal cord trauma and injuries, as one-third of these patients develop over one injury because they become bedridden and wheelchair dependent with prolonged sitting. Therefore, ischial pressure injuries are the most common both in incidence and recurrence [2,3]. There has been a great debate among plastic surgeons regarding the ideal flap that could be used in ischial pressure injuries, the criteria include reproducibility, simplicity in design, seldom complication rates, and versatility to obliterate the dead space and tolerate the pressure at the ischium. A myriad of fasciocutaneous, muscle, and myocutaneous flaps have been used with some pros and cons [4]. Recurrence is the major complication of surgical treatment, regardless of the flap used. This is because of shearing forces, spasticity, contractures, residual bursa, and osteomyelitis of the ischium [5]. There is a clear-cut gap in the medical literature regarding which appropriate techniques can prevent pressure injury. It is important to educate patients about the mechanism of pressure injury and how they should understand the prevention strategies. Those who are not compliant will eventually contribute to being a burden on the healthcare system and the economy [6]. Patient and family education helps improve outcomes and decrease the costs, morbidity, and mortality. This will boost the patient quality of life substantially [7]. Our study aimed to present a simple solution to manage recurrent deep ischial pressure injuries with the concept of three-dimensional dual flap reconstruction to obliterate dead space and close the skin defect simultaneously.

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PATIENTS AND METHODS

The authors conducted a retrospective study on a cohort of patients who were admitted to the Plastic and Reconstructive Surgery Department at Mansoura University Hospital between July 2019 and July 2021. The study included 30 patients who suffered from recurrent 38 deep ischial pressure injuries (Grade IV) after they had been previously managed with fasciocutaneous flap coverage primarily. Our inclusion criteria were patients with spinal cord injury between 18 and 60 years of age with a body mass index (BMI) between 20 and 35. While, our exclusion criteria were patients with comorbid diseases e.g., diabetes mellitus, hypertension, or patients with multiple recurrences who were not compliant with their post-operative rehabilitation program.

All demographic data, including age, gender, associated co-morbidities, lab study in the form of complete blood count and albumin levels, other injuries, previous operations, urinary catheter condition and duration, and presence of osteomyelitis were recorded. Any postoperative complications were recorded as wound dehiscence, hematoma, seroma, partial or total flap loss, and injury recurrence.

Surgical technique:

Pre-surgical preparation:

Patient and family education programs were implemented. It consists of a regular check-up of common pressure points that are sensitive to pressure injuries either in supine or sitting decubitus which includes the occiput, around and behind the shoulders, the elbows, wrists, ischium, sacrum, trochanters, knees, ankles, and heels. Repositioning tips in the form of self-shifting of patient weight or asking for help frequently every two hours, seeking a specialty wheelchair, cushions, or a mattress that relieves pressure, and adjusting the bed at 30 degrees elevation. Mirror self-examination was also taught. Skincare education in the form of keeping skin clean and dry. Skin Protection using emollients and protective dressings. This education program is very important to prevent injury recurrence in the future. One of the most critical points in patient preparation was through improving their nutritional status including a high protein diet, iron, zinc, ascorbic acid, and multivitamins to improve wound healing power. A normal range of laboratory results (e.g., hemoglobin, total leucocyte count, serum total proteins, serum albumin, serum iron, and C-reactive protein) was considered a good indicator of improved nutritional status. All patients underwent culture and sensitivity swap, a preparatory rectal enema, and a prophylactic anti-

biotic was given the day before surgery according to culture and sensitivity results. The pre-operative physical rehabilitation program was started to make joints supple and decrease the muscle contracture, especially at the hip and knee joints.

Operative steps:

Most of our patients were operated on without general anesthesia (GA) due to documented sensory loss. Only 2 patients underwent GA as they were sensate due to low spinal cord injuries. The patients were placed in a prone position with 30° flexion. Aggressive debridement of the ischial pressure injury was done to remove all necrotic, no viable, and fibrotic tissues. The ischial tuberosity was carefully blunt and a bone biopsy was taken for cultures and proved the presence of osteomyelitis. The overall dimension of the defect was measured and a random pattern rotation flap was designed to close the skin defect taking care not to interfere with any flaps to be used in case of recurrence. Once the fasciocutaneous rotation flap was elevated, the gluteus maximus muscle was exposed. The full thickness of the lower part of the gluteus maximus muscle; including the muscular perforator of the inferior gluteal vessel; was divided parallel to the muscle fibers till the level of gluteus medius muscle then dis-inserted from the femur followed by transposing it to obliterate the deep cavity over the ischium. The muscle was sutured to the lower deepest part of the injury using 0 absorbable sutures. The rotation flaps were closed primarily and sutured in two layers over a suction drain.

Post-operative care:

Patients were guided to sleep and rest in a prone position on an air mattress for at least 4-5 days to avoid pressure on the operative site until complete healing was achieved. A high protein, high-calorie diet was established for the patients. Open wound dressing was used to facilitate easy wound care and follow-up. Drain removal was carried out when the output was 30 ml or less per day. At 3 weeks post-operatively, sutures were removed, and physical therapy and rehabilitation programs were started. A strict sitting protocol was explained to the patients and their caregiving starting 6 weeks post-operatively. Half an hour of sitting was started every day and was increased by 10 minutes every 5 days until 2h per day was achieved. Patients were allowed 5 minutes of sitting with 1min of pressure relief during this period. Follow-ups were recommended monthly for 1 year and yearly after that.

Statistical analysis:

Mean and standard deviation will be calculated using a *t*-test. Data will be described by absolute

and relative frequencies. Data will be analyzed using IBM SPSS v. 19 (New York, NY, USA).

RESULTS

In this study, we reported 2 females and 28 males with 38 ischial pressure injuries including 8 bilateral cases. The mean age was 40.23 ± 10.1 SD years. All injuries were grade IV. The average defect size after debridement ranged between 7.53 ± 2.1 SD cm in height and 6.61 ± 2.2 SD cm in width. While the mean operative time ranged around 73.94 ± 17.6 SD min.

The authors left the surgical drains for 7.24 ± 1.5 SD days. The mean hospital stay was 8.24 ± 1.5 SD days. Eight patients had bilateral ischial injuries and 6 patients had concomitant sacral or trochanteric pressure injuries. Ten patients had previous two previous surgeries and the rest of the patients had only one previous surgery for injury coverage (Table 1).

Table (1): Patient demographic data and follow-up.

Number of patients	30 (28 male, 2 female)
Number of ischial injuries	38
Age	18-58 (40.23 ± 10.1 SD) years
Previous surgeries number	10 patients: Two, 20 patients: One
Injury size	7.53 ± 2.1 SD cm x 6.61 ± 2.2 SD
Hospital stays	8.24 ± 1.5 SD days
Operative time	73.94 ± 17.6 SD min
Follow-up	12.42 ± 4.6 SD months
Complications	1 wound dehiscence, 1 recurrence

The follow-up period ranged between 12.42 ± 4.6 SD months. One patient had early superficial wound dehiscence at the tip of the rotation flap and was managed conservatively. Another patient had superficial injury recurrence 18 months after surgery and managed by re-advancement of the rotation flap and the muscle was found intact and no exposure of the ischium.

Some cases (Figs. 1-3).

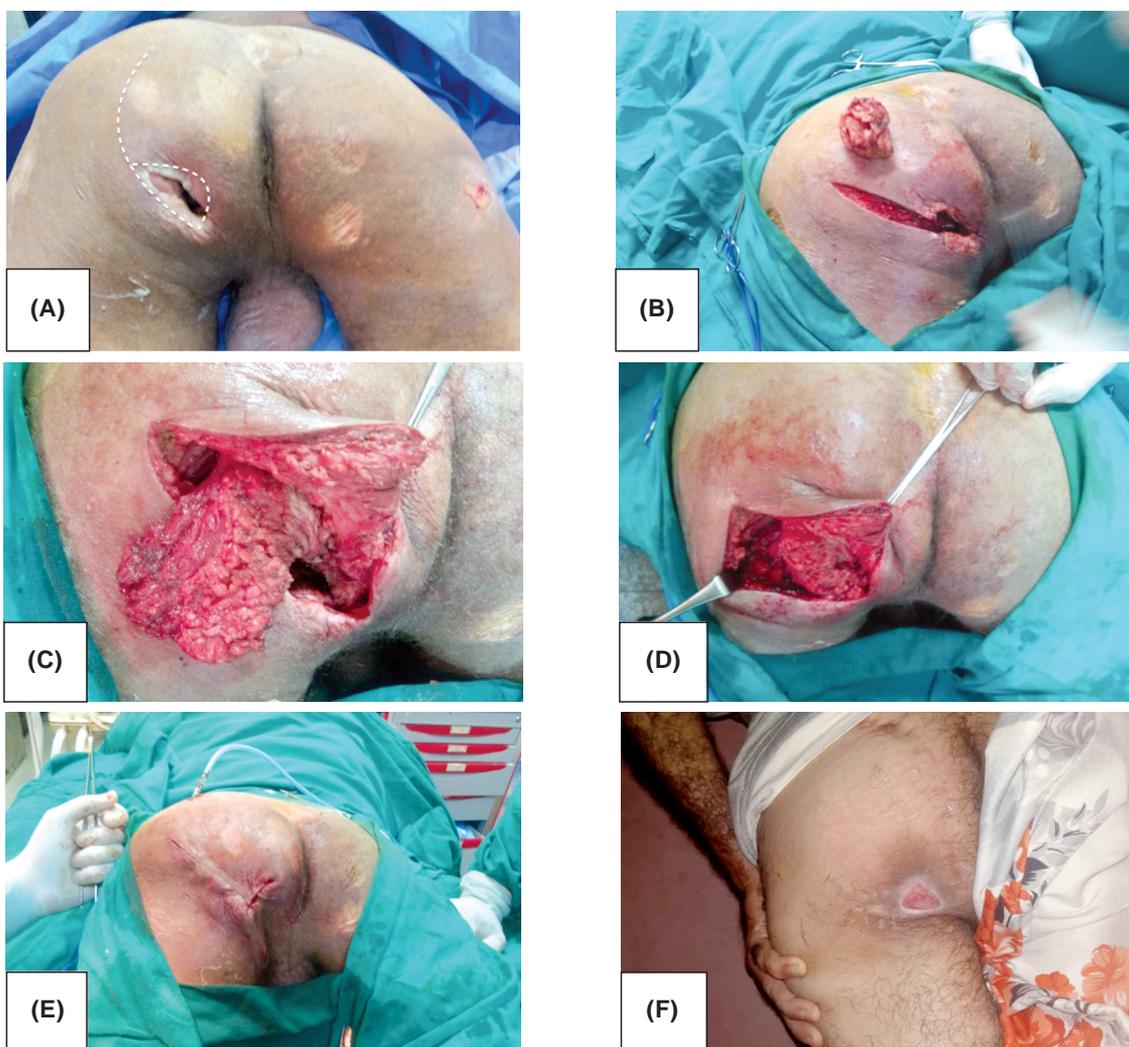


Fig. (1): 34 years old male patient with a left recurrent ischial pressure injury. (A): Pre-operative marking of the planned defect for excision and random rotation flap design. (B): After rotation flap incision and debridement of the pressure injury. (C): A skin flap is elevated exposing the gluteus maximus muscle. (D): The lower part of the gluteus muscle is transposed and sutured over the ischium. (E): Immediate post-operative after skin rotation flap is closed. (F): A superficial recurrent ulcer after 1.5 years.

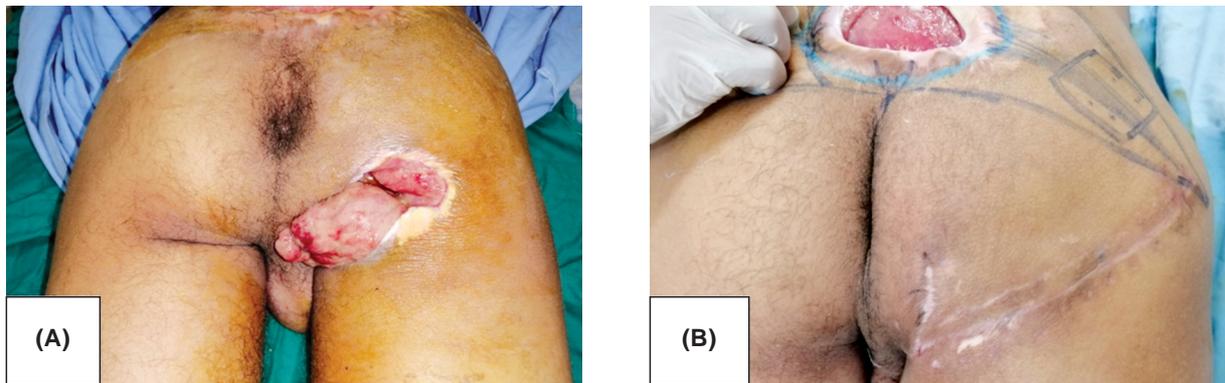


Fig. (2): 26 years old male patient with a right recurrent ischial pressure injury. (A): A pre-operative photograph with large granulation tissue bulging from the defect. (B): 4 months post-operative follow-up with no recurrence.

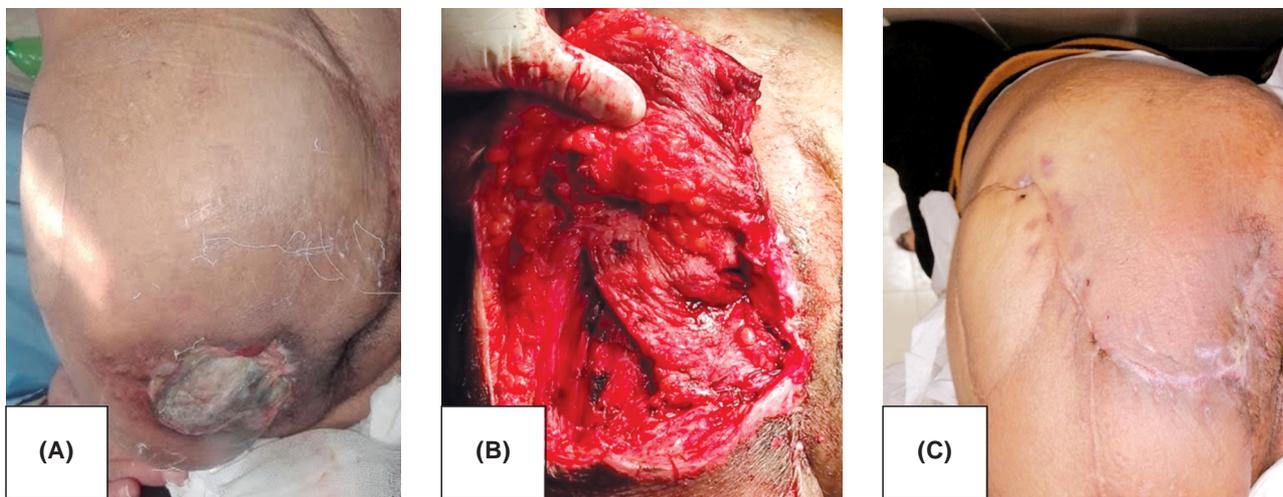


Fig. (3): 38 years old male patient with a recurrent ischial pressure injury. (A): A pre-operative photograph with a necrotic defect after a previous V-Y advancement. (B): The rotation flap was raised to expose the gluteus maximus muscle and suture it over the ischium then closure of the skin flap. (C): 8 months post-operative follow-up with no recurrence.

DISCUSSION

The existence of numerous local flaps for reconstruction of ischial pressure injuries has demonstrated that there was no ideal flap that guarantees local recurrence, especially in large and deep cases. Therefore, a plan B should be in consideration to manage recurrence without burning all the available options in the primary attempt [8]. In our series, the main cause for recurrence besides the patient's general condition was that the fasciocutaneous flaps that had been used targeted a two-dimensional skin defect and neglected the deep 3rd dimension that is considered a nidus for recurrence in the future. According to Sameem et al., 2012, a lower recurrence rate (8.9%) was reported when musculocutaneous flaps were used in ischial pressure injuries compared to the recurrence rate of the fasciocutaneous flaps (11.2%) [9]. The use of both muscle and fasciocutaneous flaps has been shown to produce lower recurrence rates [10]. Acartürk

2009 emphasized the importance of the muscle flaps in the obliteration of dead spaces and chronic cavities to prevent infections and treat osteomyelitis [11]. The use of gluteus muscle for the treatment of ischial injuries gives overall lower complication rates [12]. However, if the entire muscle is dissected, the operative time will be much longer, increasing blood loss and disrupting probable future ambulation. In our technique, we used only the lower part of the muscle without the need for excessive dissection and without sacrificing any major blood vessels. The skin rotation flap also provides tension-free coverage of the pressure injury. The main disadvantage of the combined flaps is the long operative time. Our technique decreased the operative time and recurrence rates were lower. Also, the ability to readvance the rotation skin flap is an advantage in injury recurrence. Nisançi et al., reported the duration of surgery in combined techniques was around 3.5 hours with bigger dissected areas [13]. Our procedures were shorter in time and

lasted between 1.5 to 2 hours. Di Pompeo et al., described the use of anterolateral thigh flap in ischial injuries with an operative time of 212min. with medium-sized defects only [14]. The gracilis muscle along with the fasciocutaneous flap has been used to cover ischial injuries with an additional incision that eventually increased the overall operative time [15]. Another study reported the use of a pedicled internal pudendal artery perforator flap for treating ischial injury in which the distal part of the flap is de-epithelized to close the dead space in small to medium-size defects [16]. Kim et al., reported a gluteal Maximus perforator-based island flap for a gluteal defect in posttraumatic, post-oncological resection, or primary pressure injuries with tension-free closure. Unfortunately, this study did not address the versatility of this design in recurrent cases as our study targeted recurrent injuries only [17].

Limitations:

This study has some limitations, regarding its small number of patients and short follow-up. Some obstacles that face pressure injury patients in our locality are illiteracy, low socioeconomic status, and long distance from the tertiary facilities with inconvenient transportation. Most of those patients are in bad general conditions or suffering from other comorbidities that limit regular follow-up. The authors recommend further studies that show the long-term result with different techniques for recurrent cases in pressure injury reconstruction.

Although those limitations, the authors consider this technique had the advantage of being fast and reliable with limited donor site morbidity.

Conclusion:

It is very important to address the three-dimensional management in treating recurrent ischial pressure injuries. The dead space obliteration is a crucial step along with the fasciocutaneous reconstruction using local skin flaps. In this study, the authors demonstrated that the gluteus maximus muscle flap could be used as a backup option with a simple cutaneous rotation flap to provide voluminous tissue to obliterate the deep dead space in recurrent cases. This option with a compliant education program can provide patients a simple and durable solution for serious ischial pressure injuries with low complications and recurrence rates.

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