The Gluteal Thigh Flap: A Reliable, Sensate Flap for the Closure of Buttock and Perineal Wounds

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The buttock and perineal regions frequently have extensive wounds requiring flap reconstruction. Pressure sores are the most common etiology, although large defects are also caused by infection, trauma, or tumor.

Random cutaneous flaps of the buttocks and posterior thigh were popularized following World War II. In recent years, superb myocutaneous flaps have been designed and offer a wide range of choices for coverage. There are, however, occasions when it may be difficult to provide sufficient “filling material” and good-quality flap cover with a single flap at one operation. The most desirable flaps may have been used or their blood supply violated. Even when available, myocutaneous flaps have not reliably provided closure for large wounds of the buttocks and deep wounds of the anal-perineal region. Additionally, the sacrifice of major lower-limb motors—gluteus maximus, biceps femoris muscles—is done with reluctance in ambulatory patients.

A search for other axial-pattern flaps in this region resulted in the discovery of a compound myocutaneous and direct cutaneous flap that receives its blood supply from the inferior gluteal artery and sensory innervation from the posterior cutaneous nerve of the thigh (Fig. 1). Our initial case report of the gluteal thigh flap has been followed by a detailed anatomic study and 18 additional patients with 21 wounds, which form the basis of this communication.

Materials and Methods

Eight fresh cadaver dissections of the gluteal thigh region have been performed with the cooperation of the Department of Anatomy at the University of Pittsburgh. Clinical angiograms of the hypogastric artery were studied with the assistance of the Department of Radiology at the Montefiore Hospital of Pittsburgh. Anatomic variations discovered during clinical use of the flap also were documented.

In order to study the course and branching pattern of the inferior gluteal artery in fresh cadavers, the intrapelvic portion of the vessel was catheterized and Conray was injected. Isolation of the inferior gluteal vascular territory from anastomotic contributions from the femoral system was accomplished by detaching the flap from the body except at the level of the vascular pedicle and repeating the fluoroscopic studies. Then 20 cc of orange Microfil† was injected into the inferior gluteal artery (IGA) (Fig. 2). After allowing at least 5 hours for the silicone to solidify, the neurovascular morphology was studied.

The clinical study involved 21 consecutive wound closures over the past 20 months. Table 1 indicates the type of wounds closed with this flap. The flaps varied in length from 12 to 34 cm and ranged in width from 6 to 15 cm. In all but one instance, the donor defect was closed by direct approximation of the wound edges.

The first gluteal thigh flaps were reserved for desperate clinical situations, but as we gained experience with the flap, the indications broadened.

* Iobalamine meglumine injection, USP 60%, made by Mallinckrodt, Inc., St. Louis, Mo 63134
† Silicone-rubber injection compound, made by Canton Bio-Medical Products, Inc., P.O. Box 2017, Bondon, Colo. 80902

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The gluteus maximus is a broad, thick, and muscle of a quadrilateral shape. It arises from the lateral sacral and medial iliac bones and nearby ligamentous structures and courses obliquely to insert across the greater trochanter onto the iliobial tract. A deep portion inserts into the gluteal tubercle of the femur. The muscle extends and laterally rotates the hip and stabilizes on assuming the erect position.

The motor nerve supply is the inferior gluteal nerve (L5, S1-2), which exits below the piriformis muscle and then fans out to the undersurface of the gluteus maximus muscle. The blood supply is segmentally divided between the superior and inferior gluteal arteries with limited intermuscular connections. The superior gluteal artery enters the gluteal region over the piriformis, and its deep branches course laterally between the gluteus minimus and medius. The inferior gluteal artery is a terminal branch of the dorsal parietal division of

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### RESULTS

#### Anatomic Study

Morphology and Superficial Anatomy. The gluteal region extends from the iliac crest to the gluteal crease and overlies the gluteal aponeurosis and the gluteus maximus muscle. The subcutaneous fat increases in thickness in the inferior portion of the buttocks and becomes progressively thinner as one proceeds down the posterior thigh. The skin and fat of the entire thigh overlies an envelope of fascia called the fascia lata. The posterior fascia lata is formed proximally by the union of the superficial and deep layers of fascia of the gluteus maximus muscle at its inferior border. It forms a thin, but distinct, covering of the hamstring muscles and the popliteal fossa. The gluteal crease is formed by adherence of the fascia lata to the ischial tuberosity.

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### TABLE 1

<table>
<thead>
<tr>
<th>Repair</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Anal-rectal</td>
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</tr>
<tr>
<td>Exposed hip prosthesis</td>
<td>1</td>
</tr>
<tr>
<td>Bootleg injury</td>
<td>1</td>
</tr>
<tr>
<td>Buttock, thigh injection</td>
<td>2</td>
</tr>
<tr>
<td>Pressure sores</td>
<td></td>
</tr>
<tr>
<td>Ischial</td>
<td>6</td>
</tr>
<tr>
<td>Multiples</td>
<td>2</td>
</tr>
<tr>
<td>Recurrent ischial</td>
<td>3</td>
</tr>
<tr>
<td>Saddle</td>
<td>1</td>
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the internal iliac artery (Fig. 3). After passing between the upper sacral nerves, it exits the pelvis through the lower portion of the sciatic foramen, between the piriformis and coccygeus muscles, to enter the gluteal region. As it descends, it descends in the interval between the greater trochanter and the tuberosity of the ischium, the inferior gluteal artery branches to the undersurface of the glutus maximus muscle. At this level, it anastomoses with branches of the obturator and medial femoral circumflex arteries.

A small direct cutaneous branch accompanies the posterior cutaneous nerve of the thigh to the popliteal fossa. This termination of the inferior gluteal artery feeds a subfascia lata plexus of vessels of the posterior thigh, which also receives flow from several deep femoral perforators.

Injection studies of the inferior gluteal artery in both patients and cadavers showed apparent termination of the vessel into the anastomotic channels of the obturator and medial femoral circumflex arteries (Fig. 4). When these other anastomosing vessels were cut, the inferior gluteal artery was seen to flow to the distal portion of the posterior thigh (Fig. 5). Clinical experience confirmed our suspicion that the skin of the posterior thigh can survive on the inferior gluteal artery alone.

**Deep Anatomy.** The roof of the gluteal region is the glutus maximus muscle and the floor is made up of six small rotating muscles of the hip (Fig. 1). The sciatic nerve, posterior cutaneous nerve (S1-2), and inferior gluteal artery travel together from medial to lateral around the ischial tuberosity within the gluteal space. The sciatic nerve is the deepest structure, and as it enters the thigh, it lies on the adductor magnus muscle and is crossed obliquely by the long head of the biceps femoris. The course of the posterior cutaneous nerve overlies that of the sciatic nerve, and it...
The flap would be designed less than 1/4 width, realizing that obese females are more likely than muscular males. Theoretically, the entire posterior thigh skin could be carried on this vessel. The flap has been extended to within 2 cm of the popliteal fossa.

The superior arc of the flap reaches the sacrum and anterior superior spine (Fig. 7). Laterally, the flap covers the greater trochanter, and medially, it reaches the pubis and can fill deep pelvic cavities. It is for this final purpose that the gluteal thigh flap has provided its most unique and rewarding capabilities. All flaps have been elevated with the patient in the prone or semiprone position.

**Clinical Results**

**Flap Design and Execution**

The design and dissection of the flap is based on the extrapelvic course of the inferior gluteal artery (see prior section). The point of rotation of the flap is 5 cm above the ischial tuberosity, which overlies the emergence of the inferior gluteal artery from under the piriformis muscle (Fig. 6). The central axis of the flap is midway between the greater trochanter and the ischial tuberosity and perpendicular to the gluteal crease. The flap is centered over the thigh as the markings approach the knee. To permit direct donor site clo-

![Fig. 6. Flap design. The point of rotation of the flap is marked 5 cm above the ischial tuberosity. The central axis is midway between the greater trochanter and the ischial tuberosity and perpendicular to the gluteal crease. The flap can be extended from the inguinal region to within 2 cm of the popliteal fossa.](image-url)
Operation

The incision is made through the skin, subcutaneous tissue, and fascia lata. In the gluteal region, the course fibers of the gluteus maximus muscle leading to the iliotibial tract, and the caudal edge of the muscle are exposed. In the thigh, the fascia lata is cut and the incision is continued through the thin layer of fat overlying the hamstring muscles. At the most distal end of the flap in the midline, brisk bleeding is encountered. This is the termination of the inferior gluteal artery, and accompanying this vessel is the posterior cutaneous nerve of the thigh. The flap is elevated from distal to proximal by sharp dissection over the hamstring muscles. Several sutures should be used to attach the fascia lata to the overlying skin. The posterior cutaneous nerve (PGN) is easily seen on the undersurface of the flap.

Several deep femoral perforators are ligated as the flap is elevated. The gluteus maximus muscle insertions are incised to as much as necessary for flap mobility, but no higher than the greater trochanter. Dissection above the superior lateral border of the biceps femoris muscle requires identification of the sciatic nerve, which is easily palpated and bluntly pushed out of harm's way. Prominent cutaneous perforators from the medial femoral circumflex artery may be identified at this level and should be sacrificed only when necessary to achieve adequate flap mobility. A
narrow portion of the gluteus maximus muscle and its underlying inferior gluteal artery can be taken with the flap up to the lower border of the piriformis muscle. The pudendal vessels lie superior and medial to the ischial tuberosity; therefore, care should be taken in this area. The posterior thigh portion of the flap can be elevated with little dissection of the gluteus maximus muscle for lower buttock wounds such as ischial pressure sores. The following cases will demonstrate the versatility of the flap.

Case Reports

Case 1

A 29-year-old man with post-traumatic paraplegia (L4 sensory level) had chronic sacral and left ischial pressure sores (Fig. 8). The ulcers were excised and closed with a unilateral gluteal thigh flap measuring 8 x 34 cm.

Case 2

A 27-year-old Vietnam veteran with post-traumatic paraplegia (L4 sensory level) had a chronic multiply recurrent right ischial pubic pressure sore (Fig. 9). Despite the presence of multiple cutaneous scars, the gluteal thigh flap was elevated safely. This was due to the subfascia lata course of the inferior gluteal artery. Satisfactory healing of this wound allowed the patient to undergo renal transplantation for his chronic renal failure.

Case 3

A 48-year-old woman developed gangrene of the buttock and upper medial thigh (Fig. 10). The wound was debrided to the ischium and around the medial thigh, and when healthy granulation tissue appeared, a gluteal thigh flap was used to close the defect. Healing was uneventful.

Case 4

A 48-year-old woman had a painful breast carcinoma metastasis to the right buttock despite 5000 rads of local irradiation (Fig. 11). The ulcer was excised through most of the gluteus maximus muscle, and when the inferior gluteal artery was found to be intact, an island gluteal thigh flap was elevated and advanced in a V-Y manner to achieve closure. The patient continues to do well 1 year following surgery.

Case 5

An obese 65-year-old woman had a large draining cavity over and above the greater trochanter that led to a total hip prosthesis that had been placed 6 months earlier (Fig. 12). All organisms cultured from the wound were sensitive to penicillin, on which the patient had been placed. The wound was widely debrided and the tensor fascia lata muscle was not to be indurated and pale and, therefore, unsafe to use as a flap. Immediate closure was obtained with a 8 x 24 cm island of skin moved on the inferior gluteal artery pedicle. There is no evidence of infection 4 months later, and the patient is ambulatory with a walker.

Fig. 9. Case 2. Recurrent ischial pubic pressure sore. (Left) Disregarding cutaneous scars, which are crosshatched in methylene blue, the gluteal thigh flap is outlined for coverage of a multiply recurrent ischial pubic pressure sore. (Right) A Z-plasty closure of the flap and donor site was followed by complete healing of the flap.
A 24-year-old man had a proctocolectomy for Crohn's disease 10 years ago (Fig. 13). He had extensive resection of perianal skin and soft tissues because of recurrent infections in the region. The pelvic wound failed to heal, was deep and widely undermined, and extended from the posterior bladder wall to the sacrum. The patient was thin and highly muscular. Because of the extensive nature of the debrided cavity, bilateral deepithelialized posterior thigh flaps were used to close the wound. Keeping the flaps less than 10 cm in width allowed for primary closure of the donor sites. There is satisfactory wound healing at 6 months and the patient has resumed jogging, basketball, and softball.

Fig. 10. Case 7. Synergistic gangrene of the buttock. (Left) Prior to treatment with antibiotics and debridement. (Right) Flap closure resulted in a healed wound.

Fig. 11. Case 4. Buttock carcinoma. (Left) Wide excision of recurrent buttock carcinoma metastasis with irradiation is outlined. (Center) The ulcer was excised with much of the gluteus maximus muscle. Exploration of the undersurface of the muscle through the lateral incision found the gluteal vessels to be intact. (Right) Following release of the lower caudal portion of the gluteus muscle, the flap was advanced in a V-Y manner and there was primary healing.
The gluteal thigh flap has been successful in the closure of 18 of 21 problematic wounds of the perineal and buttock region. Three flaps had necrosis of the distal portion, and in each instance, the flaps initially appeared viable. The causes of flap loss were hematoma, direct pressure on the flap, and delirium.

All donor sites healed primarily, and there was minimal and temporary morbidity in the six ambulatory patients. Nonparaplegic patients commonly noted tightness of the thigh and discomfort when using the bed, pan, walking, or climbing steps. In 6 to 12 weeks, these symptoms resolved. These patients also noted numbness in the popliteal region, which improved somewhat with time. The scars were flat and rather inconspicuous. Unilateral procedures were followed by posterior thigh asymmetry, which did not disturb the patients because they had been warned about this complication. Donor-site scar location in paraplegic patients is not over a bony prominence and as such has not been the site of recurrent pressure sores (2 to 14 months follow-up).

**Discussion**

The reliability, versatility, and low morbidity of the gluteal thigh flap has been demonstrated by its use in our consecutive series of 19 patients with 21 buttock and perineal wounds. The flap should receive surgical consideration whenever there is a reconstructive problem in this region.

The gluteal thigh flap may well be the flap of choice for the closure of chronic midline deep anal-perineal wounds, as may occur following wide rectal resection for carcinoma or Crohn's disease. The biceps femoris myocutaneous flap can be considered for this purpose, but its distal vascular origin and significant functional loss have not made it a popular flap. The gracilis myocutaneous flap has a tendency to necrose in its distal third, so that although it is currently the most popular approach to close these wounds, a significant degree of failures has caused some surgeons to be quite cautious. One or two deepithelialized gluteal thigh flaps can be used to close very extensive anal-perineal defects, and we have accomplished this in three patients.

The use of this flap for vaginal reconstruction because of its excellent sensation has been considered, but as yet, we feel the proximal portion of this flap is too bulky for transposition into the labial-thigh region.

The flap is based on the muscular and direct cutaneous branches of the inferior gluteal artery and should therefore be classified as a "compound myocutaneous and direct cutaneous arterialized flap." The myocutaneous portion of the flap includes the inferior gluteus maximus muscle and overlying skin. Beyond the caudal border of the
gluteus muscle, the inferior gluteal artery courses between the biceps femoris muscle and the fascia lata of the thigh, branching off perforating vessels to the skin. Except in the region of the ischial tuberosity, the inferior gluteal artery does not provide significant blood flow to the biceps femoris muscle, as suggested by James and Moir. Their successful transfer of cutaneous paddles of posterior thigh skin on the biceps femoris muscle is more likely due to preservation of the direct cutaneous inferior gluteal artery supply rather than through deep musculocutaneous perforators.

The obligatory inclusion of the posterior cutaneous nerve gives the flap good sensation, and the implication for free flap transfer is obvious. The first gluteal thigh free flap was recently transferred to cover an extensive post-traumatic heel and plantar surface of the foot defect with the arterial anastomosis being from end to side, inferior gluteal artery to posterior tibial artery, and joining the posterior cutaneous nerve with the sural nerve (Fig. 14). The result is too recent to report on sensation.

Buttock free flaps have been previously reported. Fujino et al. reconstructed a breast with a flap based on the superior gluteal artery in 1975. Le-Quang was successful in three of four microvascular transfers of the inferior gluteal region. The flaps were based on the inferior gluteal vessels and oriented obliquely across the gluteal crease and did not include the posterior thigh skin.
SUMMARY

A compound myocutaneous and direct cutaneous flap has been based on the inferior gluteal artery. Nineteen of 21 consecutive difficult wounds of the buttock and perineal region were closed using this flap in a single stage. The flap demonstrates unique capabilities for reconstruction of extensive anal-perineal defects.

ACKNOWLEDGMENTS

The authors would like to recognize Yaron Hat-Shai, medical student at the Technion, Israel Institute of Technology in Haifa, Israel, for his assistance in the cadaver dissection; and Dr. Bernard Hirshhowitz, Chief of the Department of Plastic Surgery at the Kamam University Hospital, Haifa, Israel, for contributing three patients to the series.

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Discussion by M. J. Jankiewicz, M.D.

Important are the observations of Hurwitz, Swartz, and Mathes on the blood supply to the skin of the posterior thigh in patients. That there is a small cutaneous branch of the inferior gluteal artery, which contributes to the perfusion of the skin of the posterior thigh, has been known and described in standard textbooks of anatomy. The important clinical observation, however, made by the authors is that this particular branch, one of the terminal branches of the inferior gluteal artery, is an axial vessel that runs along the posterolateral aspect of the semimembranosus muscle accompanying the posterior femoral cutaneous nerve. By definition, therefore, an axial pattern flap of skin, subcutaneous fat, and fascia lata exists on the posteromedial thigh. The authors have demonstrated its usefulness not only as another transposition flap in paraplegic patients, but much more importantly, as an innervated transposition flap in patients with an intact nervous system who have been afflicted by grievous sores in the perineum. Clearly too, it has great potential as a free flap because the posterior femoral cutaneous nerve is included in the island. Moreover, the vessel can be dissected back to the larger-caliber parent vessel, the inferior gluteal,
thereby enabling the surgeon to achieve more successfully free transfer.

That this skin has a dual blood supply is now apparent to us. We at Emory University Affiliated Hospitals have been using a simple V-Y advancement flap of this skin based on the perforating branches of the profunda femoris artery that supplies the posterior muscles of the thigh. A V-Y musculocutaneous flap using semitendinosus or biceps femoris muscle is a rapid, simple, highly reliable method of achieving closure of ischial pressure sores in paraplegic patients (Figs. 1 through 3). In so doing, it is certain that this axial vessel is cut at the edge of the ischial defect. Thus, the skin is supplied by profunda femoris perforators to the muscle used as a carrier. Clearly this V-Y advancement flap is to be used only in paraplegic patients. The flap of Hurwitz, Swartz, and Mathes consists of skin, subcutaneous fat, and fascia. Thus it can be used in all patients in whom the need arises.

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