

Adductor Myocutaneous Flap Coverage for Hip and Pelvic Disarticulations of Sarcomas with Buttock Contamination

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Received: 9 December 2009 / Accepted: 28 June 2010 / Published online: 15 July 2010
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Abstract

Background Hip disarticulation and hemipelvectomy are alternatives to limb-salvage procedures for patients with extensive tumors of the upper thigh and buttocks. In cases when neither the conventional posterior gluteus maximus flap nor the anterior quadriceps flap can be used because of the location of the tumor, a medial adductor myocutaneous flap may be an alternative.

Description of Technique The flap is outlined over the anteromedial thigh. The distal extent is at the level of the adductor hiatus. The common femoral vessels and nerve are traced, preserved, and protected. The adductor muscles then are divided above their insertions on the femur and preserved with the flap. En bloc removal of the tumor is performed by either hip disarticulation or hemipelvectomy.

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

This work was performed at the Philippine General Hospital, University of the Philippines.

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The long adductor myocutaneous flap is brought up laterally and proximally to close the wound.

Patients and Methods We reviewed four patients who underwent a medial adductor myocutaneous flap after either hip disarticulation or hemipelvectomy. The medical records and radiographs were analyzed. These patients were followed up for at least a year or until death.

Results Wide surgical margins were achieved in all four patients and the flap remained viable, with no skin necrosis or flap breakdown. The patients were able to sit on the flap, and one patient was able to wear a prosthesis.

Conclusions In patients undergoing hip disarticulation or hemipelvectomy where tumor infiltration or inadvertent contamination by previous surgery will not allow the traditional posterior gluteus maximus or anterior quadriceps flap, this unconventional medial adductor myocutaneous flap is a feasible, technically simple option.

Level of Evidence Level IV therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Hip disarticulation and hemipelvectomy are alternatives to limb-saving surgery for patients with extensive tumors of the upper thigh and buttocks. Wound closure, however, presents a problem when tumor involvement of the buttocks and anterior proximal thigh compartment precludes the use of the standard posterior gluteus maximus flap or even the atypical anterior quadriceps muscle flap [5, 7, 8, 10, 11, 13, 20, 21, 24]. Free flaps [2, 4, 15–17, 22, 23, 25, 26] (eg, latissimus dorsi muscle, fillet leg flap), pedicled flaps from the ipsilateral lower extremity [1], and regional flaps from the abdominal wall [3, 16, 22] (eg, rectus

abdominis and external oblique muscles) are options, but they are associated with technical difficulties and donor-site morbidities.

An infrequently reported alternative is the medial thigh adductor myocutaneous flap, initially described by Luna-Perez and Herrera in 1995 [12] as a modification to the classic hemipelvectomy closure for patients with tumors involving the buttock and anterolateral upper thigh. A case report from Dormans and Vives in 1997 [6] is the only other available article in the English literature that describes this atypical soft tissue procedure.

We describe the use of an adductor myocutaneous flap in four patients, all of whom had tumor contamination of the posterior gluteal and anterior quadriceps muscle compartments. The adductor myocutaneous flap not only allowed wide surgical margins but also provided thick and healthy soft tissue coverage, containment of peritoneal contents in a hemipelvectomy, and allowed weightbearing and later prosthetic use.

Surgical Technique

The medial myocutaneous flap was based completely on a viable adductor muscle compartment and its overlying skin. Blood is supplied to the adductor muscles from the muscular branches of the profunda femoris and obturator arteries [6]. Vascular supply to the skin and subcutaneous tissue of the flap is maintained by the profunda femoris and superficial femoral arteries [6]. Surgeries were performed with patients either in a semisupine position with a bolster under the ipsilateral torso (Fig. 1) or in a lateral decubitus position. A diagram of the flap was drawn over the anteromedial thigh, its distal extent usually at approximately the level of the adductor hiatus (Fig. 2). Proximally, this flap was extended from the anterior to the posterior superior iliac spines just over the iliac crest and the insertions of the glutei muscles, providing a wide margin around the buttock compartment. Posteriorly, the flap was curved distally medial to the buttocks, along the buttock crease and then anteriorly to meet the posterior extent of the medial flap (Fig. 3).

Dissection in the inguinal region identified the common femoral vessels and nerve. These were traced until the distal extent of the flap and protected, taking care throughout surgery not to allow the vessels to shear off the extent of the flap, ligating them only at the distal end of the flap. The profunda femoris artery, which arises from the posterior aspect of the common femoral vessels and passes deep into the posterior surface of the femur, was identified and its branches to the adductor muscles preserved. It was ligated only after the perforating branch to the adductor magnus muscle was identified.



Fig. 1 The outline of the iliac crest and the anterior superior iliac spine (A) for anatomic reference and the surgical scar from a previous surgery are shown.



Fig. 2 The outline of the distal extent of the medial flap at the level of the adductor hiatus is shown.



Fig. 3 The proximal extent of the dissection to detach the glutei muscles from its origin in the pelvis allows for removal of the entire buttock compartment.

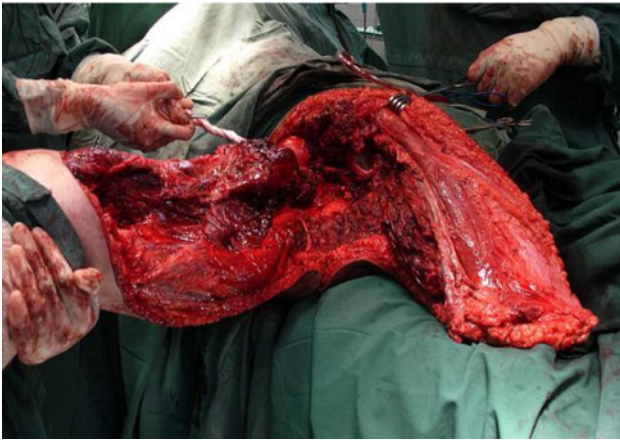


Fig. 4 The adductor muscle was maintained with the medial flap. The femoral head is dislocated before en bloc removal of the tumor.

Posteriorly, the glutei muscles were dissected off their origin en bloc from the iliac crest (or removed with the ilium in the case of hemipelvectomy), taking care not to allow any tumor contamination from within these muscles. This en bloc removal also allowed complete observation and disarticulation of the hip.

The pectineus, adductor brevis, adductor longus, adductor magnus, and gracilis muscles were divided a few centimeters above their insertions on the femur and preserved with the medial thigh flap. Extreme care was taken throughout surgery not to separate overlying skin and subcutaneous tissue from the muscle mass (Fig. 4). The femoral and obturator nerves are sectioned as far distally as possible to maintain their motor innervations, avoiding atrophy of the flap and also preserving cutaneous sensation.

Posterior to the hip, the short external rotators were divided, the amount of muscle removed depending on the extent of contamination from tumor or previous surgery. Finally, the hamstring muscles were detached from the ischial tuberosity and the sciatic nerve ligated. The entire lower extremity then could be disarticulated.

The long adductor myocutaneous flap was brought up laterally and proximally. The wound was closed over a suction drain to eliminate any dead space and a large bulky dressing was applied over the flap.

Patients and Methods

From 1993 to 2007, we performed a medial adductor myocutaneous flap on four patients after either a hip disarticulation (three) or hemipelvectomy (one). We retrospectively reviewed the records of these four patients and recorded demographics, histology, symptoms, tumor presentation, tumor stage, and perioperative complications.

We considered the following serious complications: flap necrosis that would entail additional surgeries to cover the defects or an infected wound requiring repeat débridement and additional antibiotic use. Radiographs, including CT scans and MR images, and operative records were analyzed to determine tumor extent and to verify the reasons for the use of this atypical flap. Patients were followed for at least 1 year or until death (range, 6–16 months). In all cases, flap healing was complete and stable enough for prosthetic use.

The median age of the four patients was 46 years (range, 25–59 years) (Table 1). The single female patient was diagnosed with myxoid round cell liposarcoma of the posterior aspect of the proximal thigh infiltrating the glutei and quadriceps muscles. A hip disarticulation was performed and closed with an atypical medial adductor flap. The second patient had a pathologic fracture through a malignant fibrous histiocytoma of the femoral neck with soft tissue extension into the posterior and anterior compartments. A hemipelvectomy was performed to attain wide margins. The third and fourth patients had potential tumor contamination of the buttock area from intramedullary nailing in their initial surgery. One had a high-grade spindle cell sarcoma of the proximal tibia. After neoadjuvant chemotherapy, the patient underwent tumor resection and arthrodesis of the knee with a long intramedullary nail. Local tumor recurrence in the tibia was detected after 3 months. The femur, quadriceps (which had been exposed during the initial surgery), and glutei muscles were considered contaminated, necessitating a hip disarticulation with an atypical adductor flap. The fourth patient had undergone locked intramedullary nailing 11 years previously for a pathologic fracture of the subtrochanteric area secondary to a low-grade chondrosarcoma. Tumor recurrence involving the quadriceps plus potential contamination of the gluteal muscles required an atypical hip disarticulation.

Results

Wide margins were achieved in all four patients and all flaps remained viable, with no skin necrosis or flap breakdown (Fig. 5). There were no serious complications. A seroma in two patients resolved after 2 weeks. None of the four patients reported phantom limb pain and all patients began to walk using an ambulatory aid within 2 weeks. All became community ambulators. Sitting on the flap was possible within a month, initially with some discomfort but negligible pain.

Of the four patients, only one actually used a prosthesis. This likely is attributable to the prohibitive cost of such a prosthesis and the relative difficulty in its use. There were

Table 1. Patients undergoing adductor myocutaneous flap reconstruction

Patient	Age (years)	Gender	Diagnosis	Location	Manner of contamination	Surgery	Other treatment	Complication	Local control	Sitting	Use of prosthesis	Status (months)
1	59	Female	Myxoid liposarcoma	Posterior compartment, proximal thigh	Tumor extension into buttocks and anterior compartment	Hip disarticulation	None	Drained serous fluid until 2 weeks postoperatively	Yes	Yes	No	DOD (7 months)
2	48	Male	Malignant fibrous histiocytoma of bone	Proximal femur with pathologic fracture of femoral neck	Tumor extension into buttocks and anterior compartment	Hemipelvectomy	None	None	Yes	Yes	No	DOC (12 months)
3	25	Male	Spindle cell sarcoma (recurrent)	Proximal tibia	Knee resection arthrodesis with intramedullary nail	Hip disarticulation	3 cycles neoadjuvant chemotherapy	Drained serous fluid until 2 weeks postoperatively	Yes	Yes	No	DOD (6 months)
4	51	Male	Chondrosarcoma (recurrent)	Proximal femur	Postfixation with intramedullary nail and tumor recurrence in anterior compartment	Hip disarticulation	None	None	Yes	Yes	Yes	ANED (16 months)

DOD = died of disease, DOC = died of other causes, ANED = alive with no evidence of disease.



Fig. 5 The flap remains viable, with no skin necrosis or flap breakdown 1 month after surgery.



Fig. 6 This prosthesis features a total contact socket design.

no problems with regular prosthesis use for that patient (Fig. 6). That prosthesis featured a total-contact socket design. It had a socket waist band that contained the stump and was secured firmly to the pelvis, allowing minimal stump socket motion. Weight was borne primarily on the ischial tuberosity.

Discussion

Our four patients with bone and soft tissue sarcomas required hip disarticulation or hemipelvectomy, but wound closure with the standard posterior flap or the alternative anterior flap was prevented because of tumor extension from the proximal thigh or hip into both glutei and quadriceps compartments or tumor recurrences in the femur or tibia, but with contamination of the glutei muscles from previous intramedullary nailing.

Standard hip disarticulation or hemipelvectomy makes use of a posterior gluteus maximus-based flap that is swung anteriorly to close the wound. However, tumor contamination from proximity to a large lesion, from previous surgery, or through tumor arising from the gluteus muscle precluded the use of this posterior gluteus flap.

An alternative quadriceps muscle flap was described by Frey et al. [7] consisting of skin, subcutaneous fat, and the quadriceps muscle. This flap receives its blood supply from the muscular branches of the superficial femoral artery [21, 25] and can cover defects up to the level of the posterior superior iliac spine [21]. However, it could not be used for our patients because of tumor contamination of the anterior thigh compartment.

Unconventional closure techniques include island pedicle flaps, such as that of the ipsilateral rectus abdominis muscle, pedicled on the inferior epigastric vessels and mobilized and tunneled through a narrow abdominal skin bridge [9, 16, 22]. Another pedicled flap is that of the external oblique muscle, receiving its blood supply from the last six intercostal arteries, which can be rotated inferiorly to cover the defect [3]. These relatively tedious surgeries, however, are accompanied by complications, such as serous leaks, hematoma, abscess formation, and flap failure [9, 16, 22], and sometimes also require the need for split thickness skin grafting of the donor site and increased operative time.

The spare parts concept uses free flaps from the thigh or leg portion of the amputated leg to cover the defect [1, 2, 15, 17, 23, 25]. These are technically demanding surgeries, especially owing to size discrepancies in end-to-end anastomosis of the lower extremity vessels compared with the larger iliac and femoral vessels [23, 26], resulting in prolonged operative time [11] and a corresponding increase in the risk of complications [18].

However, the medial adductor myocutaneous flap is a relatively simple procedure that allows removal of the entire buttock and quadriceps compartments with safe tumor margins. This flap was first described by Luna-Perez and Herrera [12] in their report of five patients who underwent hemipelvectomies for large buttock and anterolateral thigh tumors. A case report published by Dormans and Vives [6] described this coverage technique for a

modified hip disarticulation in a patient with radiation-induced osteosarcoma of the proximal femur and unhealthy irradiated skin for a previous Ewing's sarcoma.

Preservation of the muscular branches from the profunda femoris and obturator arteries is the key to providing excellent blood supply to the adductor muscles and the overlying skin and subcutaneous tissue [7]. The profunda femoris artery arises from the lateral side of the femoral artery in the femoral triangle. It runs posteriorly and leaves the femoral triangle by passing between the pectineus and adductor longus muscles, giving off perforating arteries to the adductor magnus, gracilis, and hamstring muscles [14]. The obturator artery, however, is a branch of the internal iliac artery that passes through the obturator foramen to supply the obturator externus, pectineus, adductor, and gracilis muscles. The skin of the medial thigh is supplied by the septocutaneous perforators that arise from the profunda and superficial femoral arteries.

All of our patients achieved complete wound healing within 2 to 3 months although two patients did have seroma formation. The seroma resolved after 2 weeks of regular wound care and compressive bandaging. No further imaging studies were obtained for these patients. Flap necrosis for hemipelvectomy reportedly ranges from 25% to 80% [13]. In one large case series, Senchenkov et al. [18] reported flap necrosis of 13% (eight of 60 cases) for posterior flap closure and 37.5% (three of eight cases) for anterior flap closures. Wound infection, however, is reported to range from 17% to 46%, depending on the level of ligation of the iliac vessels [19]. We attribute good wound healing in our patients to the large muscle mass of the adductor compartment and its fairly abundant blood supply. The large mass of the adductor muscles also provides a durable flap, sturdy enough for sitting, and with adequate support on which the prosthesis may fit comfortably without trauma to the overlying skin. This was evident in one of our patients who had early prosthetic fitting.

We describe four such patients in whom an atypical adductor myocutaneous flap provided adequate margins, good wound closure, and a flap strong enough for sitting and prosthetic use. We recommend this unconventional medial myocutaneous flap when the traditional posterior gluteus maximus or the anterior quadriceps flap is infiltrated by tumor or inadvertently contaminated by previous surgery. For patients undergoing hip disarticulation or hemipelvectomy in whom tumor infiltration or contamination will allow neither the conventional posterior gluteus flap nor the anterior quadriceps flap, the medial adductor myocutaneous flap is a feasible, technically simple option.

Acknowledgments We thank the Orthopedic resident staff of the Philippine General Hospital, University of the Philippines and Manila

Doctors Hospital, who rendered their full support and cooperation during the conduct of this research.

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