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Lower gluteal muscle flap and buttock fascio-cutaneous rotation flap for reconstruction of perineal defects after abdomino-perineal resections

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Summary *Background:* Abdomino-perineal resection (APR) in the treatment of anal and low rectal cancers is associated with perineal wound problems, especially after pre-operative radiotherapy. Immediate reconstruction of defects after APR with flaps has been shown to reduce post-operative morbidity. The combined gluteal muscle and buttock fascio-cutaneous rotation flap is useful for this purpose. The dual blood supply of the gluteus maximus muscle allowed it to be split into superior and inferior halves. The inferior fibres were used to fill the pelvic cavity, whilst the superior fibres were preserved to maintain hip function. The buttock rotation flap was used for skin closure.
Methods: Eight patients who underwent APR for low rectal ($n = 5$) and anal ($n = 3$) carcinomas had immediate reconstruction with the gluteal muscle and buttock fascio-cutaneous rotation flap. The size of the perineal defects ranged from 5×7 to 13×9 cm. The indications for reconstruction were: skin defects too large for primary closure ($n = 7$) and previous failed flaps ($n = 1$).
Results: All the flaps survived without major complications. The minor complications were superficial wound dehiscence ($n = 1$) and seroma ($n = 1$). Both wounds healed with conservative treatment. All patients were ambulating well within 1 month with full range of active and passive motion at the hips, and completed post-operative radiotherapy without perineal wound complications.
Conclusions: The gluteus maximus muscle and fascio-cutaneous buttock rotation flap was useful for reconstructing perineal defects after abdomino-perineal resection.

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Abdomino-perineal resection (APR)[1] is the main treatment for rectal carcinoma situated in the distal third of the rectum as well as for recurrent or residual anal carcinoma following combination chemoradiotherapy. APR involves removal of the anus, the rectum and part of the sigmoid colon with their associated lymph nodes, through incisions made in the abdomen and perineum. With advances in radiotherapy and ultra-low anterior resection techniques, the incidence of APR has reduced. However, it is still indicated in cases where there is an advanced tumour or where radiotherapy has failed.

APRs that include wide resections of perianal skin are best reconstructed with well-vascularised tissue, as opposed to primary closure. This is especially pertinent when the patient has underdone pre-operative radiotherapy to downstage the tumour.[2–5] Primary reconstruction has been shown to reduce the incidence of wound infections and dehiscence.[2–9] The preferred flaps for perineal defects have traditionally been the vertical rectus abdominis myocutaneous (VRAM)[10] and gracilis flaps.[11] The transpelvic VRAM is a well-established technique but with a potential risk of weakening the abdominal wall. Gracilis flaps have insufficient bulk for cavernous defects.

The purpose of this article is to describe the use of the gluteus maximus flap in conjunction with the fasciocutaneous buttock rotation flap. This approach fulfils the dual goals of dead space obliteration and skin cover.

Patients and methods

Between 1999 and 2004, eight patients (seven males, one female) with large perineal defects following APRs underwent reconstruction using dual flaps. All patients received pre-operative radiation therapy to downstage the disease. The indications for reconstruction were: defects deemed too large for primary closure ($n = 7$); failed primary reconstruction with gracilis flaps resulting in wound dehiscence ($n = 1$).

Technique (Figure 1(A)–(D))

APR with a permanent end-colostomy is performed by colorectal surgeons. After closure of the laparotomy incision, the patient is repositioned prone in a slight jack-knife position for exposure of the gluteal region.

A superiorly based buttock rotation flap is designed and elevated using a curvilinear incision along the buttock crease to expose the gluteus maximus muscle (Figure 1(A)). It should be as broad-based and as large as possible to allow re-rotation if the wound breaks down. A bloodless field is critical to ensure visibility and to avoid inadvertent ligation of the perforators to the skin. Use of perforator dissection techniques also ensures that there is minimal blood loss. These skin perforators from the inferior gluteal artery are carefully preserved and mobilised to facilitate rotation of the buttock skin.

The gluteus maximus muscle is split into two halves along its long axis, isolating the inferior fibres on the inferior gluteal artery (Figure 1(B)). Care is taken to preserve the sciatic nerve running deep to the gluteus maximus. The inferior half of the gluteus maximus muscle flap is disinserted and transposed medially to fill the pelvic cavity (Figure 1(C)). It is then secured to the walls of the pelvic cavity with 2/0 Vicryl sutures to reconstruct the pelvic floor. The superior half of the gluteus maximus muscle is preserved. Finally, the perforator-based buttock fasciocutaneous flap is rotated in to close the perineal wound (Figure 1(D)). The additional surgical time inclusive of re-positioning is approximately 2.5 h.

Drains are placed separately underneath the buttock flap and in the pelvic cavity. They are removed after 2 weeks when daily drainage drops to less than 20 ml. The patient is nursed in the prone position for 10 days to avoid pressure on the buttock flap. Pillows are placed under the left chest and hip to avoid compression on the colostomy in prone position. Thereafter, ambulation is allowed and the patient is discharged once all the drains are removed.

The patient is reviewed in the out-patient clinic and stitches are usually removed after 2 weeks. When the perineal wound is healed, the patient is referred for radiation therapy. The patient continues to be reviewed in the clinic for radiation-related wound problems.

Results (Table 1)

The mean patient age was 56 (48–68) years. Perineal skin defect size ranged from 5 × 7 to 11 × 12 cm. The patients were followed-up for a mean period of 44 (29–66) months. All patients underwent reconstruction employing a combined buttock rotation flap and a gluteus muscle flap in the same setting. Uncomplicated healing was achieved in 6 of 8 patients. Of the two wounds with complicated healing, one developed a superficial wound dehiscence that healed with dressing and another had a seroma that resolved after aspiration. None of the patients developed perineal hernia during the period of follow-up.

Illustrative case reports

Patient 2 (Figure 2(A)–(F))

A 67-year-old male presented with a chronic discharging perianal sinus for 30 years. Incision and drainage of bilateral ischio-rectal fossae was performed and the histological findings confirmed the diagnosis of adenocarcinoma involving the rectum and the anus (Figure 2(A) and (B)). He underwent neo-adjuvant chemotherapy combined with radiotherapy to downstage the tumour before undergoing an APR. An end-colostomy was fashioned in the left iliac fossa. The resultant perineal defect (Figure 2(C)) measured 11 × 12 cm. He underwent reconstruction with a right gluteus muscle and perforator-sparing buttock fasciocutaneous flap based on the inferior gluteal vessels (Figure 2(D) and (E)). He was discharged 3 weeks later and completed post-operative radiation therapy to the perineum without any wound breakdown (Figure 2(F)).

Patient 3 (Figure 3(A)–(F))

A 63-year-old Chinese male presented with per-rectal bleeding and weight loss of 5 kg over 1 month. Colonoscopy showed an ulcer 3 cm from the anal verge and histology confirmed the presence of an adenocarcinoma involving the

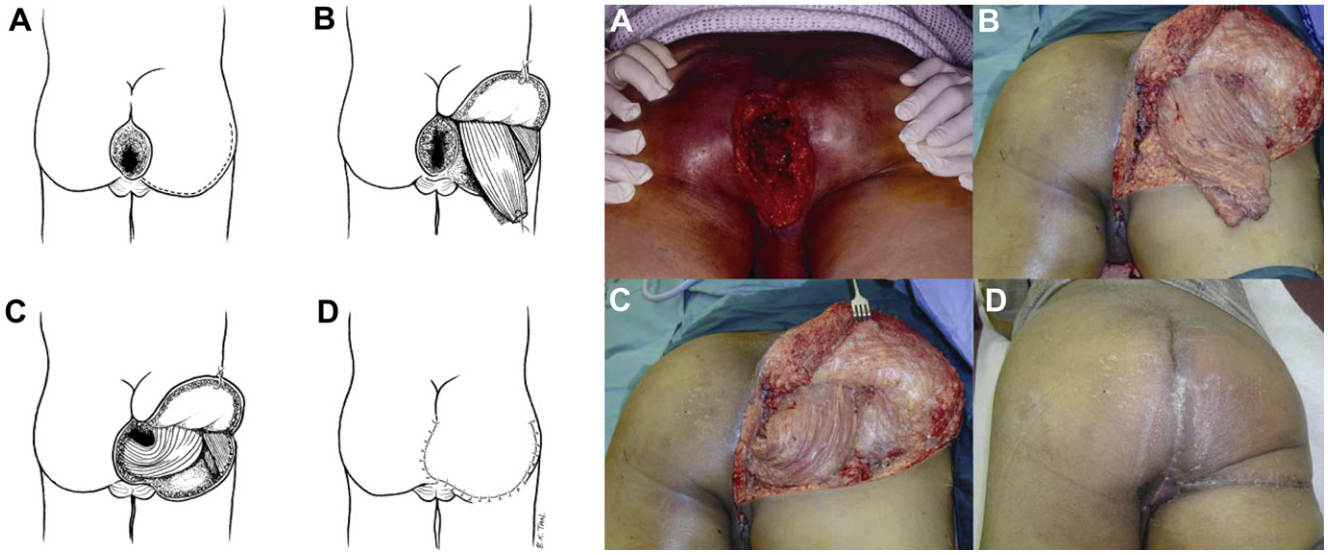

Figure 1 A schematic illustrating the gluteus muscle and buttock fascio-cutaneous flap. A. A superiorly-based buttock rotation flap is designed and elevated with the use of an infero-medial incision to expose the gluteus maximus muscle. B. The gluteus muscle is split into 2 halves along its long axis, isolating the inferior fibers on the inferior gluteal artery. C. The inferior half of the gluteus muscle flap is disinserted and transposed medially to fill the pelvic cavity. It is then secured to the walls of the pelvic cavity with 2/0 Vicryl sutures to reconstruct the pelvic floor. D. Finally, the buttock fascio-cutaneous flap is rotated in to close the perineal wound.

rectum. A pre-operative hand-held Doppler was performed to localise the perforators of the inferior gluteal vessels. Intra-operatively, the tumour was noted to be involving the prostatic urethra. The patient underwent APR and a portion of the urethra was resected *en bloc* with the tumour. The urethra was mobilised and primarily repaired end-to-end. The gracilis muscle was used as a wrap-around to vascularise and reinforce the urethral repair. The resultant perineal defect measured 9 × 10 cm. A right-sided inferior gluteus muscle and perforator-sparing buttock rotation flap was raised and used to reconstruct the perineal defect. He was discharged 3 weeks later and completed radiation therapy to the perineum without any breakdown. The catheter was removed subsequently in the clinic and the patient was able to void naturally. He remains on a yearly follow-up and has had no complications of wound breakdown or tumour recurrence.

Discussion

APR is a common procedure in patients with tumours in the lower rectum and anus. Three-quarters (75%) of patients with tumours within 6 cm of the anal verge are treated with APR.[1] After APR, a major source of morbidity is a chronic perineal wound due to dependency, wound tension and pelvic dead space. The rate of perineal wound infection and

Table 1 Results and Outcomes.

Patient	Sex	Age (yr)	Diagnosis	Indication	Size of Perineal Wound (cm × cm)	Preop DXT	Postop DXT	Complication(s)	Outcome
1	M	56	Adenocarcinoma Rectum	Large perineal defect	8 × 9	+	+	Nil	Successful
2	M	67	Adenocarcinoma Rectum	Large perineal defect	11 × 12	+	+	Nil	Successful
3	M	63	Adenocarcinoma Rectum	Large perineal defect	10 × 9	+	+	Seroma treated conservatively	Successful
4	M	68	Squamous cell carcinoma anal canal	Failed primary closure	13 × 9	+	+	Nil	Successful
5	F	49	Squamous cell carcinoma anal canal	Large perineal defect	12 × 9	+	+	Nil	Successful
6	M	48	Squamous cell carcinoma anal canal	Large perineal defect	7 × 5	+	+	Nil	Successful
7	M	48	Adenocarcinoma Rectum	Large perineal defect	10 × 8	+	+	Nil	Successful
8	M	49	Adenocarcinoma Rectum	Large perineal defect	9 × 7	+	+	Superficial wound dehiscence	Successful

Figure 2 A, B. Patient 2. Adenocarcinoma of the rectum and anus in a 67-year-old male patient. C. Resultant perineal defect measuring 11 by 12 cm. D,E. Gluteus muscle and perforator-sparing buttock fascio-cutaneous flap based on the inferior gluteal vessels. Arrow marks the perforator supplying the fascio-cutaneous flap. F. Tension free closure of the perineal defect resulted in a well healed scar.

dehiscence after conventional APR with primary perineal closure varies from 35% to 66%.[2–5] A non-healing wound invariably leads to delay in post-operative adjuvant therapy.

Surgical approaches to minimising perineal wound complications after radical resection of primary or recurrent anorectal cancer represent an ongoing challenge to reconstructive surgeons. The causes of perineal wound morbidity are multi-factorial: First, APR may be combined with vaginectomy, sacrectomy[12] or exenteration of pelvic organs. Following such radical surgery, the pelvic cavity appears closed externally but there remains a non-collapsible dead space held up by the pelvic bones. Wound tension, dependency in the sitting position and fluid accumulation in the pelvic cavity predispose to wound breakdown. Second, pre-operative radiotherapy for anorectal cancer delays healing and exacerbates the odds of developing perineal wound complications by 2—10 times after APR with primary closure.[6–8] Radiation-induced endarteritis obliterans has been implicated as the cause of wound complication in 41% of APRs for rectal cancer.[6]

The goals of perineal reconstruction are four-fold. The first is to provide durable skin cover without tension; second, to fill the pelvic cavity and perineal wound with tissue that is well-vascularised and of adequate volume; third, to reconstruct the pelvic diaphragm which is a vital restraint to keep the viscera from the radiation field; and fourth, to minimise donor morbidity. The benefits of reconstructing perineal defects with musculocutaneous flaps is well established,[8,9] leading to reduction in wound infection rates and decreased hospital stay.

The rectus abdominis,[10] gracilis[11] and gluteus[12,13] myocutaneous flaps have been described. The intrapelvic vertical rectus abdominis flap or oblique rectus abdominis myocutaneous flap offers adequate muscle bulk to fill a large pelvic dead space and provides a well-vascularised skin paddle for cutaneous healing. The rectus muscle forms an effective sling to support abdominal viscera and there is sufficient bulk for the pelvic cavity. However, the incidence of peristomal hernias is high even when the colostomies are matured through unoperated rectus abdominis muscles.[14] Harvest of the rectus muscle in such

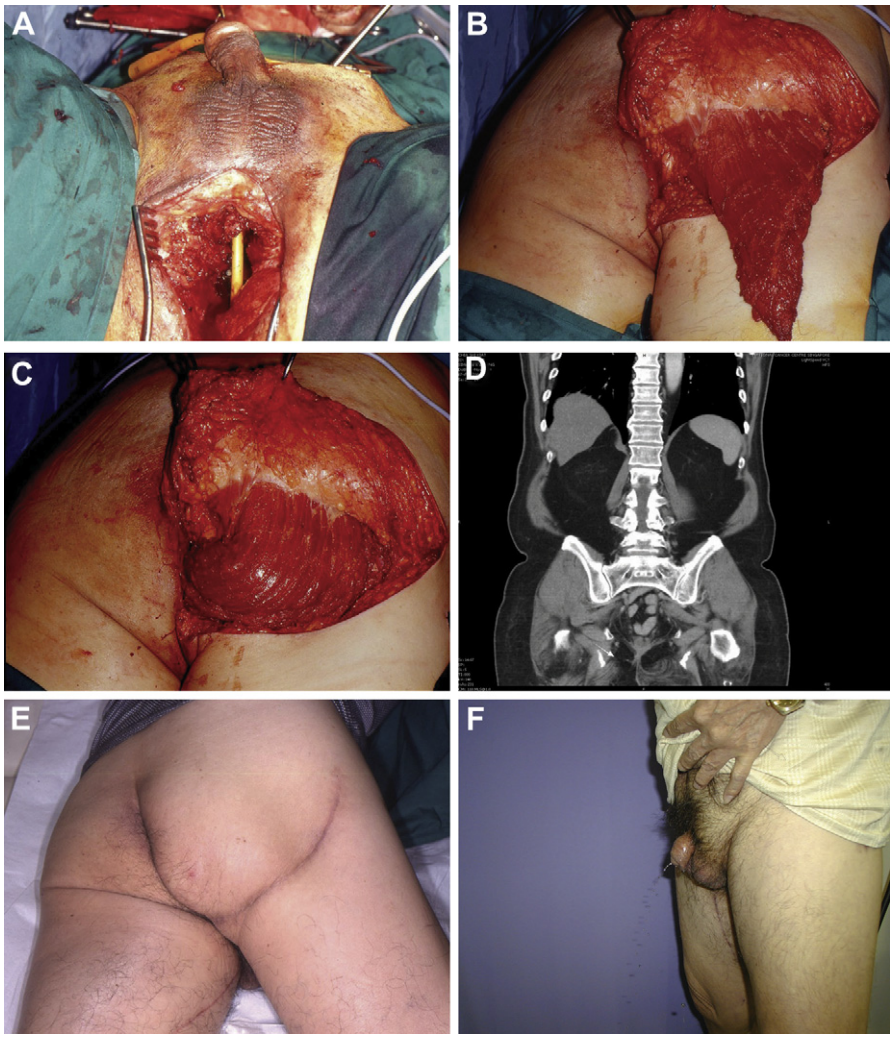

Figure 3 A. Patient 3. Adenocarcinoma of the rectum involving the prostatic urethra in a 63-year-old male patient. Abdominoperineal resection performed with resection of the prostatic urethra. B, C. Gluteus muscle and perforator-sparing buttock fasciocutaneous flap based on the inferior gluteal vessels. D. CT-scan showing the gluteus muscle inset into defect to recreate the pelvic floor. White arrow shows the gluteal muscle that was used to recreate the pelvic floor. E. Tension free closure of the perineal defect illustrating the scar that is located in the gluteal crease. F. The patient was able to void normally and completed his course of adjuvant radiotherapy without complications.

patients invariably weakens the abdominal wall and leads to an increased risk of abdominal wall dehiscence and hernia. Furthermore, the rectus abdominis flap is denervated and not contractile, and so prone to loss of volume with time. Whilst the gracilis muscle is ideal for the reconstruction of the vaginal or vulva defect, it is not suited for large defects in the perineum due to the inadequate tissue bulk and a restricted arc of rotation.

In our present technique, we modified the flap[12,13] by splitting the gluteus maximus muscle, and preserving its superior fibres. A separate perforator-based fasciocutaneous buttock flap ensured tension-free closure. The gluteus maximus muscle is a robust flap with dual blood supply derived from the superior and inferior gluteal arteries. During dissection of the gluteus maximus flap, the superior half of the muscle was spared so that most of its function was preserved. The muscle is a powerful extensor of the thigh, especially for activities such as running and climbing. No major functional disorders have been reported by the patients during follow-up. With this technique, most of the gluteus maximus muscle can be preserved for future use, hence retaining stair climbing function and single-limb stance. The gluteus maximus muscle is separated from the gluteus medius by an avascular plane. The sciatic nerve runs lateral to the pedicles supplying the gluteus maximus (Figure 4) and care was taken to preserve the nerve. The gluteus provides a large bulk of tissue in close proximity to the dead space to be obliterated and therefore the wound can be reliably closed using only one flap in almost all instances. A separate buttock skin flap was isolated based on perforators from the inferior or superior gluteal artery and this allowed some free play between muscle and skin during insetting.[15] By designing the buttock flap with a large arc, it could be re-used if needed.

The scars were sited along the gluteal crease to preserve the natural contour of the gluteal fold. The scars did not affect sitting and was well accepted by all the patients. The

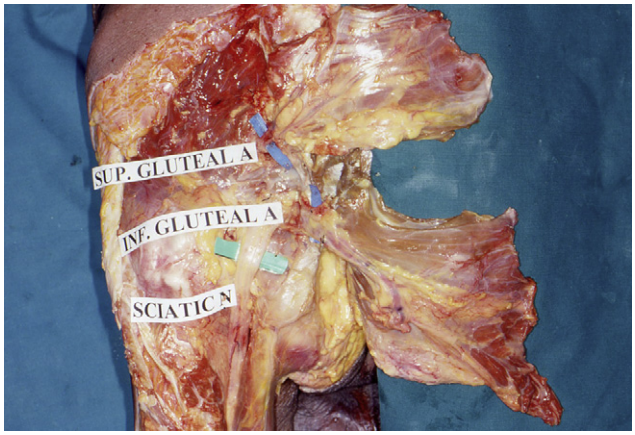

Figure 4 Cadaveric dissection illustrating the split halves of the gluteal maximus muscle supplied by the superior and inferior gluteal arteries respectively. There is an avascular plane between the gluteus maximus and the gluteus medius. The sciatic nerve runs lateral to the pedicles supplying the gluteus maximus muscle.

drawback of this technique was the need to reposition the patient in prone position, which may add an additional half-an-hour to the operating room time.

The use of mesh to reconstruct perineal defects has the benefits of shorter operating time, earlier return to activity, less restrictive post-operative regime, decreased costs and no donor-site morbidity.[16] In the authors' experience, the use of synthetic meshes increases the risks of infection and enterocutaneous fistulaes. Mesh removal, in the event of infection, is extremely difficult. With the improvement in the engineering of biological meshes, recent studies have shown them to be comparable to or even better than autologous tissue reconstruction.[17] However, such materials risk future stretching. Longer-term studies and randomised controlled trials are required before further conclusions can be made on the reliability of biological meshes for perineal reconstruction. At the present moment, autologous tissue reconstruction of perineal defects is still the safer and more reliable option.

Conclusions

The gluteus muscle is an ideal flap for reconstituting the dead space of large perineal defects. Modification of this flap with a buttock rotation flap based on the skin perforators provides a versatile option for tension-free skin closure of the perineal wound.

Ethical approval

Not required.

Funding

None.

Conflicts of interest

None declared.

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