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Reconstruction of the pelvic floor and the vagina after total pelvic exenteration using the transverse musculocutaneous gracilis flap

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Summary *Background:* Total pelvic exenteration (TPE) is a rare operation in which the pelvic contents are removed entirely. Several options for pelvic floor and vaginal reconstruction have been described including transverse rectus abdominis musculocutaneous (TRAM) or deep inferior epigastric perforator (DIEP) flaps. The transverse musculocutaneous gracilis (TMG) flap has been introduced for breast reconstruction as a free flap. We adopted the pedicled TMG flap for reconstructions after TPE. To the best of our knowledge, this is the first report of this method in the literature.
Methods: Between November 2011 and February 2014, 12 patients underwent TPE and reconstruction with unilateral (six patients) or bilateral (six patients) pedicled TMG flaps. Five patients underwent vaginal reconstruction with bilateral TMG flaps. We describe the operative procedure and the outcome of the operation in these patients.
Results: The total mean operative times for TPE with or without vaginal reconstruction were 467 ± 12 and 386 ± 59 min, respectively. The TMG flaps had enough vascular tissue and mobility for reconstructing the TPE defects. There was distal edge necrosis in one out of 18 flaps, while the rest survived completely. During the follow-up, complete wound healing with no signs of weakening of the pelvic floor was observed in all cases.
Conclusions: Soft-tissue reconstructions are needed to reduce complications associated with TPE, to secure the pelvic floor and to reconstruct the vagina in select patients. The TMG flap

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is a logical flap choice that does not lead to functional deficits, complicate the abdominal ostomies or weaken the abdominal wall. It reduces the length of operation compared to that of abdominal flaps.
Level of evidence: IV, therapeutic.

Introduction

In 1948, Brunschwig described total pelvic exenteration (TPE) as a treatment for recurrent or locally advanced cervical carcinoma.[1] The operation still provides only a curative option in select cases of pelvic malignancies, especially those involving the female reproductive organs. Generally, TPE is considered when it is the only possible curative intervention to treat central residual or recurrent tumours of the vulvar, vaginal, cervical or uterine malignancies after initial surgery, radiation therapy and chemotherapy.[2] Bricker developed urinary diversion with a small bowel conduit in 1950, which is still one of the most commonly used reconstructions of the distal urinary tract after TPE.[3] Later, methods for reconstructing the pelvic floor were described to reduce the morbidity associated with TPE,[4] and, finally, reconstructions of the vagina offered a possibility to preserve sexual function and improve the quality of life in select patients.[5–8] In TPE, the pelvic contents including the rectum, bladder, vagina, uterus and adnexes are removed en bloc. The operation results in two permanent ostomies or, in some cases, a urinary diversion and a low rectal anastomosis.[9] Without flap reconstruction to replace the missing tissue bulk, only the thin skin of the vulva remains over the emptied pelvis and birth canal, and wound complications are likely to be encountered. Reconstruction of the pelvic floor is also needed to prevent perineal evisceration or hernia. While achieving this, flap reconstruction can also be used to form a neovagina.[10] Several options for flap coverage have been described earlier. These include local skin flaps, the gracilis muscle flap or the musculocutaneous flap with a vertical skin island, the transverse rectus abdominis musculocutaneous (TRAM) flap and, most recently, the deep inferior epigastric perforator (DIEP) flap.[11–14]

The transverse musculocutaneous gracilis (TMG) flap has been described by Schoeller et al. for breast reconstruction and has been also been used for other purposes as a free flap. The experience with TMG breast reconstruction has shown that the vascularity of the transverse skin island is reliable even at the length of 30 cm.[15] The proximity of the donor site to the pelvis and external genitalia makes it a logical option for reconstructions after TPE. Harvesting gracilis flaps does not create functional defects for the patient and does not weaken the abdominal wall or complicate the ostomies. That is why since November 2011 we have been using the pedicled TMG flap in pelvic floor and vaginal reconstructions. In this article, we describe the method and review the outcome in 12 consecutive patients who underwent TPE and reconstruction with unilateral or bilateral TMG flaps at our hospital.

Patients and methods

Between November 2011 and January 2014, 12 patients (mean age 62 ± 10.3 years) underwent TPE and TMG flap reconstruction at our hospital. The most frequent malignancy was a cervical carcinoma (Table 1). The patients were informed about the possibility of vaginal reconstruction and received sexual counselling from a specialized nurse. Finally, five patients asked for vaginal reconstruction. One patient had a large recurrent carcinoma of the vulva and needed wide skin resection of the perineum; in this case, bilateral TMG flaps were used to reconstruct the pelvic floor and the defect of the perineum. In the remaining six patients, a unilateral TMG flap was used to reconstruct the pelvic floor without a reconstruction of the vagina. Furthermore, two patients had had previous radical vulvectomy; one patient had previous hysterectomy and salpingo-oophorectomy; and one patient had previous cystectomy, hysterectomy, salpingo-oophorectomy and sigmoidectomy followed by urinary diversion and sigmoidostomy.

The patients were followed up at the outpatient clinic for 4–24 months post-operatively.

Operative technique

The TPE procedure was performed as presented in the current literature, and it encompassed removing the distal urinary tract, the uterus and adnexes if not removed earlier, and the rectum (Figure 1a).[9] In all the patients, a urinary diversion with Bricker's conduit was performed during the operation, except in case no. 3 (she already had an existing Bricker's ileal conduit). The extent of excision of the vulva varied depending on the location of the tumour and ranged from partial excision of the labia minora to extensive excision of skin and soft tissue from the perineal and perianal area. The clitoris was spared in 10 out of 12 patients and in all the patients who underwent vaginal reconstruction.

The technique to raise the TMG flap has been described in detail in Ref.[15] and with further refinements in Ref.[16] We mark the patient preoperatively in an upright position. The gluteal crease is marked as the upper border of the cutaneous part of the flap, and the distal end of the flap is located between the middle and lateral thirds of