Reconstruction of perineal defects

M Mughal¹, RJ Baker¹, A Muneer², A Mosahebi¹

¹Royal Free London NHS Foundation Trust, UK

²University College London Hospitals NHS Foundation Trust, UK

ABSTRACT

INTRODUCTION Perineal defects are commonly encountered in an oncological setting although they may also present as a result of trauma and infection (eg following Fournier's gangrene). Reconstruction of these poses functional as well as aesthetic challenges. Skin coverage and tissue volume may both be required in addition to anogenital preservation or reconstruction. General prerequisites of an adequate reconstruction of perineal defects include provision of skin cover, well vascularised tissue to fill the dead space (reducing fluid collection and infection), vulvovaginal reconstruction and no faecal or urinary contamination.

METHODS A literature search was performed using PubMed and MEDLINE®. The search terms included 'perineal defects', 'perineal reconstruction', 'perforator flaps for perineum', 'vulval flaps', 'secondary healing of wound' and 'vacuum assisted closure'. Backward chaining of reference lists from retrieved papers was also used to expand the search.

FINDINGS Modern developments have led to an increased expectation in improved quality of life as the main goal of reconstruction, therefore necessitating surgery with less morbidity and early return to normal activity. Progress in microsurgical procedures has been the main recent advance in perineal reconstruction and, in future, refinements in perforator flap design and tissue engineering techniques will lead to even better reconstructions.

KEYWORDS

Perineal reconstruction – Perineal wound – Negative pressure wound therapy – Local flaps for perineum – Perforator flaps – Wound management

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CORRESPONDENCE TO

Maleeha Mughal, Plastic Surgery Registrar, Royal Free Hospital, Pond Street, London NW3 2QG, UK
E: leeha_h82@hotmail.com

Perineal defects are commonly encountered in an oncological setting such as penile, anorectal or vulval carcinomas. Excision of extensive or fungating inguinal lymph node metastases may result in significant adjoining defects. Similar defects may also present as a result of trauma (eg wounds from landmines and improvised explosive devices seen in soldiers returning from conflicts) and infection (eg following Fournier's gangrene). This may be on a background of malnutrition,^{1,2} inflammatory bowel disease,³ prior irradiation,⁴ chemotherapy,⁵ steroid use, advanced cancer, infection⁴ or urinary/faecal contamination.

The management of these defects depends on patient co-morbidities, adjuvant therapies, disease progression and technical expertise of the operating surgeon. Early diagnoses in younger patients has led to an increased expectation in terms of quality of life⁶ with less morbidity and early return to normal activity.

Successful aesthetic and functional perineal reconstruction requires adequate skin cover and well vascularised (non-irradiated) tissue to fill dead space with minimal faecal or urinary contamination. The modern 'reconstructive

elevator' approach (the best reconstructive technique for a defect may not necessarily be the simplest) has superseded the 'reconstructive ladder'.⁷

Although healing by secondary intention, negative pressure wound therapy (NPWT) and skin grafting is occasionally appropriate, flap reconstruction now predominates. This includes regional pudendal flaps as well as pedicled thigh, gluteal and abdominal flaps. Free tissue transfer is available for massive resections.

Methods

This review confines itself to the discussion of reconstruction of perineal defects generally as opposed to specific discussion of the reconstruction of the vagina, penis or anorectum and aims to inform resecting surgeons of the reconstructive possibilities now on offer. PubMed and MEDLINE® were searched from 2000 to the present day with the following terms, singly or in combination: 'perineal defects', 'perineal reconstruction', 'perforator flaps for perineum', 'vulval flaps', 'secondary healing of wound' and 'vac-

Figure 1 Lotus petal flap: design and inset into defect

uum assisted closure'. Historical references are also cited where appropriate.

Secondary intention healing

Although secondary intention healing is a reasonable option in small wounds, healing is delayed (consider NPWT) with the attendant risks of contamination, infection and wound extension. Adjuvant therapy may also be delayed. Scar contraction is pronounced and final appearance is unsightly.

Negative pressure wound therapy

NPWT is useful as a temporising measure or for wounds too large or contaminated for immediate reconstruction.⁸ It accelerates wound contraction and granulation tissue formation. Local tissue perfusion is increased and oedema fluid is removed with harmful exudates, bacteria and cytokines.^{4,6,9}

NPWT increases wound stabilisation, facilitating patient mobility,^{10,11} while preventing shear and may be more comfortable than conventional dressings as well improving split skin graft take.⁷ Maintaining an airtight seal in the perineum is challenging, and catheters and bowel management systems can be helpful.

Direct closure

Clean perineal wounds can be closed directly provided closure is tension free and does not distort local anatomy, especially the vaginal introitus and anus. Wounds should be closed in layers to avoid dead space and restore muscle continuity. Nevertheless, infections (11%) and delayed healing (14%) are common sequelae.⁵

Local flaps

A local flap is a block of tissue adjacent to the perineal defect into which it is rotated or transposed while retaining its own blood supply. Local flaps are quick and simple to perform, and aesthetically ideal as reconstruction is with 'like' tissue. However, they are limited by their size (5cm), and their vascularity may be jeopardised by radiotherapy and the resection.¹²

Regional flaps

These are non-adjacent flaps in the perineum based on named vessels that provide more volume and more robust vascularity than local flaps.¹³ The internal pudendal artery¹⁴ supplies the two main regional pudendal flaps: the Singapore and lotus petal flaps. These adipocutaneous flaps are based on perforating vessels located between the medial edge of the gluteus maximus and the posterior border of the scrotum or vulva. Preoperative Doppler ultrasonography can confirm viable perforating vessels. Pudendal flaps are easy to design and raise. They are reliable, have minimal donor site morbidity and can be used to reconstruct vaginal defects. However, they are relatively small and often need to be bilateral.

Singapore flaps

The Singapore flap was described by Wee and Joseph in 1989¹⁵ and is so called because the authors were in Singapore. The flap is raised from the tissue lateral to the labia majora, based posteriorly and transposed medially.

Lotus petal flaps

The lotus petal flap was described by Yii and Niranjan¹⁶ as a fasciocutaneous flap based on the internal pudendal artery. Multiple flap axes are possible and, drawn together, resemble a lotus petal (Fig 1). The flap has been modified by excluding the deep fascia layer, making it thinner and more pliable.¹⁷

Distant pedicled flaps

These flaps are transferred from separate anatomical regions to the perineum while retaining their vascular

Figure 2 Vertical rectus abdominis myocutaneous flap raised with skin paddle (A) and inset into defect through a peritoneal tunnel (B)

pedicles to those regions. The specific regions are abdomen, gluteal muscles and thighs. Fasciocutaneous flaps (eg the tensor fascia lata and anterolateral thigh [ALT] flaps) are useful for resurfacing large skin defects whereas myocutaneous flaps (eg the gracilis and vertical rectus abdominis myocutaneous [VRAM] flaps) are better for volume defects. Regional flaps have an advantage in that they are outside the field of irradiation of perineal tumours.

Vertical rectus abdominis myocutaneous flaps

The rectus abdominis flap was modified by Shukla and Hughes in 1984¹⁸ to have a vertical or oblique skin paddle and inferior pedicle for application to perineal defects. It is the main abdominal flap used routinely in the perineum. It consists of the rectus abdominis muscle containing the deep inferior epigastric vessels, which give off perforating branches through the muscle to supply the skin of the abdomen. The skin island may be up to 10cm x 20cm. The caudal end of the rectus abdominis is divided and the flap is tunneled through an incision in the pelvic peritoneum (Fig 2a). After delivery through the defect, the skin paddle is sutured to the edges of the defect (Fig 2b).

The VRAM flap has the advantages of a long robust pedicle, abundant volume and surface area, ease of harvest and low incidence of necrosis. Nevertheless, it does necessitate a laparotomy incision, and donor site morbidity is significant in terms of reduced core strength and ventral herniation.¹⁹ The use of mesh and fascia/muscle sparing techniques can reduce these complications. In the presence of a stoma, the incision should skirt around the side of the umbilicus contralateral to the stoma so that when the VRAM flap is raised the umbilicus does not necrose.

Thigh flaps

These include the gracilis myocutaneous, tensor fascia lata and posterior thigh flaps.^{10,20} Thigh flaps are robust, and can provide abundant skin and muscle. Donor site morbidity is minimal provided direct closure is possible. However, the thigh scars are long and in the well fed Western population, the flaps are often unappealingly bulky and paler than perineal skin.

Gracilis flaps

Described by McGraw in 1976,²¹ the gracilis flap consists of a transversely orientated crescent of skin and fat at the crease between perineum and thigh and the underlying gracilis. The muscle is completely expendable and provides bulk. The donor scar is concealed and flap harvest is relatively straightforward in a supine position (Fig 3). The main disadvantage is unpredictable viability of the skin paddle due to the muscle's segmental blood supply. Bilateral flaps are often necessary. Modifications include Soper *et al*'s short gracilis flap,²² in which a more proximal pedicle allows greater mobility and adjustment of the skin paddle into an L-shape extending into the gluteal sulcus such that only 90° rotation is required.

Figure 3 Harvest of gracilis flap providing robust myocutaneous tissue to fill dead space

Figure 5 Perforator markings for anterolateral thigh flap

Figure 4 Bilateral inferior gluteal artery perforator flaps marked (A), and raised and inset in V-Y manner (B)

Tensor fascia lata flaps

The tensor fascia lata flap incorporates the muscle as well as the skin and fascia of the lateral thigh up to an area of 10cm x 30cm. It is based on the ascending branch of the lat-

eral circumflex femoral artery. It is technically easy to raise, provides abundant skin and allows harvest with the patient supine. It can be used for inguinal and perineal defects but has little advantage over the ALT flap described below.

Gluteal flaps

These include the gluteal fold flap and the inferior gluteal artery perforator (IGAP) flap (described below). These flaps are robust, technically easy to raise, and provide ample skin, fat and even underlying gluteus maximus with a concealed scar. They are used mainly for posterior perineal defects but can be extended to reach anterior defects.^{23,24} However, gluteal flaps require prone positioning and usually need to be bilateral. The gluteal fold flap described by Knol and Hage in 1997²⁵ is designed along the same principles as the lotus petal flap but has since been modified by thinning the adipose tissue surrounding the vascular pedicle. Laxity of the skin in the region allows tension free closure with little risk of wound dehiscence.

Perforator flaps

A perforator flap is based on branches perforating through muscle or fascial septa from a source artery en route to the skin. The advantage of perforator flaps is that the underlying muscle is not included in the flap, thereby reducing donor site morbidity in terms of function, pain and contour deformity.^{10,26}

Inferior gluteal artery perforator flaps

Described by Higgins *et al* in 2002,²⁴ the inferior gluteal artery perforator (IGAP) flap has gained popularity owing to its technical simplicity and reliability. Preoperative and even intraoperative identification of perforators is unnecessary because of their constancy, making dissection straightforward. IGAP flaps are usually raised bilaterally, and are advanced towards the midline and closed in a V-Y fashion with medial edges de-epithelialised and buried, providing volume and a stronger closure (Fig 4). Considerable patient compliance is required postoperatively as lying or sitting on the flaps must be avoided for two weeks to prevent necrosis.

Anterolateral thigh flaps

The ALT flap was described by Song in 1984²⁷ and first used in perineal reconstruction in 1992.²⁸ It is a fasciocutaneous flap of the lateral thigh based on perforators from the transverse branch of the lateral circumflex femoral artery (Fig 5). The donor site defect can be closed directly if the width is less than 8cm but flaps of up to 15cm wide can be raised with grafting of the donor site. The ALT can be used as a pedicled or free flap. Although robust, harvest of the ALT flap is challenging technically.²⁹

Free flaps

A free flap has its pedicle divided and then anastomosed to recipient vessels at the site of the defect. In practice, free flaps are rarely required for perineal reconstruction but may be used for special circumstances such as penile reconstruction with the radial forearm flap.³⁰

Selecting method of reconstruction

Reconstruction is usually a choice between a pudendal flap for smaller defects and a regional flap for larger defects. Flap selection depends on defect size and shape, availability of donor sites, patient choice, surgeon expertise, medical co-morbidities and previous treatments. Tensor fascia lata or VRAM flaps would provide plenty of skin whereas bilateral gracilis flaps would provide muscle bulk. Previous operations and radiotherapy should be considered as they may have compromised the vascularity of possible flaps. For example, the vessels supplying the VRAM flap may have been divided in a Caesarean section and iliofemoral bypass grafting may similarly affect thigh flaps.

Intraoperative patient positioning should be considered. The supine patient will have to be rotated into a lateral decubitus or prone position if unilateral/bilateral IGAP flaps are to be used. If the patient has to remain supine during surgery, the options will be restricted to VRAM and thigh flaps.

Future directions in perineal reconstruction

Undoubtedly, the future for perineal reconstruction (as for other parts of the body) is in tissue engineering and manipulation of wound molecular biology. The first case reports of artificial dermal matrices such as AlloDerm® (LifeCell, Kidlington, UK) being used in perineal reconstruction are emerging.³¹

Conclusions

Reconstruction of perineal defects has aesthetic, functional and three-dimensional considerations. Overall patient health and past treatments must be considered. There is a range of reconstructive options available for perineal reconstruction, from local flaps to free flaps. Choice of technique follows the reconstructive elevator principle. Progress in perforator flap surgery has been the main recent advance in perineal reconstruction and in the future, refinements in

perforator flap design and tissue engineering will lead to even better reconstructions.

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