

# Overview of gynaecological and colorectal reconstruction

**Plastic surgeons are often required to reconstruct defects following radical pelvic surgery for advanced or recurrent anorectal and gynaecological malignancies. This article describes the most commonly used flaps for reconstruction following radical pelvic surgery and provides a treatment algorithm to facilitate decision making.**

**A**cquired defects of the vagina and perineum most commonly arise following oncological surgery. Preoperative radiotherapy decreases the recurrence rate of rectal carcinoma (Garcia-Aguilar et al, 2003) but increases the rate of perineal wound complications (Bullard et al, 2005). Pelvic exenteration may result in very large defects where locoregional flaps serve not only to close the wound, but also obliterate dead space and improve wound healing, especially in previously irradiated fields (Mathes and Hurwitz, 1986). Multidisciplinary team involvement in these cases is very important from the outset. Plastic surgeons work very closely with colorectal, gynaecological and urological surgeons to plan the surgery and ensure that incisions and stoma locations are correctly placed thereby maximizing the reconstructive options.

Plastic surgeons have become an integral part of the primary management of these complex wounds. The goals of reconstruction are to achieve rapid and uncomplicated wound healing, and control presacral dead space, therefore preventing small bowel herniation. The latter is particularly relevant in patients who require postoperative radiotherapy as it decreases the risk of radiation enteritis and obstruction. It is also important to restore anatomy and function especially in vaginal reconstruction while minimizing donor site morbidity. Uncomplicated wound healing is essential for early mobilization and timely discharge from hospital, as well as preventing delays in starting adjuvant therapy.

This article gives an overview of the reconstructive options available for vaginal, vulval and perineal defects.

## Anatomy of the blood supply of the perineum

The blood supply of the perineum was described by Manchot and colleagues in 1889, who divided the cutaneous area of the perineum into anterior and posterior

regions (Manchot et al, 1983). The perineum provides a rich vascular network mainly formed by branches of the femoral and internal iliac arteries. The anterior region is supplied by the superficial and deep external pudendal arteries, while the posterior region is supplied by the internal pudendal artery and branches of the inferior gluteal artery. This rich vascular network provides a wide range of flaps for reconstruction of this region.

## Vaginal and vulval defects

Vaginal reconstruction improves both the quality of life and psychological wellbeing of the patient, by improving body image and restoring sexual function (Morley et al, 1973; Höckel and Dornhöfer, 2008).

Invasive carcinoma of the vulva accounts for 3–5% of female genital tract neoplasms. It is more frequent after the fifth decade of life. Currently, the standard treatment for vulval cancer is radical vulvectomy or radical local excision with inguinal lymphadenectomy (Thomas et al, 1994).

Vaginal cancer is the rarest of all female genital malignancies, accounting for 2% of all gynaecological malignancies (Eifel et al, 2008). Primary invasive carcinoma of the vagina is predominantly a disease of elderly women with 70–80% of cases being diagnosed in women older than 60 years (Beller et al, 2006).

It is important to classify the resultant vaginal defect using the Cordeiro classification (Cordeiro et al, 2002). This provides a useful aid in flap selection for defects not amenable to primary closure or skin grafting. Type I defects are defined as partial non-circumferential defects of the vagina, and can be subclassified into type IA and type IB defects. Type IA defects involve the anterior and/or lateral vaginal wall, and may result from resection of primary vaginal cancers or urinary tract malignancies. Type IB defects involve the posterior vaginal wall and typically result from resection of locally advanced colorectal carcinomas. Type II defects are defined as circumferential defects, and are subclassified into type IIA and type IIB defects. Type IIA defects involve the upper one-third to two-thirds of the vagina, and may result from resection of cervical and uterine malignancies. Type IIB defects involve the entire vagina, and usually follow total pelvic exenteration.

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### Reconstructive options for vaginal or vulval defects

Occasionally skin grafts can be used, but their application is limited by the depth of tissue loss, difficulty immobilizing the graft, wound contamination, graft contracture, and poor cosmetic and functional outcome (Korlof et al, 1975).

Fasciocutaneous and myocutaneous flaps are most commonly used for reconstruction of full thickness defects. These flaps provide a large volume of well-vascularized tissue that can be used to fill the dead space and reconstruct the vagina and vulva. This is especially important in patients who have had preoperative radiotherapy.

Most vaginal defects can be reconstructed using local flaps, the choice of which depends on the site and size of the defect. Local flaps can be mobilized in three ways: transposition (Singapore flap), rotation (lotus petal flap) or V-Y advancement flaps. For larger defects rectus abdominis myocutaneous flaps or pedicled gracilis flaps can be used for reconstruction.

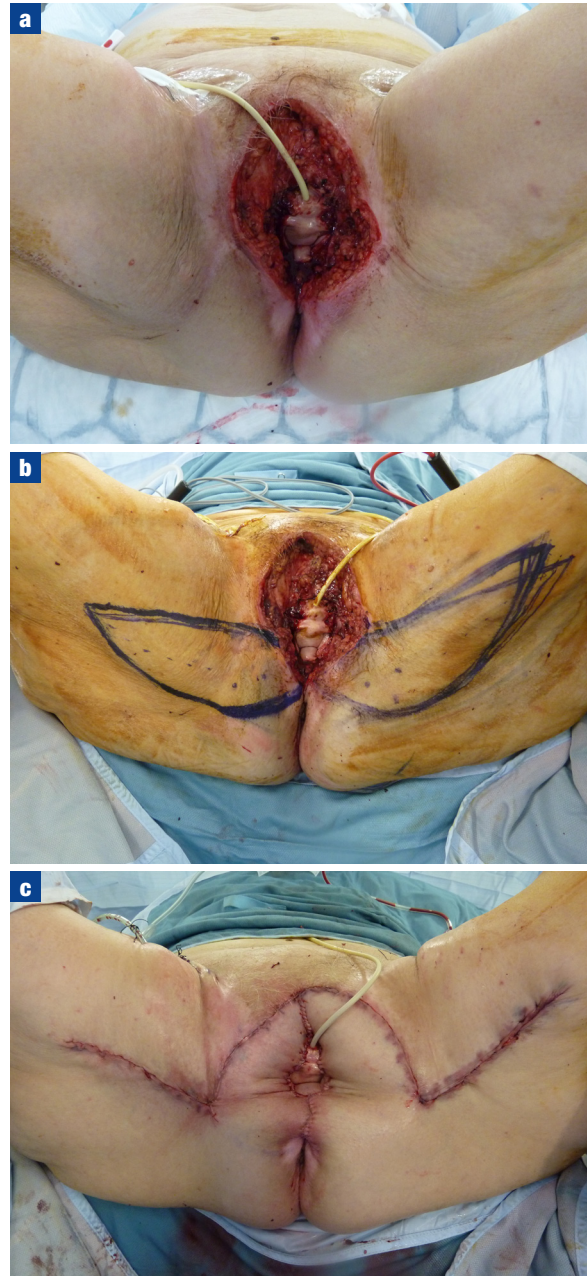
Wee and Joseph (1989) first described the Singapore flap which is based on the labial artery. These flaps can be used to reconstruct vulval defects as well as partial (unilateral flap) or total vaginal defects (bilateral flaps). With the patient in the lithotomy position, the flaps are raised in the subfascial plane. If bilateral flaps are required for total vaginal reconstruction, the flaps are sutured together once transposed to form a cylinder creating the neovagina.

Yii and Nirajan (1996) described the lotus petal flap for vulvo-vaginal reconstruction. Flaps raised on perforators around the perineum resemble the petals of the lotus and can be used to reconstruct a variety of vulvo-vaginal defects (*Figure 1*). Once the defect is apparent the flap is then designed using reverse planning. Perforator vessels at the base of the flap are mapped using a handheld Doppler ultrasound probe. An exploratory incision is made down to muscle and the flap is raised in the subfascial plane. V-Y advancement flaps can also be used with the perforator vessels located at any point along the midaxis of the flap. However, in the lotus petal rotation flap, the perforators need to be located at the base of the flap to allow adequate mobilization.

Shukla and Hughes (1984) first described the vertical rectus abdominis myocutaneous flap. This flap provides a robust technique for the reconstruction of posterior type IB and type II vaginal defects and can be used with either a single or double skin paddle.

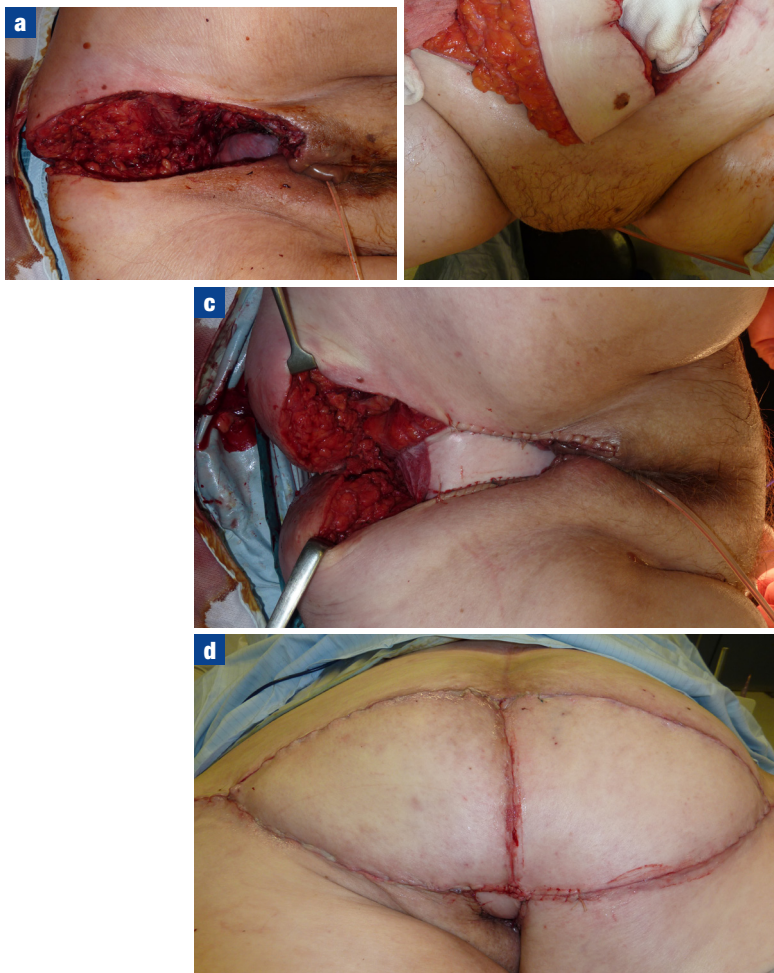
This flap provides muscle bulk to fill the pelvic dead space and a skin paddle that can be used to reconstruct the vagina. The skin paddle of the flap is designed vertically along the rectus abdominis muscle. The skin and subcutaneous tissue are incised down to the anterior rectus sheath which is then incised and the rectus muscle is elevated off the posterior rectus sheath. The superior epigastric vessels are identified and ligated and the flap mobilized on the deep inferior epigastric vessels. The muscle is detached superiorly from its costal attachments, while the inferior insertion at the

**Figure 1.** **a.** Defect post excision of a vulval squamous cell carcinoma. **b.** Perforator vessels at the base of the flap are mapped using a handheld Doppler ultrasound probe and their positions marked. Bilateral lotus petal flaps are then planned. **c.** The flaps are then raised and used to reconstruct the defect with the donor sites being closed directly.



pubic symphysis may be preserved or released, depending on the desired arc of rotation. The flap is rotated medially into the pelvis and inset into position (*Figure 2*). For type II defects Cordeiro et al (2002) described rolling the rectus flap to create a cylinder. Abbott et al (2008) described the oblique rectus abdominis myocutaneous flap which incorporates a larger paddle of skin in an oblique configuration useful for reconstructing larger defects. A transverse orientation for the skin paddle can also be used particularly for larger defects. Although this flap is very

**Figure 2. a.** Perineal defect with involvement of the posterior vaginal wall post abdominoperineal excision. **b.** Vertical rectus abdominis myocutaneous flap is raised and rotated medially into the pelvis. **c.** The vertical rectus abdominis myocutaneous flap is then used to reconstruct the vaginal wall as shown. **d.** The patient is then turned prone and bilateral inferior gluteal artery perforator flaps are then raised and used to reconstruct the perineal defect.



robust it is associated with significant donor site morbidity, in particular abdominal wall hernias.

The gracilis myocutaneous flap was first described by McCraw et al (1976) and is another useful flap for neovaginal and perineal reconstruction particularly in the reconstruction of type IIB defects, where bilateral flaps would be required. The gracilis flap is supplied by the medial circumflex femoral artery, originating from the profunda femoris, and entering the gracilis 8–10 cm from its origin. An elliptically-shaped vertical skin paddle is planned and the skin, subcutaneous fat and gracilis fascia are incised. Once the muscle has been identified it is disinserted and raised from distal to proximal, while protecting the musculocutaneous perforators to the skin

paddle. The flap is then passed via a subcutaneous tunnel into the defect requiring reconstruction and the donor site closed primarily. Similarly to the vertical rectus abdominis myocutaneous flap, the muscle bulk is used to fill the pelvic dead space and the skin paddle to reconstruct the vagina.

In colorectal surgery, the gracilis myocutaneous flap has been used to reconstruct the neosphincter of the anus, with or without electrical stimulation, in patients with faecal incontinence (Mander et al, 1999). It was first described for neoanal sphincter reconstruction by Chetwood (1902).

The reconstruction of an electrically stimulated anal neosphincter requires three stages. In stage 1, the gracilis muscle is mobilized by dividing its distal tendinous attachment and used to form the neosphincter. In stage 2, 6 weeks after the first stage the pulse generator and stimulating electrodes are implanted. In stage 3, the patient undergoes a period of training whereby a period of chronic electrical stimulation is used to convert the type 2 fast twitch muscle to type 1 slow twitch (Konsten et al, 1993). At the completion of the training period, the muscle is continuously stimulated and the pulse generator only turned off when the patient wishes to defaecate. The pulse generator is controlled with a handheld magnet that is passed over the skin to turn it on or off.

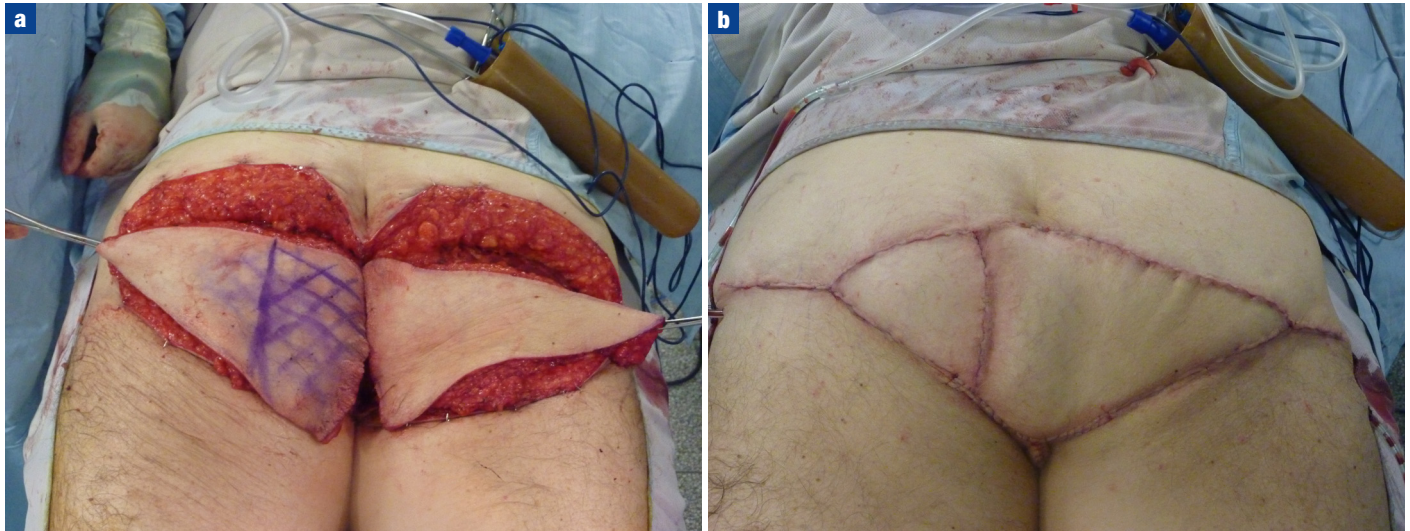
## Perineal reconstruction

Abdominoperineal resection, first described by Ernest Miles (1908), remains the gold standard surgical treatment for cancers of the lower rectum and anus (Okaro et al, 2006). This is carried out either as a curative or palliative procedure and involves an extended abdominoperineal excision with or without an anterior, posterior or total pelvic exenteration. Morbidity with these surgical techniques is high, mainly because of the wide cutaneous defect and large dead space created which increases the risk of complications. In addition the use of neoadjuvant chemo-radiotherapy leads to delayed wound healing in up to 66% of cases (Brady et al, 1995). Chadwick et al (2006) looked at 96 patients who underwent abdominoperineal excision after radiotherapy and found that 60% of patients remained unhealed at 1 month, 50% at 3 months and 25% at 1 year. Therefore it is essential to use well-vascularized non-irradiated tissue to reconstruct these defects and reduce these recognized wound complications.

With advances in colorectal surgery plastic surgeons have had to develop and evolve their reconstructive techniques accordingly. First, there has been a move away from the Lloyd Davies position which allowed a synchronous approach to abdominoperineal excision, and now the abdominal mobilization is performed with the patient supine and the perineal excision with the patient prone. Second, colorectal surgery is rapidly moving away from open to laparoscopic with all the associated benefits of reduced postoperative pain, enhanced recovery and reduced hospital stay.

With these developments the inferior gluteal artery perforator flap has been popularized (Griffin et al, 2011).

**Figure 3. a.** Bilateral inferior gluteal artery perforator flaps are raised to reconstruct a large perineal defect in a male patient post abdominoperineal excision. The medial aspect of the left inferior gluteal artery perforator flap is marked (as shown) and de-epithelialized. **b.** This buried part of the flap is anchored with sutures to prevent herniation. The contralateral inferior gluteal artery perforator is mobilized across the midline and double breasted over the first in the midline.



Either unilateral or bilateral flaps can be raised and inset in the prone position with no need to turn the patient. The abdominal wall is left intact thereby reducing abdominal pain and morbidity resulting in enhanced recovery. Other options for perineal reconstruction include the vertical rectus abdominis myocutaneous and gracilis flaps as described above. In cases of total pelvic exenteration combined with a sacrectomy the resultant wounds are substantial and bilateral stomas are required, rendering the vertical rectus abdominis myocutaneous flap an unavailable option.

The inferior gluteal artery perforator flap is a fasciocutaneous flap based on the perforators of the inferior gluteal artery (Griffin et al, 2011). The flaps are elevated with the patient in the prone position and the legs slightly abducted. The size of the defect and whether a vaginal reconstruction is required determines if a unilateral or bilateral inferior gluteal artery perforator flap is required. The flaps are elevated in a subfascial plane off the gluteus muscle with the perforating vessels supplying the subcutaneous fat and skin being preserved and dissected throughout their length, allowing the flap to be advanced into the defect. Inferior gluteal artery perforator flaps provide a substantial volume of tissue which, unlike the vertical rectus abdominis myocutaneous and gracilis flaps, does not atrophy with time. The flaps can be mobilized high into the pelvis to close the dead space and reconstruct either partial or total vaginal defects. The buried part of the flap is de-epithelialized and anchored with sutures to prevent herniation. For larger defects not requiring vaginal reconstruction the contralateral inferior gluteal artery perforator flap is also mobilized across the midline and double breasted over the first in the midline (Figure 3). If total or partial vaginal reconstruction is required the two flaps are mobilized into the midline and used to recreate the vagina.

Postoperative care following vertical rectus abdominis myocutaneous, gracilis or inferior gluteal artery perforator flap reconstruction is very important. The patient is nursed in the lateral position for the first 48 hours with a pillow between the legs. The patient is encouraged to mobilize early on and is allowed to lie supine after 48 hours. The suction drains are left in place until the patient is fully mobile and has drained less than 30 ml in a 24-hour period. The sitting protocol is commenced at day 5, when the patient is encouraged to sit on a pressure-relieving cushion for 5 minutes four times a day, increasing the sitting time period by 5-minute increments every day.

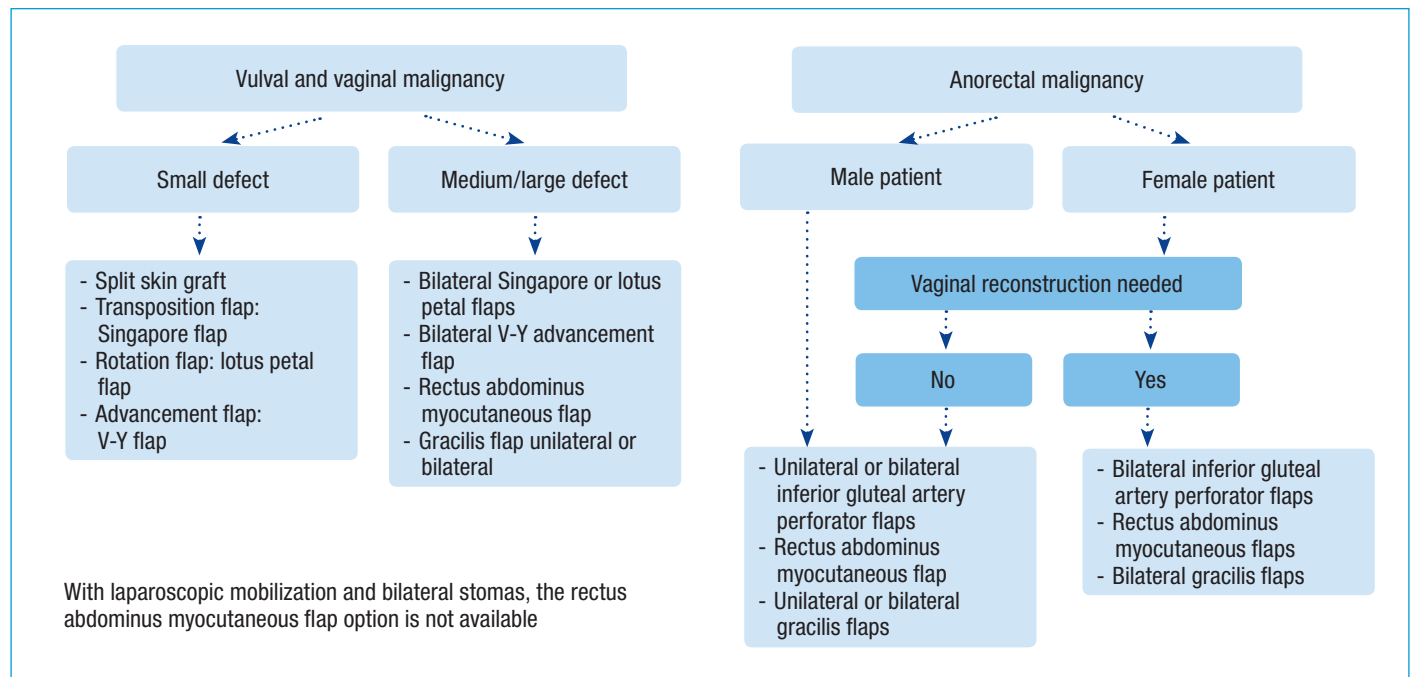
### Conclusions

A multidisciplinary approach to vaginal and perineal reconstruction is of utmost importance in order to maximize oncological success, encourage rapid recovery and minimize postoperative complications. A vast range of reconstructive techniques is available for vaginal, vulval and perineal reconstruction. The complexity of perineal wounds following radical abdominoperineal excision has increased with neoadjuvant radiotherapy becoming the standard treatment for rectal and anal cancers. Therefore it is essential that these patients have primary reconstruction to introduce healthy well-vascularized tissue into the area requiring reconstruction in order to close off the dead space and facilitate wound healing. The reconstruction needs to be tailored according to the patient's needs, the size of the defect and the structures involved. Accordingly, the authors have devised a treatment algorithm for the reconstruction of vulval, vaginal and perineal defects (Figure 4). **BJHM**

*Conflict of interest: none.*

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Figure 4. Treatment algorithm for the treatment of vulval, vaginal and perineal defects.



## KEY POINTS

- A multidisciplinary team approach is essential.
- Primary involvement of the plastic surgeon permits radical oncological resection and immediate reconstruction.
- Flap selection depends on the location, size of defect and structures requiring reconstruction.

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