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ORIGINAL ARTICLE

Immediate vaginal reconstruction following pelvic exenteration using the pedicled vertical Deep Inferior Epigastric Perforator (DIEP) flap: A technical note



La reconstruction vaginale immédiate par lambeau perforant basé sur le pédicule épigastrique inférieur après exentération pelvienne : note technique

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KEYWORDS

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Summary Immediate vaginal reconstruction is usually offered following pelvic exenteration for recurrent cervical cancer in women previously treated with radiotherapy or with severe radiation-induced fistulae. Introduction of muscle-sparing flaps, such as the pedicled vertical deep inferior epigastric perforator (DIEP) flap, provides viable tissues for vaginal reconstruction and is associated with reduced donor-site morbidity. This report describes the surgical technique, which is one of the procedures of choice for vaginal reconstruction. It is safe and beneficial, especially for women with gynecologic cancer who have undergone pelvic exenteration after failed radiation therapy.

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MOTS CLÉS

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Résumé La reconstruction vaginale immédiate est généralement réalisée à la suite d'une exentération pelvienne pour cancer du col de l'utérus, en cas de récurrence (après radiothérapie) ou de fistules radiales sévères. Le prélèvement des lambeaux sur des vaisseaux perforants, tels que le lambeau perforant basé sur le pédicule épigastrique inférieur (DIEP), permet d'obtenir des tissus viables pour la reconstruction vaginale et est associé à une réduction de la morbidité du site donneur. Ce rapport décrit la technique chirurgicale, qui est l'une des procédures de choix pour la reconstruction vaginale. Il s'agit d'une technique fiable et avantageuse, en particulier chez les femmes pour qui il ne restait plus que l'option de l'exentération en cas d'échec de l'irradiation.
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Introduction

Pelvic exenteration (PE) is a radical procedure consisting of the *en bloc* removal of all pelvic structures, including the genital, urinary, and/or digestive organs. It is an uncommon salvage procedure for gynecologic cancers, and depending on the case, PE can be total or partial [1]. In most cases, this mutilating surgery is performed in patients with recurrent cervical cancer that has previously been treated with radiotherapy or in women with severe radiation-induced fistulae.

The vacant pelvic cavity is a cause of high morbidity and mortality [2,3] due to the transposition of intestinal loops in the lower pelvis with an increased risk of digestive fistula, infection, and intestinal occlusion. After exenteration, the poorly vascularized, often irradiated pelvic cavity, now vacant, becomes a potential site for collections and, subsequently, infection. The main challenge with PE is the filling of the pelvic cavity and the reconstruction of the amputated organs.

Several benefits are associated with vaginal reconstruction. In addition to offering psychological benefits to the patient, vaginal reconstruction provides a therapeutic benefit in reducing the morbidity and mortality associated with PE [4]. In patients who have received radiotherapy for recurrent cervical cancer, filling the empty pelvic dead space left after PE with healthy, viable tissue, such as colonic advancements and omental or myocutaneous flaps, is associated with reduced incidence of fistulae, infections, intestinal obstruction, and bleeding [4]. Reconstruction also facilitates speculum examination during subsequent gynecological follow-up visits.

Given the significant morbidity of PE, the benefits of vaginal reconstruction should outweigh its risks. Therefore, it is necessary for the surgeon to use a simple, fast, and reliable technique that provides good-quality tissue. General surgeons prefer using the vertical rectus abdominis myocutaneous (VRAM) flap for neovagina reconstruction because the technique is easy to perform. Additionally, they do not systematically have access to plastic surgeons. Thus, a multidisciplinary collaboration seems essential in these cases. This article aims to describe a technique for vaginal reconstruction using the pedicled vertical deep inferior epigastric perforator (DIEP) flap after PE.

Surgical approach**Preoperative preparation**

Computed tomography (CT) angiography should be performed to choose the harvest side before surgery. A urologist,

gynecologic, or digestive surgeon should be consulted to determine the side for harvesting based on the quality of the perforators (seen on the CT scan) and the options for urinary and digestive diversion (colostomy, Miami) [5].

The skin paddle

A plastic surgeon trained in perforator flap techniques should be present at the beginning of the procedure to identify the perforators using Doppler flowmetry. The plastic surgeon is also responsible for drawing the intended skin paddle location before surgery (Fig. 1) and checking that the perforators are not damaged during median laparotomy.

Dissection of the perforator arteries

The skin paddle is unilateral and vertical. An incision is made in the area marked out beforehand, and a pre-aponeurotic dissection is performed to identify the perforators. The muscle is split longitudinally to expose the deep inferior epigastric pedicle inferiorly. The dissection is continued through the deep inferior epigastric pedicle up to the bifurcation of the external iliac artery (Fig. 2). The flap is then passed through the muscle in preparation for transfer.

Administration and role of indocyanine green

Once the flap is completely mobilized and pedicled on the inferior epigastric vessels (Fig. 3), its viability is clinically evaluated based on parameters such as temperature, color, and re-capillarization time. Doppler ultrasound sonography is also performed to assess flap viability; however, indocyanine green is the most sensitive technique for assessment [6].

Intravenous indocyanine green 0.2 mg/kg (maximum 0.5 mg/kg) should be administered shortly before surgery; at most, two injections are required during the procedure [7]. A few seconds after administration, the product diffuses and it helps to visualize the subcutaneous vascular network. Thus, the administration of indocyanine green is a reliable method for performing *in situ* resection of tissues at risk for necrosis.

Flap modelization

The flap is wrapped around a stent to form a tube-like structure resembling the vaginal shape. Then, the lateral edges are sutured using Vicryl 0 (Fig. 4). The bottom of the vagina consists of the lower edge of the flap that is closed with running sutures.

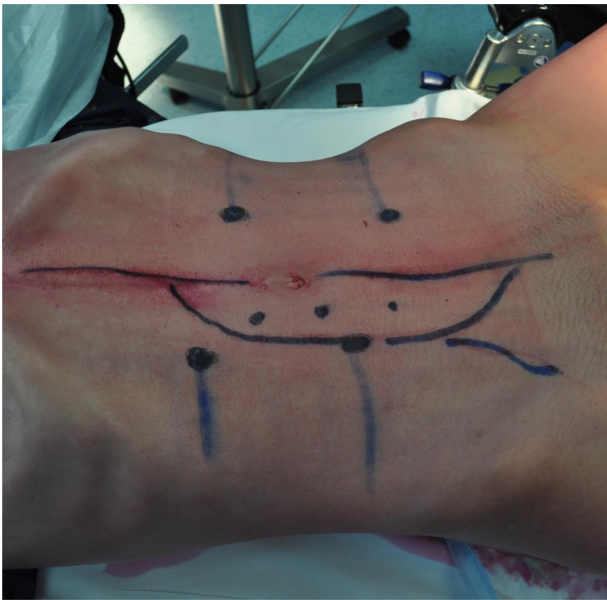


Figure 1 Drawing of the skin paddle of the flap for vaginal reconstruction.

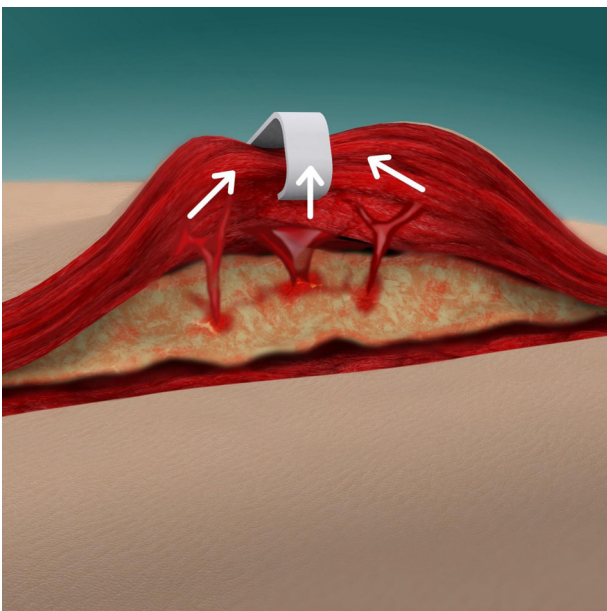


Figure 2 Pedicled vertical DIEP flap raised based on three perforators.

Transposition of the flap

The flap is transposed to the pelvis through the abdominal cavity. One practical tip to prevent the pedicle from being dislodged or kinked is to incise the peritoneum and pass the pedicle through it before closing the former with interrupted sutures using Vicryl 2-0. The flap is then sutured to the vaginal introitus anteriorly and the perineum posteriorly (Fig. 5).

A dual catheter is placed to drain accumulated fluids.

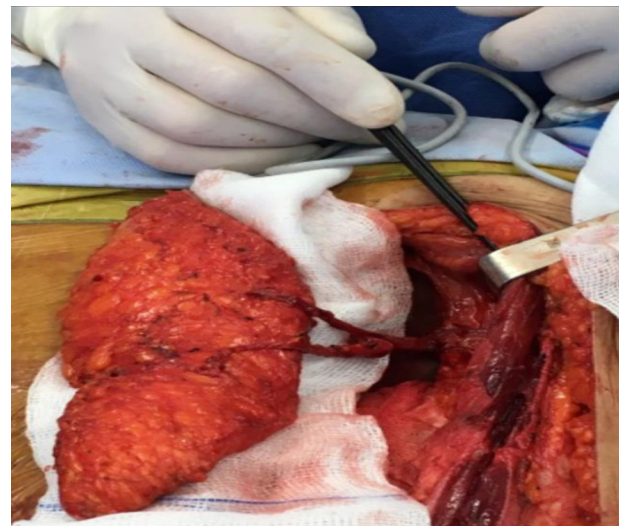


Figure 3 Mobilized DIEP flap before interposition.

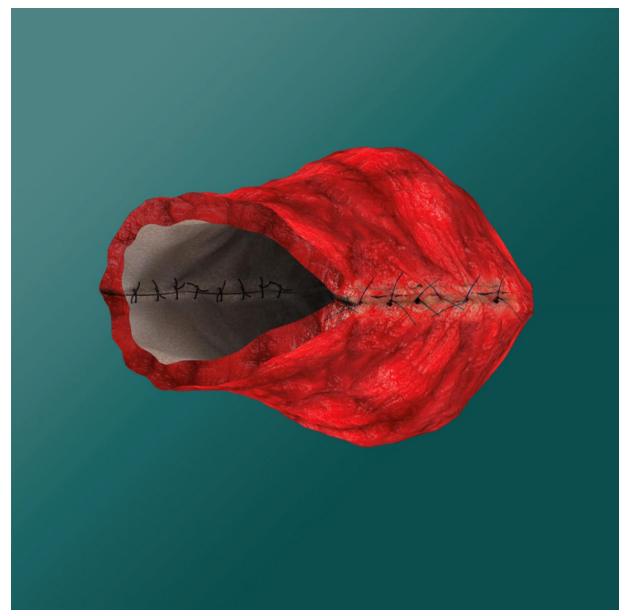


Figure 4 Neovagina formed by folding the flap on itself and suturing the lateral walls using Vicryl 0.

Postoperative management

Flap monitoring is challenging in vaginal reconstruction because bedside clinical and Doppler evaluation of the neovagina is sometimes not possible. It is generally necessary to place a drainage tube to perform daily lavage. It may also be necessary to examine the patient using an endoscope or to perform a speculum examination once or twice a week in the operating room while the patient is under general anesthesia.

Flap necrosis is a potential complication that can result in subsequent fistula formation and stenosis of the neovagina



Figure 5 Flap sutured to the vaginal introitus.

[8]. It is necessary to perform debridement of the necrotic areas under general anesthesia and interpose a well-vascularized tissue between the digestive system and the flap. Flap repositioning can be attempted if the necrosis is partial. In cases where muscle viability is preserved, guided scarring can be provided, or skin grafting can be performed later. In the case of total flap necrosis, the surgeon should perform a redo reconstruction.

Daily vaginal dilatation is performed, and a return to sexual activity is recommended as soon as the healing of the neovagina is obtained.

An analysis of reconstructive options in vaginal reconstruction

Several techniques are available for vaginal reconstruction after PE. Of these, muscle-sparing DIEP flap reconstruction is currently the technique of choice [1]. Previously, the most commonly used technique was muscle-sparing vertical rectus abdominal muscle (VRAM) flap reconstruction, which is easier and faster to perform than the DIEP reconstruction [9,10]. The skin paddle in the VRAM flap is adherent to the right rectus muscle containing the vascular pedicle, and the rate of abdominal wall complications associated with this technique (i.e., abscesses, hernias, and fistulae) make it less preferable than the DIEP. In fact, 21% incisional herniation was reported with VRAM versus < 3% with DIEP [8].

Vaginal reconstruction using an omental flap and split-thickness skin graft is an old technique that involves the use of an omental flap based on the right gastroepiploic artery and transposing it into the pelvic cavity where it is modeled into a tubular shape [11]. The main downside of this technique is that it requires an adequate volume of omentum

(which is uncommon in cancer patients, who are usually “consumed” by their disease). Additionally, the risk of vaginal stenosis is high [11]. Nevertheless, the omental flap is a good choice in cases of partial exenteration in obese patients or in cases involving isolated amputation of the vagina and uterus.

Rectus abdominis myocutaneous flaps and gracilis myocutaneous flaps are reportedly safe for vaginal reconstruction and have acceptable operative morbidity [12]. One of the major advantages of using myocutaneous flaps is that they can create bulk in the hollow pelvis and decrease the risk of fistula formation. Additionally, the incident rate of flap necrosis is very low, even when urinary diversion (Miami pouch) is performed [12].

The gracilis myocutaneous flap is the first flap described for vaginal reconstruction [13]. It is a good option, especially when the abdomen appears to be a poor donor site (previous surgery, poor quality of the perforators) and is favored by many reconstructive surgeons due to the donor site profile and short operative time [14]. However, the flap is difficult to harvest due to the location of the gracilis muscle.

The sigmoid, cecum or ileum are viable alternatives for reconstruction of the vagina. Although the sigmoid or ileal vagina have an adequate size and appear to be reliable, patients experience excessive mucus secretions and contractions [15].

Bilateral gluteus maximus myocutaneous flaps are derived from the proximal posterior aspect of the thigh and are typically recommended in cases of large tissue loss of the perineal region [16]. However, these flaps are usually not recommended for total vaginal reconstruction for several reasons, including the long distance between the point of the flap and the vaginal introitus.

Conclusion

Vaginal reconstruction following PE is an infrequent and challenging procedure that requires a multidisciplinary team approach. It can reduce postoperative complications by providing adequate pelvic cavity filling and potentially reduce the risk of fistula formation, occlusion, and pelvic abscess. Reconstruction should be performed immediately after PE due to its clinical benefits. Thus, reconstruction improves the prognosis of this mutilating surgery, which is performed in patients who are more susceptible to emotional lability due to cancer and its treatment.

Disclosure of interest

The authors declare that they have no competing interest.

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