

Perforator flaps for vulvar reconstruction: basic principles

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Abstract. *Background and aim:* In vulvar cancer, the standard treatment is radical local excision, with immediate reconstruction. Reconstruction aims to restore anatomy and function of the external female genitalia, facilitating preservation of normal body image, sexual function, and micturition and defecation functions. *Methods:* The purpose of this paper is to describe the principles of perforator flaps for vulvar reconstruction. *Results:* Basic concepts, indications and operative technique are discussed and detailed. *Conclusions:* In vulvar reconstruction, the use of perforator flaps is a superior surgical technique when compared to the use of conventional flaps. (www.actabiomedica.it)

Key words: Vulvar cancer, vulvar reconstruction, perforator flaps

Introduction

Vulvar cancer is rare. It is more common among women with a medical history of vulvar intraepithelial neoplasia, human papillomavirus (HPV) infection, or genital warts. The rate of new cases of vulvar cancer was 2.6 per 100,000 women per year based on 2014–2018 cases, age-adjusted. Approximately 0.3 percent of women will be diagnosed with vulvar cancer at some point during their lifetime, based on 2016–2018 data. According to the Surveillance, Epidemiology, and End Results (SEER) Program, vulvar cancer represents 0.3% of all new cancer cases annually at a rate of 2.6 per 100,000 women per year in the United States (1). Diagnosis is usually made in the sixth through eighth decades of life and is commonly identified at an early stage of the disease. Squamous cell carcinoma (SCC) accounts for most vulvar cancers, while basal cell carcinoma (BCC), extramammary Paget disease, and vulvar melanoma comprise the less common subtypes. Surgery remains the mainstay of vulvar cancer treatment,

with medical and radiation oncology playing an increasingly important role in preventing recurrence and improving outcomes. Surgical excision is the standard therapy for vulvar cancer, but adjuvant radiation and chemotherapy may be recommended depending on the histopathology and extent of the disease (2). For SCC with a depth of invasion ≤ 1 mm, wide-local excision without lymphadenectomy is sufficient with a recommended surgical margin of 1 to 2 cm. If tumor depth is greater than 1mm or tumor diameter exceeds 2 cm, radical resection with margins extending to the perineal fascia and inguinal lymph node assessment should be performed. This more aggressive treatment is recommended due to the risk of occult nodal metastasis and increased risk of death for groin recurrence. For verrucous carcinoma, local excision is typically sufficient; however, the advanced disease may require radical resection (2). Tumor-free margins decrease the risk of recurrence (3). Similarly, wide local excision with tumor-free margins is also recommended for vulvar melanoma as in cutaneous melanoma because

radical surgery to treat vulvar melanoma does not improve survival and is associated with increased morbidity (4). In vulvar Paget's disease, local excision is the standard of care; however, given that multifocal disease is common, high rates of positive margins and recurrence are often observed. Inguinal lymphadenectomy should be considered if the invasion is greater than 1mm. Mohs surgery may benefit the successful resection of Pagetoid lesions and has been associated with a higher rate of negative margins (5). In vulvar sarcoma, the standard treatment is radical local excision, with inadequate excision of margins being the most important predictor of recurrence (6). Reconstruction aims to restore anatomy and function of the external female genitalia, facilitating preservation of normal body image, sexual function, and micturition and defecation functions. The purpose of this paper is to describe the principles and techniques of perforator flaps for vulvar reconstruction based on our experience.

Operative technique

Closure of the defect site after larger vulvar excisions presents not only a technical challenge to the surgeon but carries significant medical, functional, and psychosocial implications for the patient. Reconstruction must be tailored to the needs of the patient with consideration of the wound geometry as well as potential secondary complications. For smaller defects, local advancement or rotation flaps generally provide adequate tissue mobility with minimal risk, while often maintaining sensation (7). For larger defects, such as seen following exenterative procedures, perforator flaps are an excellent choice. A perforator is defined as a skin flap without the deep fascia or the muscle based on a muscle perforator requiring intramuscular pedicle vessel dissection (8). Perforators can be categorised as direct cutaneous perforator, septocutaneous perforator and musculocutaneous perforator. "Direct cutaneous perforator" is the perforator sprouting from the proximal vessel to dermis without traversing the muscle or deep fascia, and mostly found in face, perineum and so on. "Septocutaneous perforator" is the one piercing between the neighboring muscles, and mostly found in extremities. "Musculocutaneous perforator", a true

perforator piercing the muscle, is the pedicle for genuine perforator flap (9). Thin perforator flaps elevated above the deep fascia have numerous advantages over traditional fasciocutaneous flaps. Their donor-site morbidity is minimized because the underlying deep fascia and nerves can be spared and muscles will not herniate. They offer thin, pliable coverage with an excellent match to the recipient defect, enhancing aesthetic outcomes and minimizing the need for secondary procedures. The optimal perforator flap is one that delivers good aesthetic and functional outcomes in a single stage, allows expedient flap elevation, does not require an intraoperative position change, promotes fracture healing, and is easily reelevated for secondary procedures (10). Hand-held Doppler device (Fig. 1) allows surgeons to identify arteries entering the skin before making any incision. In this way, a skin island can be designed over a pulsatile vessel that can then be identified and traced by retrograde dissection until a satisfactory pedicle is harvested.

As accurately described by Wallace et al., the region from which the perforator flap is harvested should be suited to the defect in terms of size, thickness, color, texture, and pliability (11). The donor region should be



Figure 1. Preoperative planning: Localization of vascular pedicles by hand-held Doppler device.

mapped for audible Doppler signals that are pulsatile, loud, and high-pitched, and can be consistently relocated by removal and replacement of the probe. The dominant cutaneous vessels with the most prominent Doppler signals should be selected as the preferred supply for the flap and marked with large red dots. Less prominent signals should be marked with smaller dots. In this way, a wide variety of types and designs of flaps are available, depending on the surgeon's creativity and ability. In vulvar reconstruction, we usually rely and harvest flaps based on superficial inferior epigastric, superficial circumflex iliac, external pudendal or gluteal perforators (Figs. 2-7).

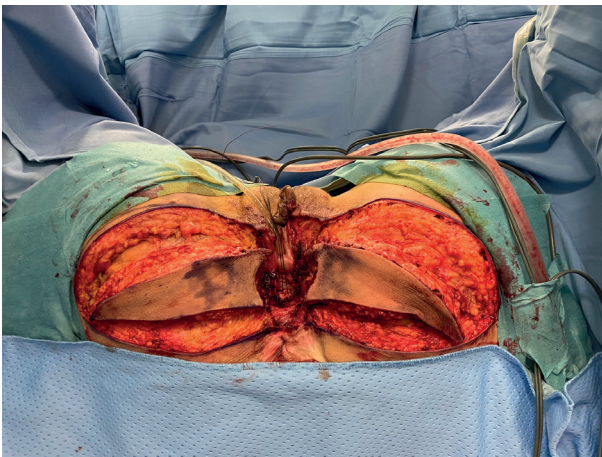


Figure 2. Bilateral vulvar squamous cell cancer in a 44-year-old patient: Bilateral vulvectomy defect with flaps' transposition.

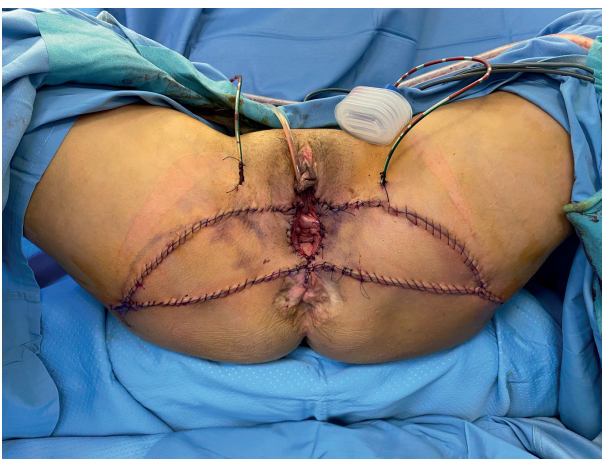


Figure 3. Immediate post-operative results.

Perforator flaps can be vascularized by direct or indirect perforators. Direct perforators only perforate the deep fascia and are therefore rather easy to dissect. In the subgroup of indirect perforators, two types of perforators



Figure 4. Result shown at one month postoperatively.

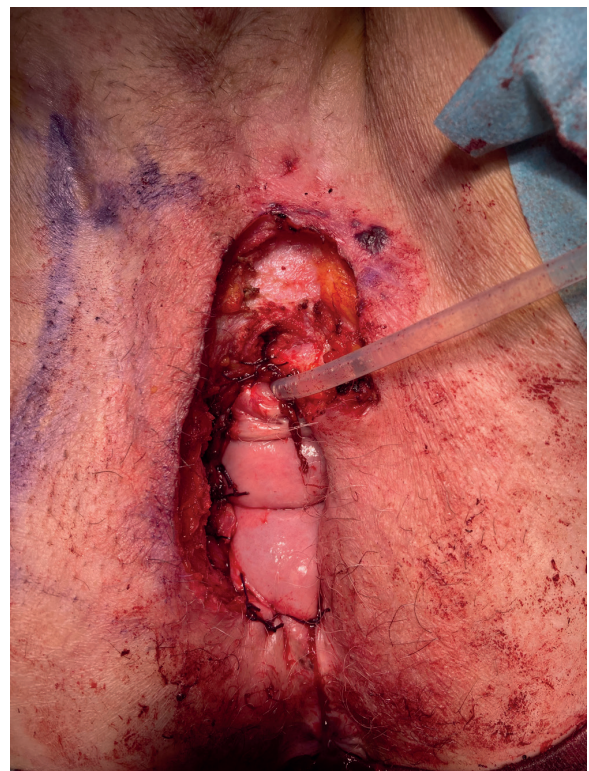


Figure 5. Moderate sized defect extends from perineal body posteriorly across the midline anteriorly, following excision anterior-central squamous carcinoma



Figure 6. The flap is incised.

need to be distinguished according to the clinical relevance: perforators that traverse muscle (transmuscular perforators, transepimysial perforators) and cutaneous side branches of muscular vessels and perforators that run through intermuscular septa. During the dissection of a muscular perforator flap, one will only take into account the size, position, and course of the perforator vessel and not whether it runs in between muscle fibers or epimysium (12). Traditionally, acceptable perforator flap donor sites have four common features: 1) predictable and consistent blood supply; 2) at least one large perforator (diameter > 0.5 mm); 3) sufficient pedicle length for the procedure; and 4) primary closure of the donor site with the absence of excessive wound tension. Indications for specific flaps are dependent on many factors including surface area and volume requirements, aesthetic appeal, patient choice, and experience of the surgeon. Common contraindications include patients who have insufficiently small perforators, have excessive scarring at the donor site, and patients who are heavy smokers (13).



Figure 7. Flap transposed and inset into defect, with donor site closed primarily.

Discussion

The goals of reconstruction include: providing quality skin cover thus minimizing scarring and distortion, restoring the vaginal introitus and vault, and maintaining the central position of the urethral meatus and preventing stenosis. Good quality reconstruction includes external cover and inner lining. External features that plastic surgeons attempt to recreate include the hair-bearing mons, symmetrical labial folds, and the ano-vaginal partition which prevented faecal passage into the vagina (14). In the striving for reaching these goals, the use of perforator flaps in reconstructive surgery is a superior surgical technique when compared to the use of conventional flaps.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Informed consent: Written informed consent was obtained from the patient concerned.

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Received: 25 February 2022

Accepted: 3 March 2022

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