



Outcomes of the use of different vulvar flaps for reconstruction during surgery for vulvar cancer



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ARTICLE INFO

Article history:

Received 12 January 2019

Received in revised form

7 April 2019

Accepted 16 April 2019

Available online 19 April 2019

ABSTRACT

Background: Vulvar carcinoma is a rare cancer, accounting for 3–5% of all gynecological cancers. Surgery is the standard treatment for patients with early stage vulvar cancer and vulvar reconstruction can be performed for these patients. The present study aimed to compare three different flap and to analyze the outcomes of vulvar surgery.

Methods: We performed a single-center retrospective study between October 2001 and December 2015. We compare patients who underwent radical surgery for vulvar cancer combined with three different vulvar flap reconstructions (GTF, gluteal thigh flap; RF, rhomboid flap; VYF, V-Y flap).

We collected data on the operating time, length of hospital stay, reoperation rate, and postoperative complications.

Results: We reviewed 179 patients who underwent radical vulvar surgery and 61 (34%) of these underwent additional reconstruction. There were no significant differences in clinical characteristics between the three groups. The median hospital stay was significantly longer for the GTF group (24 days) than RF (17 days) and than VYF (14 days) ($p = 0.002$). No significant differences were found concerning the operating time. Regarding postoperative complications, reoperation rates of 69%, 41%, and 25% were noted in the GTF, RF, and VYF group, respectively ($p = 0.04$); partial necrosis was the most common postoperative complication. The overall and recurrence-free survivals were comparable between the three groups.

Conclusion: When the defect is too large, VYF seems to be the procedure of choice for ensuring healing without a prolonged hospital stay compared to RF and GTF. Moreover, VYF was associated with a lower reoperation rate within 60 days compared to RF and GTF.

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Introduction

Vulvarcarcinoma is a rare disease, accounting for 3–5% of all gynecological cancers. The definition of vulvar cancer includes squamous cell carcinoma (SCC) and carcinoma in situ, which is also known as vulvar intraepithelial neoplasia [1]. It is predominantly the disease of elderly women with a median age of 67 years but is now becoming more common in younger women because of human papilloma virus (HPV) infection [2]. There are different

etiopathogenic pathways for the development of vulvar SCC, and one of them is HPV infection. Another pathway is lichen sclerosus (LS)-associated [3], with the risk of SCC in LS being approximately 5%, although the histopathological examination of vulvar SCCs indicates that 45%–61% occur on the background of LS [4–6].

SCC is the most frequently diagnosed vulvar cancer (90–95%), followed by melanoma, sarcoma, and basocellular carcinoma [2]. Some patients present with rare vulvar malignancies such as Paget's disease, which must also be treated by surgery [7]. Anogenital Paget disease could be also treated by neoadjuvant radiotherapy, post-operative radiotherapy or as exclusive treatment even if the level of evidences are low [8].

Vulvar cancer is staged using the American Joint Committee on Cancer TNM and the International Federation of Gynecology and

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Obstetrics staging systems [9].

Surgery is the standard treatment for patients who present with early stage vulvar cancer, and often involves the combination of radical vulvectomy with inguinal lymph node dissection by separate incisions. Currently, more individualized and less radical treatments such as wide local excision have been proposed for localized lesions. As suggested some authors, sentinel lymph node seems to be safe and accurate in patients with clinical N0 invasive vulvar cancer [10]. Also in order to decrease the risk of lymphedema, Gentileschi et al. reported a preventive approach by using a lymphatic superficial circumflex iliac vessels deep branch perforator flap. The exact mechanism is unknown but their results are interesting and suggest a potential effect for the lower limb lymphedema. A longer follow-up could confirm their findings [11].

A sentinel lymph node biopsy is also performed in pT1b and pT2 stage (<4 cm) and is used to limit wound complication or lymphedema [12]. For lateral lesions smaller than 4 cm and at more than 2 cm from the vulvar midline, an ipsilateral groin dissection is adequate treatment [13,14].

Radiotherapy can be used in the primary, adjuvant, or exclusive treatment of patients with advanced, metastatic, or inoperable disease.

When surgery involves a limited vulvar resection, the defect can be directly repaired. However, it is necessary to perform a large resection that is total or limited to the lateral and/or anterior/posterior side in some cases. Therefore, when the defect is too large, a vulvar reconstruction is necessary. Reconstructive surgery leads to good results in patients with vulvar cancer, especially for large tumors. The oncologic outcome is favorable and cosmetic results are excellent [15]. Different lengths of hospital stay and rate of complications depend on the reconstruction techniques [16], which include the V-Y flap (VYF), rhomboid flap (RF), and a myocutaneous flap with the gluteus maximus muscle (gluteal thigh flap) (GTF). These three kinds of flap can be considered to be workhorses even if some others flaps can be choose as perforator's flap or lotus flap. Some authors have implemented an algorithm, which could be a useful tool to help for flap technique selection [17]. Pedicled anterolateral thigh flap also proved to be a sure technique with a very low rate of complication [18].

The present study aimed to compare three different reconstruction techniques (VYF, RF and GTF) and to analyze the outcomes of vulvar surgery with vulvar reconstruction.

Material and methods

Study design and selection of patient

Between October 2001 and December 2015, 179 consecutive patients were surgically treated for primary or recurrent vulvar lesion in the gynecological oncology department of our center. Of these, 61 underwent radical surgery combined with flap reconstruction.

All patients who presented with vulvar cancer (SCC or other histological neoplasias) or a precancerous lesion such as intra-epithelial neoplasia, Paget's disease, or Bowen's disease were reviewed.

We divided the patients into three groups in terms of flap type (VYF, RF, and GTF). We collected data on risks factors such as diabetes, obesity, or tobacco consumption. The surgical approach was clearly described. Surgical management options included radical vulvectomy (partial or total) and superficial vulvectomy (partial or total). We determined if a flap reconstruction was performed and what kind of flap was used. We also noted if external or internal radiotherapy was performed before surgery. Data on sentinel node and/or an inguinal lymphadenectomy, tumor size, size of total

resection, margins, operating time, and length of hospital stay were collected. We also noted the postoperative complications within 60 days and the rate of reoperation.

The study was approved by an executive ethics committee that included a lead statistician. All the patients provided written informed consent at time of diagnosis.

Surgical techniques of vulvar reconstruction

V-Y flap

V-Y flap is an advancement flap fashioned in a triangular shape with the base running along the edge of the perineal defect and the apex at the level of the gluteal fold, and has been reported to be simple and safe [16]. VYFs are secure because of the large area of deep vascular supply (Fig. 1) [16].

Rhomboid flap

This cutaneous flap can be used for small vulvar defects if closure may deform the cutaneous relief. It is easy to achieve and is inspired by the lateral transposition flap. RF has all sides equal in length [19]. The advantage of this procedure is its simplicity (Fig. 2) [16].

Gluteal thigh flap

GTF is a transposition flap centered on the mid-posterior axis of the thigh. It is a secure myocutaneous flap because of its axial vascularization by the inferior gluteal artery. A large area of the mid-posterior thigh is vascularized by this artery and can be offered as a flap that is occasionally 20 cm long. The flap's pedicle runs parallel to the posterior femoral cutaneous nerve. A prospective pilot study showed that GTF can be used for the reconstruction of difficult and extensive vulvar, perineal, and vaginal defects with excellent results [20] (Fig. 3) [16].

Outcome measures

We evaluated the reoperation rate for complications, including flap dehiscence, partial or total flap necrosis, abscess, and hematoma. We also compared the length of hospital stay and the operating time between the three different flap types.

Statistical analysis

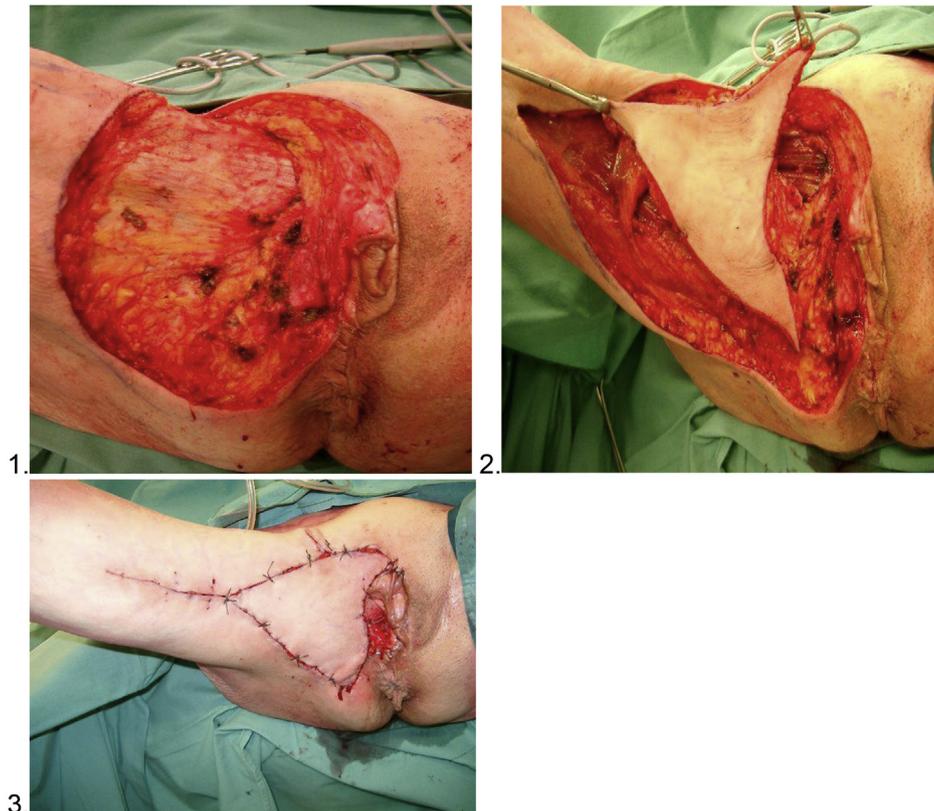
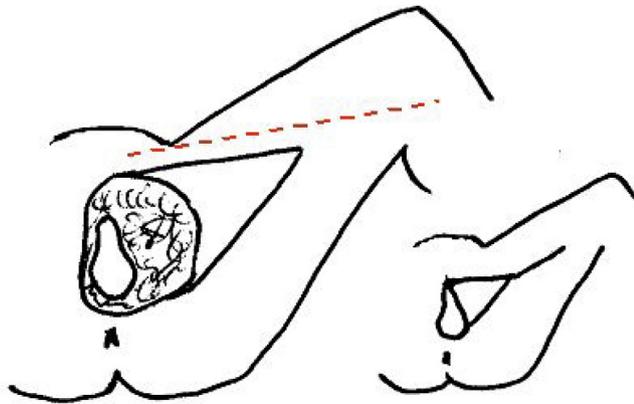
Quantitative variables are presented as mean, median, standard deviation, and ranges. Qualitative variables are presented as contingency tables with frequency and the percentage by modality. The groups were compared using the chi-squared test for postoperative complications. The length of hospital stay was compared using the Wilcoxon/Mann-Whitney test. A p-value of <0.05 was considered statistically significant. Statistical analyses were performed using Stata v13.1 (StataCorp; College Station, TX).

Results

Sixty-one patients underwent vulvar surgery combined with reconstruction. Among these patients, 16 received VYF, 29 RF, and 16 GTF. The patients' characteristics are detailed in Table 1. There were no significant differences in clinical characteristics (age, histological type, FIGO stage) between the three groups, including previous radiation, obesity, tobacco consumption, and diabetes.

The median age of the patients was 64.2, 64.6, and 63.2 years in the GTF, RF, and VYF group, respectively. The most frequent histological type was SCC. Regarding lesions at <FIGO II and ≥FIGO II, there were no significant differences between the three groups.

The perioperative data are detailed in Table 2. No statistical



1. Vulvar resection. 2. Triangular flap is lifted. 3. The flap is attached to the internal margin and the wounds are sutured filling the defect without tension.

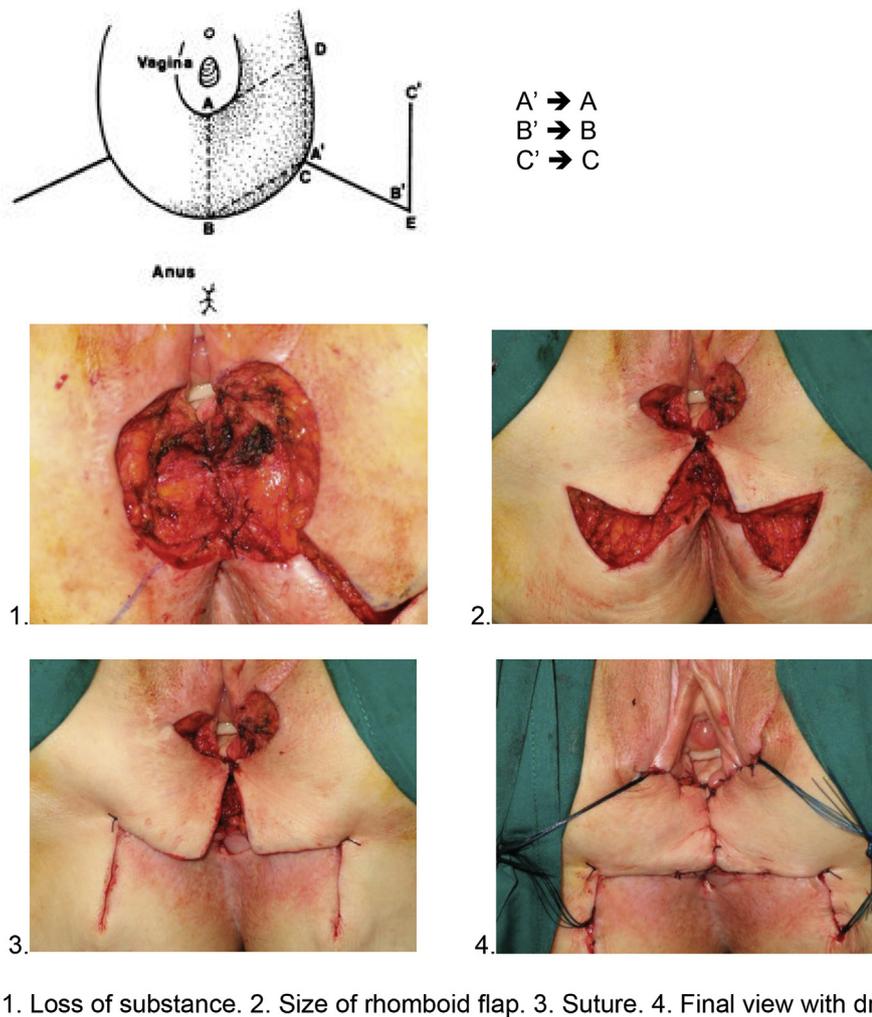
Fig. 1. V-Y flap (Leblanc et al., EMC 2007).

significant difference was found between the three groups in terms of tumor size and thickness. However, the total resection size tended to be larger with GTF (median 120 mm) than with RF (median 85 mm) and VYF (median 80 mm) ($p = 0.08$). There were no statistical differences in term of positive margins between the different groups (0% in GTF, 7% in RF and 6% in VYF group).

There were no significant differences in operating time between the three flap types, although GTF tended to have a longer operating time (median 230 min, range 120–600) compared to RF (median 200 min, range 90–360) and VYF (median 165 min, range

60–480) ($p = 0.1$). The median hospital stay was significantly longer for GTF (24 days, range 10–52) than for RF (17 days, range 9–38) and VYF (14 days, range 3–34) ($p = 0.002$). The length of hospital stay also differed between RF and VYF but with a no statistically significant p -value of 0.05.

After a median follow-up time of 88.8 months (range 50.4–117.6), the reoperation rate due to postoperative complications were 69%, 41%, and 25% in the GTF, RF, and VYF group, respectively ($p = 0.04$). The partial necrosis rate was 38%, 10%, and 0%, respectively ($p = 0.007$). However, the differences in these



1. Loss of substance. 2. Size of rhomboid flap. 3. Suture. 4. Final view with drainage

Fig. 2. Rhomboid flap (from Leblanc et al., EMC 2007).

parameters were not significant, comparing the RF and VYF group ($p = 0.3$ for reoperation rate and $p = 0.5$ for rate of partial necrosis). These findings are summarized in Table 3.

The overall and recurrence-free survivals (RFS) were similar for all groups. After a median follow-up of 7.4 years, the 2-year overall survival rate was 75% for GTF, 85.7% for RF, and 87.5% for VYF ($p = 0.3$). The 2-year RFS rate (median RFS, range) was 62.5% (2.7 years, 0.9–8.7) for GTF, 75.9% (4.8 years, range 3.6–6.4) for RF, and 74.5% (4.4 years, range 1.4–12.8) for VYF ($p = 0.9$).

The 3 and 5-year overall survival rate was respectively comparable (62.5%) for GTF, 77.9% and 72.7% for RF and comparable (87.5%) for VYF.

Discussion

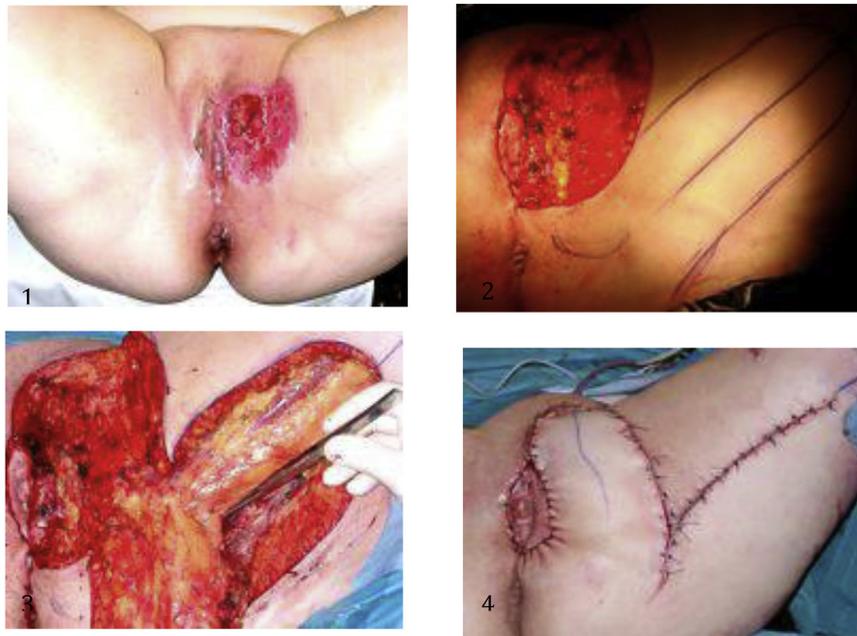
Surgery for vulvar cancer is challenging on two fronts; first, with regard to local disease control and second, concerning the severe anatomic distortion, large tissue resection, and difficulty of healing that may result. Therefore, if wide excision is necessary, it must be followed by the surgical reconstruction of vulvar defects, which could aid closure. Our study compared the postoperative outcomes of patients treated for vulvar cancer with vulvar reconstruction using three different flap types. Although several authors have reported their outcomes with different flap types, this report, to our knowledge, is the first to compare vulvar reconstruction using

three different flap techniques.

In our study, 34% of patients (61/179) had a flap reconstruction. This rate seems a little high but in our region, most of patients have a locally advanced lesion required large resection. Because of lacking of gynecologist, the diagnosis is unfortunately done late. Moreover, to decrease the risk of local recurrence, the macroscopic margins must be at least 1 cm. Heaps et al. showed a 50% local recurrence rate in patients with histopathological margins of less than 8 mm [21]. Some authors showed no patient with tumor-free margins of >8 mm developed a local recurrence, while 22.5% with at least one tumor-free margin ≤ 8 mm developed local recurrences ($p = 0.002$) [22]. Moreover, this study showed that in 50% of the patients the histological tumor-free margins were ≤ 8 mm in spite of intentional macroscopic margins of 1 cm. Based on these studies, de Hullu et al. advised local excision with an intentional surgical margins of 2 cm [23].

In the current study, we found that the reoperation rate within 60 days was significantly higher in patients that underwent GTF, although the risk factors were comparable between the three groups. Moreover, the length of hospital stay was longer for GTF and RF compared to VYF, although the tumor size and total resection were comparable between the three flap techniques. The reoperation rate for positive margins was similar for all groups.

Age, body mass index (BMI), diabetes mellitus, or previous radiotherapy can delay wound healing. For this reason, surgical



1. Aspect of the vulvar lesion. 2. Left vulvectomy and landmarks of GTF. 3. Flap size and tracking of gluteal thigh. 4. Final view

Fig. 3. Gluteal thigh flap (Leblanc et al., EMC, 2007).

Table 1

Clinical characteristics of the patients who underwent a radical vulvar surgery combined with a vulvar reconstruction by different flap type.

Characteristics	Gluteal thigh flap		Rhomboid flap		V-Y flap		Total		p-value
	N = 16		N = 29		N = 16		N = 61		
Age at diagnosis (years)									
Median (Range)	64.2 (36.2–82.2)		64.6 (25.8–87.5)		63.2 (32.6–83.6)		64.6 (25.8–87.5)		0.4
Histology: n, %									
Squamous	14	88%	28	97%	13	81%	55	90%	
Others	2	13%	1	3%	3	19%	6	10%	
FIGO Stage									
<II	5	31%	10	36%	7	44%	22	37%	0.8
≥II	11	69%	18	64%	9	56%	38	63%	
in situ			1						

Table 2

Perioperative data of the patients who underwent a radical vulvar surgery combined with a vulvar reconstruction by different flap type.

Perioperative data	Gluteal thigh flap		Rhomboid flap		V-Y flap		Total		p-value
	N = 16		N = 29		N = 16		N = 61		
Tumor size (mm)									
Median (Range)	57.5 (15–120)		40 (3–110)		40 (0.6–105)		45 (0.6–120)		0.2
Total resection size (mm)									
Median (Range)	120 (50–160)		85 (44–250)		80 (35–125)		90 (35–250)		0.08
Operating time (minutes)									
Median (Range)	230 (120–600)		200 (90–360)		165 (60–480)		165 (60–480)		0.1
Length of hospital stay (days)									
Median (Range)	24 (10–52)		17 (9–38)		14 (3–34)		18 (3–52)		0.002* 0.05**

*p-value between the three groups.

**p-value between the rhomboid and V-Y flap groups.

reconstruction of vulvar defects after a wide excision can be used to restore the anatomy without excessive wound tension, although comorbidities have to be identified early in candidates for vulvar reconstruction [24]. Reconstruction surgery is frequently used to prevent failure to heal after pelvi-perineal radiotherapy.

As Benedetti et al. showed, the use of VYF decreased the median postoperative hospital stay [16]. In the current study, the GTF, RF, and VYF groups demonstrated median postoperative hospital stays of 24, 17, and 14 days, respectively, and these values were comparable with reports from the literature. Moreover, the length of

Table 3

Postoperative complications of the patients who underwent a radical vulvar surgery combined with a vulvar reconstruction by different flaps.

Postoperative complications	Gluteal thigh flap		Rhomboid flap		V-Y flap		Total		p-value
	N = 16		N = 29		N = 16		N = 61		
Reoperation in less than 60 days: n, %	11	69%	12	41%	4	25%	27	44%	0.04* 0.3**
Scar dehiscence: n, %	5	31%	11	38%	2	13%	18	30%	0.2
Abscess: n, %	2	13%	1	4%	2	13%	5	8%	0.5
Partial necrosis: n, %	6	38%	3	10%	0	0%	9	15%	0.007* 0.5**

*p-value between the three groups.

**p-value between the rhomboid and V-Y flap groups.

hospital stay was significantly shorter for the VYF group than for the RF group.

Our results revealed no significant differences in tumor size between the three groups. Postoperative complications were more frequently found with GTF than with RF and VYF. This result is highlighted with respect to partial necrosis, which demonstrated significant differences between the three groups. Reoperation rates were higher for the GTF group than for the two other groups, and there was no significant differences between the RF and VYF groups. Thus, VYF and RF can be considered safer techniques than GTF. Moreover, VYF reduced the postoperative hospital stay which can be associated with reduced hospital costs. Concerning overall survival and RFS, no significant differences were found between the three groups.

Among the fasciocutaneous flaps in the literature, the most commonly used for reconstruction is VYF, which incorporates some technical advantages such as wide mobility and high vascularization [25]. In our opinion, VYF is safe and simple with a lower rate of complications compared to the two others flaps. Regardless of the amount of tissue loss, VYF can be used in a single surgery session. According to Gentileschi et al. when the defect is solely vulvar and if skin laxity is absent (no obesity, old age), a perforator based V-Y flap from the inner thigh is performed. It allows more mobility. To help us in decision for flap type, we can refer to their proposed algorithm [17].

Concerning medical risk factors, BMI is a major risk factor for wound healing. BMI > 30 kg/m² is associated with chronic systemic inflammation that could contribute to the development of complications [26]. Obesity is characterized by a pro-inflammatory condition in which hypertrophied adipose tissue along with immune cells contribute to increase the level of pro-inflammatory cytokines [27]. Moreover, obesity is associated with an increased risk of vulvar cancer at older ages [28].

Considering these findings, VYF is advantageous for vulvar reconstruction. This advantage could be explained by the maintenance of proprioceptive and protopathic sensitivity. The nerve supply guarantees acceptable sensation at the reconstructed area [29].

Although this study is limited by its non-randomized design and small sample size, our findings suggest that radical vulvar surgery should be combined with VYF as it is more advantageous compared to GTF and RF. Therefore we adapted our surgical technique and we performed a VYF when a flap is necessary following a vulvar surgery.

Conclusions

VYF is a simple procedure compared to GTF and RF and seems safe and cost-effective because of the reduced operating time and hospital stay. We suggest that it could be considered as choice

technique for vulvar reconstruction and it can be employed even in the case of wide defects after the resection of a large vulvar lesion.

Conflict of interest statement

All authors declare no conflict of interest.

Author contribution section

FN encouraged ST to investigate and supervised the findings of this work.

JW performed the statistical analysis and reviewed this section of manuscript.

MB and ST collected the patient's data.

JW and FN helped in interpreting the results and worked on the manuscript.

ST wrote the manuscript with support from FN, EL and LG.

FN, EL, DH and LG helped supervise the project.

FN, EL and DH underwent the vulvar surgery.

All authors discussed the results and contributed to the final manuscript.

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