

# Comparison of V-Y Advancement Flap Versus Lotus Petal Flap for Plastic Reconstruction After Surgery in Case of Vulvar Malignancies

## *A Retrospective Single Center Experience*

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**Abstract:** Vulvoperineal defects after demolitive surgery for preneoplastic or malignant vulvar lesions require a reconstruction to restore good sexual functions and to offer a satisfactory cosmetic result. Several techniques of reconstruction have been described in the past, leading to a more conservative and localized treatment. This study retrospectively reviewed patients with primary or recurrent vulvar malignancies that had undergone vulvoperineal reconstruction between 2010 and 2016 using the V-Y advancement flap and the 2 variant of the lotus petal flap (LPF) in terms of surgical outcome and postoperative complications. Two hundred eighty-four (284) women were reviewed, 234 of them having undergone V-Y flap and 128, the LPF. Overall, postoperative complications occurred in 21.5% of patients including 21% (27/128) of the V-Y group and in 13% (14/106) of the LPF group. The 2 techniques are valid and feasible for vulvar reconstruction in case of moderate defects. No statistically significant differences in terms of complications were observed between the 2 groups overall ( $P = 0.588$ ), or by comparing the primary ( $P = 0.202$ ) or the recurrent setting ( $P = 0.281$ ). Lotus petal flap, particularly the tunneled variant, was superior to V-Y advancement flap in terms of functional and cosmetic results in patients undergoing resection for primary vulvar malignancies.

**Key Words:** vulvar malignancies, plastic reconstructive surgery, V-Y advancement flap, lotus petal flap

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Vulvar carcinoma is a relatively rare malignancy accounting for 3% to 5% of all gynecological malignancies. This is a disease found mostly in elderly women, with the median age of 65 to 70 years at the time of diagnosis.<sup>1,2</sup> The type of surgical treatment depends primarily on the tumor stage.

Since the 1980s, en bloc radical vulvectomy with bilateral groin dissection has been replaced by the triple incision technique that allowed for a more conservative surgery. Notwithstanding, when radical surgery is required, the multidisciplinary approach of a dedicated surgical team is required for the treatment of such a tumor to plan an adequate morphological and functional reconstruction before the demolitive surgery.

The most recent evolution of the reconstructive techniques, including the V-Y gluteal fold flaps, the tensor fascia lata flaps, and lotus petal flaps (LPFs), has led to a reduction of surgical complications, allows for normal sexual function, and guarantees an adequate quality of life.<sup>3–6</sup>

This study compared 2 reconstructive techniques, V-Y versus LPFs in terms of perioperative wound complications after demolitive surgery in case of vulvar malignancies.

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## PATIENTS AND METHODS

### Selection of Patient Population

From 2000 to date, 284 women were operated on for primary or recurrent vulvar malignancies in our Department of Obstetrics and Gynecology (see Fig. 1). In this retrospective study, 234 patients that had undergone a vulvar reconstruction with either V-Y flap or LPF were reviewed. One hundred twenty-eight patients underwent V-Y advancement flap reconstruction, whereas 106 patients underwent LPF (58) or its tunneled variant (48). Moreover, some patients may have undergone multiple plastic reconstructions that sometimes included both techniques.

A team approach involved both gynecology oncologists and plastic surgeons during all surgeries. All women signed an approved informed consent before surgery.

### Surgical techniques

#### V-Y Advancement Flap

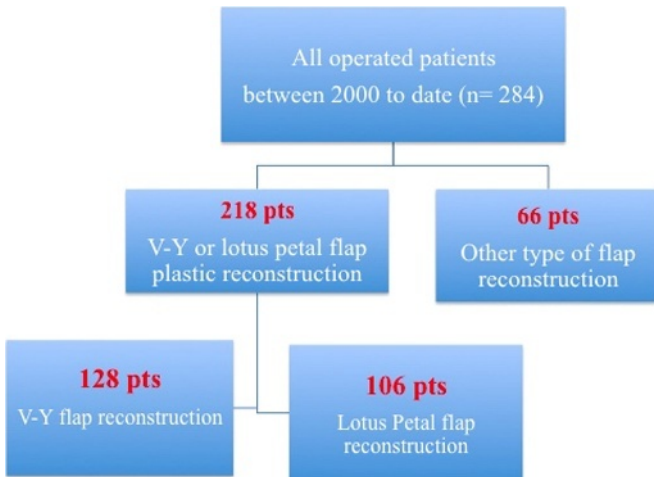
This flap was used by Essen as far back as 1917 and, from his introduction, has been largely redefined and adopted.<sup>8–10</sup> The V-Y flap presents a dermal-hypodermic pedicle, which guarantees the survival of the flap through the vascular supply from the depths. It draws on the skin surface of the same size as the adjacent loss of tissue to be filled in. The skin is incised perpendicularly through the whole thickness up to the muscle fascia, along the contour of the figure drawn. The results are a prism or a cylinder with a hypodermic stalk connected in depth. The V-Y advancement flap is then elevated to the margin of the defect with no tension. The donor area is sutured with interrupted sutures with a V or Y suture line with a 3-0 and 4-0 Vicryl suture, and therefore, there is minimal scarring (Fig. 2).

#### Lotus Petal Flap

The LPF is based on the dense network of perforating vessels near the midline of the perineum. After the selection of the appropriate flap and ensuring that the flap is of adequate length and size, an incision is made on 1 side of the flap down to the fascia preserving the perforators entering the base of the flap. The flap is then raised and includes the fascia. The modified LPF differs from Yii and Niranjani's LPF,<sup>11</sup> because it is based on random vascularization of this region, since no attempt is made to identify and preserve perforators and it does not include the deep fascial layer (Fig. 3). The flap edges are incised, and the distal part rose to the level of superficial subcutaneous fat. As more of the flap is raised, the thickness of the flap steadily increases, so, as its base is approached, the depth of the flap is in the deep subcutaneous tissue. The flap is then islanded on its base.<sup>12–15</sup>

#### Tunneled Variant of LPF

The flaps were designed after considering the vulvoperineal resection, based on the extent of the cutaneous defect, as previously described.<sup>13</sup> Tunneled LPF can be easily elevated by blunt dissection through the deeper tissue. First of all, the dissection of the flap should



**FIGURE 1.** Progress of patients through the study. Data adapted from the CONSORT statement.<sup>7</sup>

not be perpendicular to the skin incision, but it should lean towards the fascia beneath. The sculpted subcutaneous pedicle, on which the rotation and translation of the flap is based, should be performed from lateral to medial and from superficial to deeper, toward the defect area, thus, preserving the blood supply and avoiding an excessive strain on the flap (Fig. 4). The width has to be sufficient to allow the flap to be inset without compression of the pedicle. Approximation of the mucosal layer is performed using a 3.0 Vicryl suture (polyglycolic 910).

### Outcome Measures

The primary endpoint measures were perioperative complications, including cellulitis (clinically diffuse inflammation of dermal and subcutaneous layers of the skin that is red, warm to the touch, swollen, and painful), wound infection (purulent drainage from the superficial incision, organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision), flap dehiscence, and partial or total flap ischemia or necrosis.

### Statistics

Absolute and percentage frequencies were used to describe categorical items, whereas median values and ranges were assessed for continuous variables. For the analysis of the surgical complications, each



**FIGURE 2.** V-Y gluteal fold flap.



**FIGURE 3.** Standard modified LPF.

harvested flap was calculated as a unit. Stata software 9.0 (Stata Corporation, College Station, Tex) was used for performing the statistical analysis. All calculated *P* values were 2-sided, and *P* values less than 0.05 were considered statistically significant.

### RESULTS

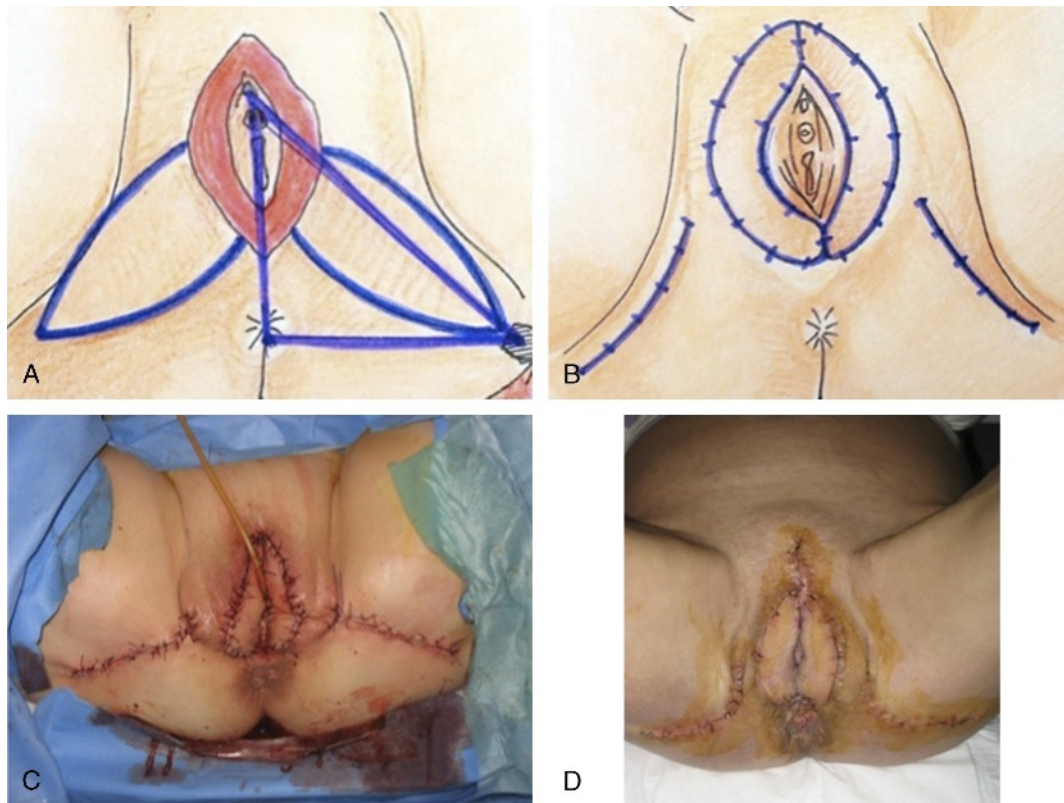
General characteristics of our study population are listed in Table 1. The median age was 68.8 years (range, 40–89 years) and 68.6 years (range, 43–90 years) for V-Y and LPF group. The median body mass index was 26.9 kg/m<sup>2</sup> (range, 19–45 kg/m<sup>2</sup>) and 28.1 kg/m<sup>2</sup> (range, 15–47 kg/m<sup>2</sup>) for V-Y and LPF groups, respectively (*P* = 0.18). There was no significant difference in relevant comorbidity between the groups (*P* = 0.991).

In 72% of the V-Y flap and in 78% of the LPF patients, a radical vulvectomy was performed during the primary surgery. On final pathology, patients with a nodal involvement were 15.6% and 17% in V-Y and LPF group, respectively (*P* = 0.458). Surgical margins less than 8 mm from resection were 22.7% in V-Y group and 23.6% in the LPF group (*P* = 0.494).

Overall, 365 flaps were harvested (214: 59% V-Y; 151: 41% LPF). Two hundred sixty-two flaps were bilateral (47% V-Y; 24% LPF), whereas 103 flaps were monolateral (11% V-Y; 17% LPF). This difference was statistically significant between the groups (*P* < 0.0001).

### Complications and Recurrence

The average length of follow-up was 84 months (range, 6–180 months). After surgery, the patients were kept in bed with protection to reduce the pressure on the wound site for 3 days. The transitional discomfort in sitting was well tolerated and quickly resolved within 1 month after healing. All patients were allowed to sit after 3 weeks after surgery. Table 2 shows the complication recorded in the study. The complications recorded were wound infection, flap dehiscence, and local flap ischemia or necrosis. This occurred in 21.5% of patients



**FIGURE 4.** Bilateral tunneled LPF. Flap project (A); bilateral tunneled LPF after elevation (B); *in vivo* bilateral tunneled LPF (C); appearance of reconstruction 1 month after surgery (D).

**TABLE 1.** Baseline and Clinical Information's of All Patients (N = 234)

	V-Y Group (N = 128)		LPF Group (N = 106)		P
	N	%	N	%	
Mean age, y	68.8 (range, 40–89)		68.6 (range, 43–90)		0.91
Mean BMI, kg/m <sup>2</sup>	26.9 (range, 19–45)		28.1 (range, 15–47)		0.18
Comorbidity					
Diabetes	16	19.3	56.6	18.8	0.991
Hypertension	47	2.4	2.7	58.8	
Previous tumor	2	15	47	2.5	
Others	18	2	16	20.0	
Histology					
Squamous cell	95	74.2	84	79.3	0.060
Carcinoma	3	2.3	—	0	
Melanoma	7	5.5	3	2.8	
Paget disease	6	4.7	10	9.4	
VIN II-III	17	13.3	7	6.6	
Others	—	0	2	1.9	
Primary surgery	92	71.9	78	73	0.443
Recurrent disease					
Free margin <8 mm					
Positive inguinal LNs					
Flap type					
Bilateral flap	86	67.2	45	42.5	<0.0001
Unilateral	42	32.8	61	57.6	
Previous radiation	10	7.8	10	9.4	0.416

VIN, vulvar intraepithelial neoplasia; LNs, lymph nodes.



**TABLE 2.** Surgical Flap's Complications by Flaps (N = 365)

	V-Y Flap (128 pts)				LPF Standard (58 pts)				Tunneled LPF (48 pts)			
	Primary (149 flap)		Recurrence (65 flap)		Primary (53 flap)		Recurrence (17 flap)		Primary (60 flap)		Recurrence (21 flap)	
	N	%	N	%	N	%	N	%	N	%	N	%
Infection	4	2.7	1	1.5	—	—	2	3.3	—	—	—	—
Flap dehiscence	11	7.4	2	3.1	2	3.8	2	11.8	2	3.3	1	4.8
Partial or total flap ischemia/necrosis	8	5.4	1	1.5	2	3.8	1	5.9	1	1.7	1	4.8
Total	23	15.4	4	6.1	4	7.5	3	17.6	5	8.3	2	9.5

Note: The statistical comparison was evaluated using the Fisher exact test for these groups of complications: (a) Overall: V-Y (27/214) vs LPF Standard (7/70) vs Tunneled LPF (7/81), *P* = 0.59; (b) subgroups "Primary": V-Y (23/149) vs LPF Standard (4/53) vs Tunneled LPF (5/60), *P* = 0.20; (c) subgroups "Recurrence": V-Y (4/65) vs LPF Standard (3/17) vs Tunneled LPF (2/21), *P* = 0.28.

including 21% (27/128) of the V-Y group and in 13% (14/106) of the LPF group (*P* = 0.59). Table 2 displays the postoperative complications recorded at primary surgery or at recurrence. Flap techniques were divided in 3 groups: V-Y flap, LPF standard, and LPF tunneled. Site of recurrence is listed in Table 3. Even if the statistical power was very low, considering the small amount of complications and recurrences that occurred in this study population, no statistically significant difference was found between the groups overall or when comparing the primary and the recurrent setting. Moreover, no statistically significant differences were recorded in terms of site of recurrence between the 2 groups (*P* = 0.97).

**DISCUSSION**

Vulvar cancer is a rare gynecological malignancy, and its frequency is higher in elderly women. Since Horton et al<sup>16</sup> described the first concept of flap design in the vulvoperineal region, many types of skin flaps have been reported in the literature.

In this retrospective study, we compared the V-Y flap with both variant of the LPF (standard and tunneled) in terms of perioperative complications.

In our institution, the LPF and its tunneled variant represent the preferred techniques in the reconstruction of the vulvoperineal area after radical vulvectomy or tumorectomy, in the case of vulvar malignancies with small to medium defect of the vulvoperineal area. However, when the defect created after the intervention of excision of the tumor is very large, the petal flap cannot be performed and the surgeon will have to choose another type of flap. Generally, to reconstruct very large defects, a myocutaneous flap could be adequate, although it presents

many major limitations. Otherwise, in all cases in which it is possible to use, we use the LPF.<sup>13,14</sup>

In our experience, the LPF is safe, easy to elevate, fast to perform, and has many advantages compared with other reconstructive methods. The V-Y fasciocutaneous flap and rhomboid transposition flap may heal with scar retraction in the donor site and limited aesthetics when compared with the modified LPF.

Among the fasciocutaneous flaps, the most commonly used for the reconstruction of the vulva are the V-Y flaps,<sup>4,7-10</sup> which incorporate some technical advantages such as wide mobility and high vascularization. V-Y advancement flaps can be harvested from the pubic region, from the gluteal fold, or from the medial thigh, allowing for the closure of the lesion with vascularized local tissues, whereas the donor site can be closed by suturing the skin margins, resulting in a scar that can be hidden in the gluteal fold. The V-Y flap in fact certainly does not have very satisfactory cosmetic results, but it does not present major postoperative complications or negative impact on the quality of life of women in the immediate postoperative or long-term follow-up.

To date, no comparative studies between the 2 techniques have been already published. However, many retrospective experiences are available. In particular, when a V-Y advancement flap is performed, the complication rates reported range from 0% to 28%,<sup>10</sup> whereas, when LPF is performed, complication rates range from 10% to 45%.<sup>15</sup> The complication rate reported for both type of reconstructive technique in our series seems to be similar with the literature for both types of reconstructive techniques.

Both techniques were feasible and adequate for vulvar reconstruction. The incidence of postoperative complications shows no statistically significant differences between the 2 groups. However, in the

**TABLE 3.** Site of Recurrence in Relation to the Technique of Reconstruction (n = 55)

	V-Y Flap (37 pts)				LPF Standard (11 pts)				Tunneled LPF (6 pts)			
	Primary		Recurrence		Primary		Recurrence		Primary		Recurrence	
	N	%	N	%	N	%	N	%	N	%	N	%
Ex vulvar region	10	38.5	2	18.2	2	25.0	1	33.3	1	25.0	1	50.0
Vaginal/urethral	4	15.4	1	9.1	1	12.5	1	33.3	—	—	—	—
Perineum	4	15.4	2	18.2	3	37.5	—	—	2	50.0	—	—
Inguinal	4	15.4	1	9.1	1	12.5	—	—	1	25.0	—	—
Distant	4	15.4	5	45.5	1	12.5	1	33.3	—	—	1	50.0

Note: The statistical comparison was evaluated using the Fisher exact test for these groups of site of recurrence. (a) Overall: V-Y (37) vs LPF Standard (11) vs Tunneled LPF (6), *P* = 0.97; (b) subgroups Primary: V-Y (26) vs LPF Standard (8) vs Tunneled LPF (4), *P* = 0.87; (c) subgroups Recurrence: V-Y (11) vs LPF Standard (3) vs Tunneled LPF (2), *P* = 0.97.



**FIGURE 5.** Some examples of LPF healing 6 months after surgery.

setting case of recurrent disease, careful attention of the patients' surgical and clinical history is recommended before the surgical approach and the flap type selection, to reduce the associated morbidity.

In our opinion, a few advantages of the LPFs versus the V-Y advancement flap can be identified: (1) a better anatomical and aesthetic appearance of the reconstructed vulvar region. This is particularly true when the tunneled variant of the LPF can be applied for the correction of the anatomic defect. In the latter case, the presence of the cutaneous bridge allows to faithfully reproduce the normal appearance of the normal external genitalia, in terms of firmness and consistency as well (Fig. 5). This is particularly important when surgery is performed in young patients or in case of inadequate primary closure.<sup>17</sup> Moreover, the scars are easily concealed along the gluteal fold and genito femoral sulcus, thus, limiting their visibility once the healing is completed. (2) In the tunneled variant because of the presence of the cutaneous bridge, the donor tissue used to harvest the flap is not strictly close to the margin of the primary tumor<sup>13</sup>; hence, in the case of recurrence, the tumor can be identified earlier and easier because it has a lower risk to grow hidden towards and within the vaginal introitus. (3) From a functional standpoint, the LPF allows easier pelvic exploration during the follow-up period. (4) Finally, sexual intercourse is still possible or not completely abolished in the sexually active women.

The strengths of this study are the large sample size, the consecutive series of patients included from 1 center, and the same multidisciplinary team involved. However, it has some limitations. First of all is the retrospective design of the study. Even if the rate of complications is low for both techniques and is similar to other reported series in the same field of application, the possibility of a selection bias cannot be completely excluded, particularly during the “learning curve” at the beginning of our experience with LPF. Notwithstanding, this attention in the selection of patients allowed us to better evaluate the feasibility of the new flap in both its variants to identify the subgroup of women that can safely undergo a procedure or another. Finally, we observed a greater number of women with a normal sexual activity in the LPF

group, but we were unable to assess the patient's satisfaction regarding this issue because the sexual function was not recorded through a validated questionnaire in this study.

## CONCLUSIONS

In conclusion, both the V-Y flap and the LPF represent 2 valid and versatile techniques for vulvoperineal reconstruction after surgery for primary or recurrent vulvar malignancies. In this retrospective study, there were no differences in complications using these 2 flaps, and the associated rates of complications are reasonable for both procedures. A careful selection of patients, tissue type, size of the loss of tissue, technical elevation of the flaps, attention to the preservation of the pedicle, and the careful attention with which the surgeon handles the tissue are the basis for the success of both reconstructive techniques.

To date, in our department, the LPF represents the treatment of choice for vulvar reconstruction, because, in our opinion, it produces the best aesthetic and functional results obtained so far.

Additional studies on functionality and patient satisfaction are needed to evaluate the impact of these reconstructive techniques on the quality of life of women.

## REFERENCES

1. Saraiya M, Watson M, Wu X, et al. Incidence of in situ and invasive vulvar cancer in the US, 1998–2003. *Cancer*. 2008;113:2865–2872.
2. Beller U, Quinn MA, Benedet JL, et al. Carcinoma of the vulva. FIGO 26th Annual Report on the Results of Treatment in Gynecological Cancer. *Int J Gynaecol Obstet*. 2006;95(suppl 1):S7–S27.
3. Hashimoto I, Nakanishi H, Nagae H, et al. The gluteal-fold flap for vulvar and buttock reconstruction: anatomic study and adjustment of flap volume. *Plast Reconstr Surg*. 2001;108:1998–2005.
4. Staiano JJ, Wong L, Butler J, et al. Flap reconstruction following gynaecological tumour resection for advanced and recurrent disease—a 12 year experience. *J Plast Reconstr Aesthet Surg*. 2009;62:346–351.

5. Sawada M, Kimata Y, Kasamatsu T, et al. Versatile lotus petal flap for vulvoperineal reconstruction after gynecological ablative surgery. *Gynecol Oncol*. 2004;95:330–335.
6. Lee JH, Shin JW, Kim SW, et al. Modified gluteal fold V-Y advancement flap for vulvovaginal reconstruction. *Ann Plast Surg*. 2013;71:571–574.
7. Begg C, Cho M, Eastwood S, et al. Improving the quality of reporting of randomized controlled trials: The CONSORT statement. *JAMA*. 1996;276:637–639.
8. Persichetti P, Simone P, Berloco M, et al. Vulvo-perineal reconstruction: medial thigh septo-fascio-cutaneous island flap. *Ann Plast Surg*. 2003;50:85–89.
9. Lee PK, Choi MS, Ahn ST, et al. Gluteal fold V-Y advancement flap for vulvar and vaginal reconstruction: a new flap. *Plast Reconstr Surg*. 2006;118:401–406.
10. Benedetti Panici P, Di Donato V, Bracchi C, et al. Modified gluteal fold advancement V-Y flap for vulvar reconstruction after surgery for vulvar malignancies. *Gynecol Oncol*. 2014;132:125–129.
11. Yii NW, Niranjan NS. Lotus petal flaps in vulvo-vaginal reconstruction. *Br J Plast Surg*. 1996;49:547–554.
12. Warriar SK, Kimble FW, Blomfield P. Refinements in the lotus petal flap repair of the vulvo-perineum. *ANZ J Surg*. 2004;74:684–688.
13. Buda A, Confalonieri PL, Rovati LC, et al. Better anatomical and cosmetic results using tunneled lotus petal flap for plastic reconstruction after demolitive surgery for vulvar malignancy. *Int J Gynecol Cancer*. 2012;22:860–864.
14. Misani M, Rovati LC, Confalonieri P, et al. Modified lotus petal flap for vulvo-vaginal reconstruction after resection for vulvar cancer—a single Institution experience. *Handchir Mikrochir Plast Chir*. 2011;43:250–254.
15. Argenta PA, Lindsay R, Aldridge RB, et al. Vulvar reconstruction using the “lotus petal” fascio-cutaneous flap. *Gynecol Oncol*. 2013;131:726–729.
16. Horton CE, Adamson JE, Mladick RA, et al. Flaps of the genital area. In: Horton CE, ed. *Plastic and Reconstructive Surgery of the Genital Area*. Boston: Little, Brown; 1973.
17. Buda A, Confalonieri PL, Rovati LC, et al. Tunneled modified lotus petal flap for surgical reconstruction of severe introital stenosis after radical vulvectomy. *Int J Surg Case Rep*. 2012;3:299–301.