OPEN
PRS GLOBAL OPEN
CASE REPORT
Reconstructive

Vulvar Reconstruction with Keystone Flaps after Radical Vulvectomy

Germán Páez López, MD*
Sofia Martínez Gil, MD†
Andreina Zannin Ferrero, MD‡
Daniel Ramos Hernández, MD†
Lina M. Caicedo Páez, MD*

Summary: Vulvar cancer is a rare oncologic pathology, accounting for only 3%–5% of all gynecologic neoplasms, with squamous cell carcinoma responsible for more than 90% of these cases; the remaining 10% includes Paget disease, lichen sclerosus, and vulvar melanoma. Radical vulvectomy has become the gold standard treatment due to the high recurrence rate and effective local control in patients with squamous cell carcinoma stages IB to IVA. To address these needs, various reconstructive options have been reported in the literature, each potentially offering different results due to their diverse nature. We present a series of patients who underwent vulvar reconstruction with the keystone flap, describing the surgical technique, complication rate, advantages over other techniques, and long-term follow-up. *(Plast Reconstr Surg Glob Open 2024; 12:e5965; doi: 10.1097/GOX.0000000000005965; Published online 10 July 2024.)*

Vulvar cancer is a rare oncologic pathology, accounting for only 3%–5% of all gynecologic neoplasms, with squamous cell carcinoma being responsible for more than 90% of these cases.[1] In Colombia, 447 cases were reported in 2020 with a mortality rate of 0.24%, according to Globocan data,[2] resulting in 134 deaths due to this pathology, equivalent to 0.24% of deaths caused by oncologic pathologies. Furthermore, data indicate that this pathology not only entails high morbidity in patients but also significant mortality.[2]

Radical vulvectomy has become the gold standard treatment due to the high recurrence rate and effective local control in patients with vulvar cancer.[1–3] However, it poses a great challenge for plastic surgeons, as it can lead to anatomical and functional distortion, affecting activities of daily living. Additionally, it may result in postoperative complications such as infection of the operative site, wound dehiscence, urinary incontinence, vaginal prolapse, stenosis of the vaginal introitus, and sexual dysfunction, among others.[4]

To address these challenges, various reconstructive options have been reported in the literature, each potentially offering different results due to their diverse nature. Therefore, this article will mention the different reconstructive options described in the literature, along with their complication rates and long-term results. Furthermore, based on the compilation of epidemiological data and a series of cases, keystone flaps will be considered a great option for reconstructing vulvar defects after radical vulvectomies.

*From *Clínica Universitaria Colombia, Bogotá, Colombia; †Universidad El Bosque, Bogotá, Colombia; and ‡Eternal Beauty S. A.S, Bogota, Colombia.*

Received for publication December 13, 2023; accepted May 14, 2024.

Copyright © 2024 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/GOX.0000000000005965

CASE REPORT

This is a case report of five patients, adult women ranging in age from 38 to 82, diagnosed with vulvar cancer: two with squamous cell carcinoma, one with Paget disease, one with vulvar melanoma, and one with lichen sclerosus. They underwent vulvar resection with radical vulvectomy followed by vulvar reconstruction with keystone flap at the Clínica Universitaria Colombia from April 2021 to September 2023. Additionally, a perception survey was conducted with all patients to gather information about their experience regarding pain, activities of daily living, and aesthetic comfort.

The results were rated (according to the question asked) on a scale of 1–5 (1 = no, 2 = sometimes, 3 = partially, 4 = usually, 5 = definitely) during the postoperative follow-up appointment.

SURGICAL TECHNIQUE

All procedures were conducted under general anesthesia, with first-generation cephalosporins administered as prophylactic antibiotic therapy. Following the radical vulvectomy performed by the gynecologic oncologist (L.C.) while the patient was in the lithotomy

Disclosure statements are at the end of this article, following the correspondence information.

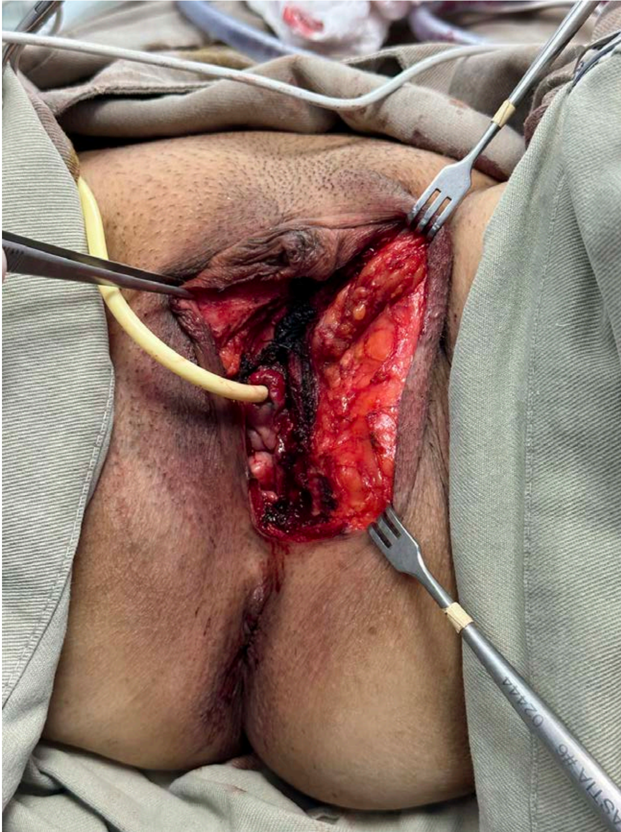

Fig. 1. Coverage defect is observed in the vulvar region after radical vulvectomy.

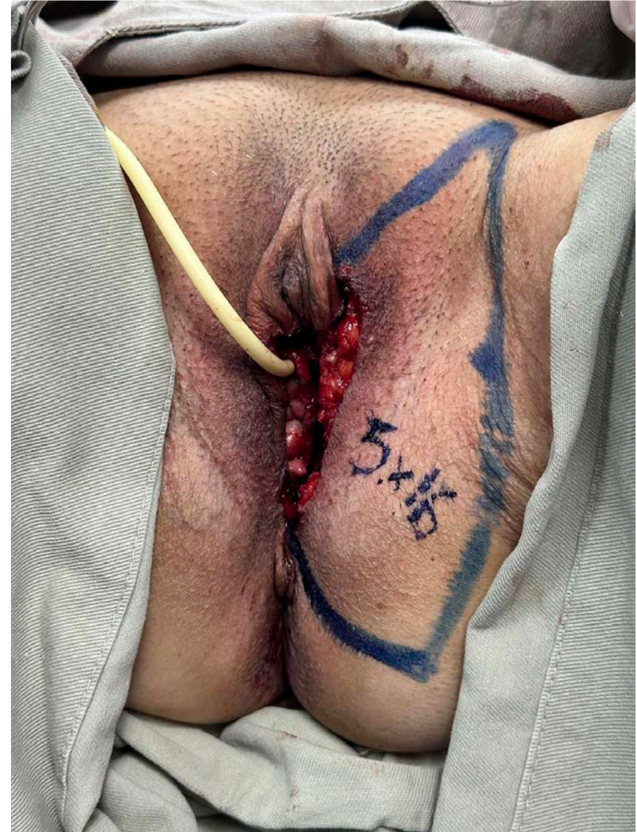

Fig. 2. The design of the keystone flap in the vulvar region is observed, considering the following proportions: width, 1.5:1; longitudinal, 1:1.

position (Fig. 1), the plastic surgeon (G.P.) proceeded as follows:

- The keystone type flap was designed with the following proportions: 1.5:1 of the defect in width and 1:1 in the longitudinal axis (Fig. 2).
- As the perforators were not located using Doppler or imaging methods, the flap was pedicled in the perineal perforators based on the concept of hot spots.
- Dissection was performed in the subfascial plane up to the region of the perforators approximately 3 cm from the edge of the flap. A pedicled area of 30%–40% was left based on the size of the defect to be covered.
- Once the flap was released, specific advancement and rotation were performed to cover the defect.
- The flap was closed in layers using 3-0 Vicryl suture material in the deep planes and Monocryl 4.0 in the skin (Fig. 3).

In addition, photographic records were taken before, during, and after the intervention.

DISCUSSION

Vulvar reconstruction is an infrequent surgical procedure in the clinical practice of plastic surgeons due to the unique challenges posed by the genital region, particularly the vulva. Multiple reconstructive options have been described in the literature, including local, regional, and free flaps. However, there is no standard surgical procedure that universally satisfies all requirements for the best reconstructive option. Instead, careful consideration of patient characteristics, defect size, and location is necessary to determine the most appropriate approach[5]

Considering the unique characteristics of the vulvar region and its reconstructive needs, Salgarello et al[3] propose essential criteria that any surgical option must meet: providing well-vascularized coverage of skin and subcutaneous tissue similar to the resected tissue, accommodating defects of various sizes, restoring functional needs, minimizing negative impacts on walking and sitting, creating a natural appearance, preserving sensitivity, and combining resection and reconstruction in a single surgical session. To address these needs, DiDonato et al[5] conducted a review of various reconstructive options reported in the literature, including the gracilis flap, gluteal fold flap, medial thigh flap, anterolateral thigh flap, rectus abdominis musculocutaneous flap, V-Y flap, Limberg flap, DIEP flap, pudendal artery thigh flap, and lotus petal flap. Each flap type presents different considerations, such as the need to identify specific perforators, abdominal flap sequelae, or prolonged recovery periods associated with certain flaps.[6]

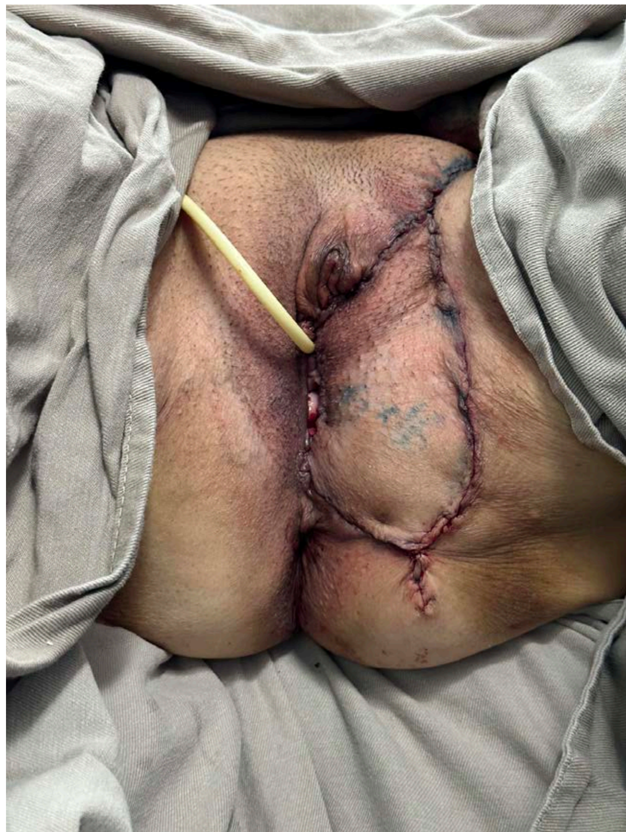

Fig. 3. Immediate vulvar reconstruction performed with keystone flaps.

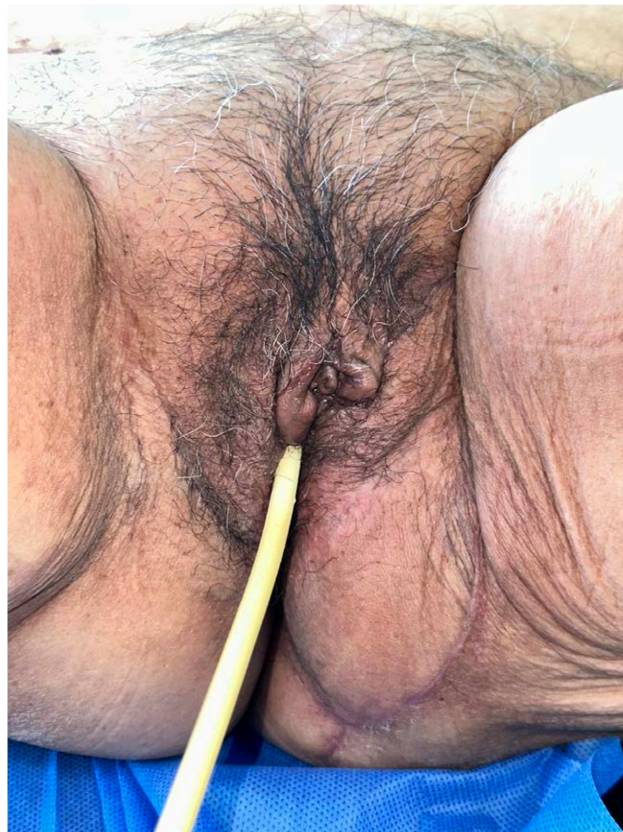

Fig. 4. Postoperative period of vulvar reconstruction after 2 months.

Introduced by Behan[7] in 2003, the keystone flap has emerged as an effective solution for reconstructing various coverage defects due to its ease of application, reproducibility, low morbidity of the donor area, and minimal risk of intraoperative/postoperative complications.[5–9] Unlike other techniques, the keystone flap does not require specific identification of perforators using radiological devices, and its success is not strongly dependent on the surgeon's skills.[5,6] Additionally, the keystone flap yields aesthetic results similar to the resected skin, with excellent cosmetic outcomes and emotional impact for patients.[6,7] As can be seen in Figure 4, showing an adequate evolution of the healing, without alteration of the anatomy and preserving the functionality of the area. Other authors who present their experience with keystone flap are Peiretti et al[9] and Lee et al[6] evidencing the positive results obtained with this reconstructive option.

The results of our perception survey revealed that vulvar reconstruction with the keystone flap significantly improves patients' self-esteem and quality of life postoperatively. Patients reported reduced pain and positive impacts on urination and defecation. In one of our cases, the urinary catheter was removed 1 week postoperatively, presenting the closure of the urethra. When the surgeon performs complete vulvectomies he also makes a periurethral resection, so the scarring process in this area can cause stretching of the urethra and its closure. For this reason, we suggest that the bladder catheter should be used for a longer period to prevent restenosis. In our case, by institutional protocol, the catheter is changed after the first month and completely removed after the second month, allowing the body to have an adequate healing period of the urethra and the surgical area. The removal of the bladder catheter must be an individualized medical opinion by the work team. More studies of this type are required to objectify how long the catheter could be left in patients with vulvar reconstruction.

The keystone flap performed at our institution has not presented any complications per se, leading us to consider it as meeting most of the necessary requirements for optimal vulvar region reconstruction. However, further studies are needed to analyze the types of complications associated with this procedure. Due to our limited number of cases, we have not been able to thoroughly discuss and debate this point.

CONCLUSIONS

Keystone flaps emerge as a promising surgical option for vulvar reconstruction, offering improved outcomes in the immediate postoperative period. Moreover, it provides a viable, practical, straightforward, and effective solution for such reconstructions, eliminating the necessity for multiple surgical sessions, perforator

dissection, or prolonged rehabilitation processes that could negatively impact patients' lives. However, further studies are necessary to definitively establish keystone flaps as the optimal surgical choice for vulvar reconstruction.

Andreina Zannin Ferrero, MD
Carrera 15 # 83-33
Bogotá DC, Colombia
E-mail: inazanninf@gmail.com
Instagram: andreinazannin

DISCLOSURE

The authors have no financial interests to declare in relation to the content of this article.

REFERENCES

1. Hand LC, Maas TM, Baka N, et al. Utilizing V–Y fasciocutaneous advancement flaps for vulvar reconstruction. *Gynecol Oncol Rep.* 2018;26:24–28.
2. World Health Organization: Globocan. Incidence, mortality and prevalence by cancer site. 2020. Available at https://gco.iarc.fr/today/data/factsheets/populations/170-colombia-fact-sheets.pdf. Accessed June 5, 2023.
3. Salgarello M, Farallo E, Barone-Adesi L, et al. Flap algorithm in vulvar reconstruction after radical, extensive vulvectomy. *Ann Plast Surg.* 2005;54:184–190.
4. Roh S, Miyamoto S, Kitamura Y, et al. Secondary vulvar reconstruction using bilateral gluteal fold flaps after radical vulvectomy with direct closure. *Plast Reconstr Surg Glob Open.* 2021;9:e3550.
5. Di Donato V, Bracchi C, Cigna E, et al. Vulvo-vaginal reconstruction after radical excision for treatment of vulvar cancer: evaluation of feasibility and morbidity of different surgical techniques. *Surg Oncol.* 2017;26:511–521.
6. Lee Y, Lee S, Lee D, et al. Vulvar reconstruction using keystone flaps based on the perforators of three arteries. *Arch Plast Surg.* 2021;49:724–728.
7. Pelissier P, Gardet H, Pinsolle V, et al. The keystone design perforator island flap. Part II: clinical applications. *J Plast Reconstr Aesthet Surg.* 2007;60:888–891.
8. Herraiz Roda JL, Llueca Abella JA, Maazouzi Y, et al. Vulvar reconstruction in vulvar cancer: "lotus petal" suprafascial flap. *Gynecol Surg.* 2016;13:51–55.
9. Peiretti M, Corvetto E, Candotti G, et al. New keystone flap application in vulvo-perineal reconstructive surgery: a case series. *Gynecol Oncol Rep.* 2019;30:100505.