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IDEAS AND INNOVATIONS

Reconstructive

Redesigning to V-Y Fasciocutaneous Flaps: Optimizing Outcomes in Patients With Pressure Injuries and Spinal Cord Injuries

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Summary: Surgical treatment for patients with stage 4 pressure injury and spinal cord injury can be difficult because the complication rates are high. Several flaps have been described, but there is no consensus in favor of any flap. The V-Y fasciocutaneous flap, although commonly used, lacks a simple, standardized, step-by-step description. This study introduces a novel, simplified approach to the design and execution of the V-Y flap to improve the outcomes for these patients. This study aimed to evaluate the efficacy of 57 newly planned V-Y fasciocutaneous flaps for achieving predictable and improved outcomes in 40 patients with stage 4 pressure injury and spinal cord injury. Our technique demonstrated notable efficacy in terms of defect coverage (maximum of 196.35 cm^2) and linear advancement (maximum of 12 cm). Interestingly, our approach records complication and recurrence rates equal to those of other flap types reported in the literature, with the advantage of not having full or partial necrosis. We describe an easy, highly reproducible, new technique of marking, tracing, dissecting, and advancing the V-Y fasciocutaneous flap so that its simplicity makes it the preferred choice of local flaps for this type of lesion; additionally, this technique is applicable to defects of varying sizes in any anatomical region. *(Plast Reconstr Surg Glob Open 2025;13:e6725; doi: 10.1097/GOX.0000000000006725; Published online 1 May 2025.)*

INTRODUCTION

The V-Y advancement flap is widely used for reconstructing various defects because of its straightforward design, ease of execution, ability to close the donor site primarily, simple learning curve, high survival rate, and presence of a random perforator supply allowing for multiple reuses.[1–3] Despite its common use, the V-Y fasciocutaneous flap lacks a simple, classic, and standardized, step-by-step description.

At our center, we routinely utilize the V–Y advancement flap as a primary reconstruction method. However, there is no consensus on its management, and patients face an increased risk of postoperative complications due to multiple factors.[4–6] We offer modifications to the design and technique, providing a detailed, step-by-step guide to achieve more successful outcomes and analyze the results obtained with this approach.

METHODS

We conducted a retrospective cohort study from January 2018 to December 2023. The inclusion criteria included stage IV pressure injuries (PIs) with spinal cord injuries, almost 6 months of follow-up, full records, and only a V-Y fasciocutaneous flap performed by a single plastic surgeon. For data analysis, chi-square tests, logistic regression, Student *t* tests, and Pearson or Spearman correlations were performed via SPSS software. The characteristics of the patients, as well as the details of their injuries, flaps, and complications, were documented.

Complications arising from the surgical procedures were categorized using the Clavien-Dindo classification system. Major complications were defined as those requiring surgical, endoscopic, or radiological intervention, corresponding to Clavien-Dindo grades 3–5. Minor

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complications were defined as those manageable with conservative treatments, corresponding to Clavien-Dindo grades 1 and 2. This classification enabled a structured assessment of postoperative outcomes, distinguishing between complications of varying severity.

In cases where lesions required debridement before the flap procedure, we used negative-pressure wound therapy to optimize the wound bed. Negative-pressure wound therapy was applied before the operation to improve the condition of the wound and enhance the likelihood of successful flap integration. This approach was selected based on the initial condition of the lesions, and its use was incorporated into the preoperative protocol to support effective wound healing and prepare the wound for surgical intervention.

Takeaways

Question: Pressure injuries and spinal cord injuries are challenging due to high complication rates. How can V-Y fasciocutaneous flap outcomes be improved?

Findings: A simplified, standardized approach to V-Y fasciocutaneous flaps provides effective defect coverage with linear advancement and minimal complications. The technique showed no cases of necrosis and successfully reconstructed large defects in challenging areas.

Meaning: This reproducible method for stage 4 pressure and spinal cord injuries is simple, effective, and adaptable. It offers a high survival rate, minimal complications, and significant promise for optimizing reconstructive surgery outcomes in high-risk patients.

IDEA

The technique involves 3 key steps.

Flap Marking

- After wound debridement, the defect is shaped as a circle or ellipse (Fig. 1).
- The *x* and *y* axes of the defect are measured. If *x* is greater than 12 cm, a bilateral flap is necessary.
- An extended line is drawn representing 2.5–3 times the length of the *x* axis, which determines the flap size closed.
- The endpoints of the *y* axis are connected to the extended *x* axis, creating an isosceles triangle.
- The triangle is divided into 3 equal segments by drawing 2 perpendicular lines.

Flap Harvesting

- A vertical dissection is performed at a 15-degree angle until the fascia is reached (Fig. 2).
- The proximal and distal thirds of the flap are carefully elevated. The distal third, representing the tip, is

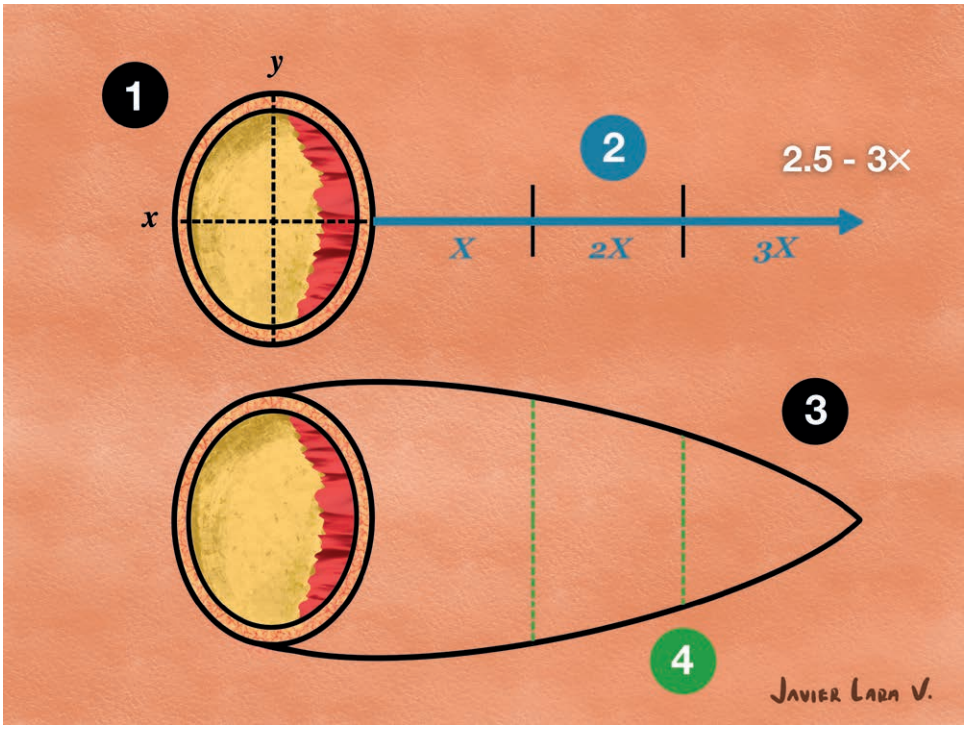

Fig. 1. Flap marking. (1) Following wound debridement, the axis (*x* and *y*) of the defect was measured. (2) Therefore, an extended line was drawn representing 3 times (2.5–3×) the width of the defect. (3) Subsequently, a spindle is delineated toward the defect. (4) The triangle is then divided into 3 equal segments by drawing 2 perpendicular lines.

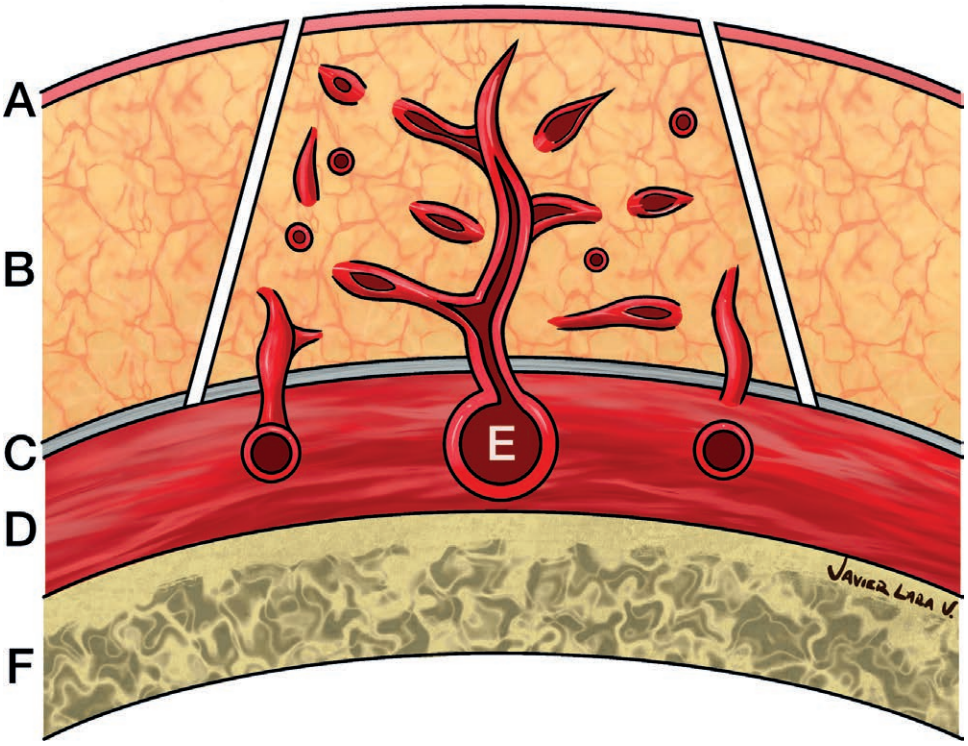

Fig. 2. Cross-section of the dissection for harvesting the flap. Note the oblique dissection of approximately 15 degrees, widening the base of the flap in relation to the skin incision to ensure more vessel perforators to flap vascularity. A, skin; B, subcutaneous tissue; C, fascia; D, muscle; E, perforating vessel; F, bone.

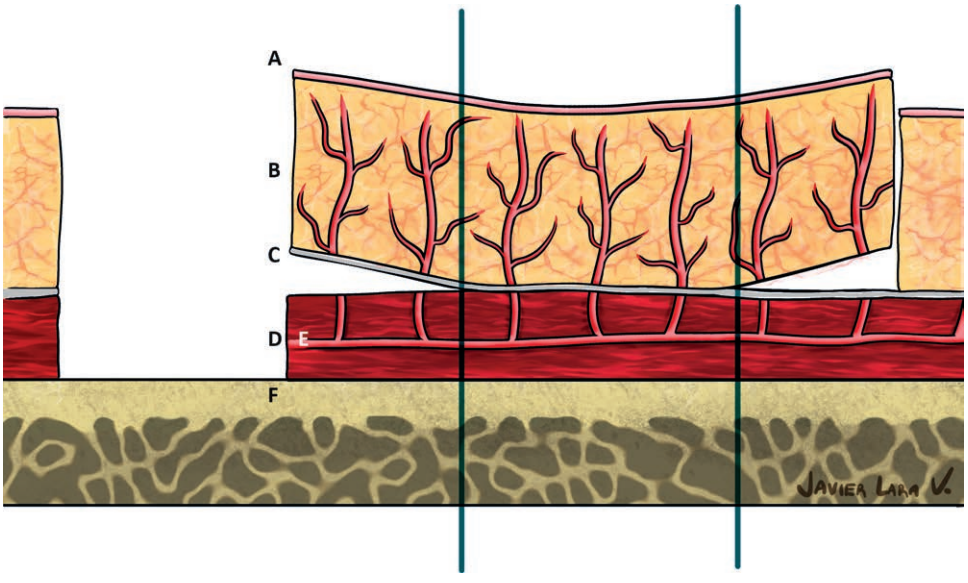

Fig. 3. Sagittal section of the dissection to harvest the flap. Subfascial dissection of the proximal region was performed, leaving the middle third intact for flap supply by perforators, and the distal third preserving the suprafacial region. A, skin; B, fatty tissue; C, fascia; D, muscle; E, main vessel; F, bone.

dissected suprafascially to optimize flap advancement (Fig. 3).

- The middle third is attached to the fascia and preserved to supply the vasculature.

Flap Advancement and Closure

- Subcutaneous sutures are placed in an oblique order (distal to proximal) to facilitate flap advancement while minimizing tension.

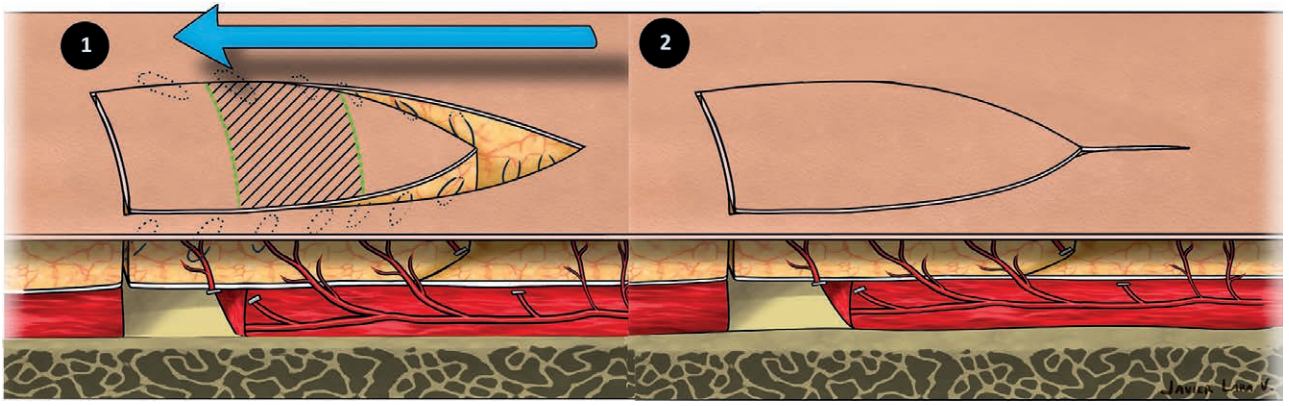

Fig. 4. Advancement of the V-Y flap. (1) The flap's advancement for wound closure is depicted by the blue arrow, and the edge contralateral to the flap base can be undermined in cases of tension. The stitches in the subcutaneous plane ranged from distal to proximal, so they carried the flaps to the defect. (2) Finally, multilayered closure is performed, resulting in a characteristic "Y" shaped outcome.

- A multilayered closure is performed, resulting in a characteristic "Y" shaped outcome.
- Skin closure is achieved by placing sutures slightly proximal to the acute tips of the flap rather than directly at these distal pointed areas. This approach reduces ischemia risks and supports spontaneous healing at the tips while maintaining tension-free closure of the surrounding tissue (Fig. 4).

RESULTS

Using this technique, we analyzed 40 patients; 125 surgical intervention records were included, and 57 flaps were obtained for 49 PIs. Our flaps had a maximum linear advance of 12 cm and a coverage size of 196.35 cm^2. On average, the incidence of postoperative complications was 35% (14% minor and 21% major). The most common complication was dehiscence, which occurred in 19.3%, and 10.5% of these patients required surgical revision. Furthermore, the recurrence rate was 7% during the first year. The mortality rate was 5% but was not related to surgery. The risk factors associated with complications were diabetes mellitus ($P = 0.007$) and polymicrobial infections ($P = 0.007$). Most of our patients had previously reported risk factors, such as AIS A (grade A on the American Spinal Injury Association impairment scale) (74%), sacral location (63%), and positive polymicrobial culture or osteomyelitis (83%). No complete or partial necrosis (0%) was reported. (**See table 1, Supplemental** Digital Content 1, which displays the results of the analysis of demographic data, characteristics of injuries, reconstruction, and postoperative follow-up, **http://links.lww.com/PRSGO/D986**.)

DISCUSSION

Preoperative planning and adequate design play crucial roles in the success of any flap, including the V-Y advancement flap. Many authors have described complex methods for its design, but the clinical application of these methods can be complicated. Therefore, we used only lines and geometric guides. First, we converted the defect into circular or semicircular forms because the area is smaller than that of other shapes. We based the length of the flap on the transverse axis, extending it by 2.5–3 times to ensure that the apical angle was near 30 degrees, as described in mathematical studies, to reduce closure force, dehiscence, and necrosis.[1–3] To ensure a robust random vascular supply, we performed the incision at a 15-degree angle to increase the flap width, attempting to increase the number of perforator vessels in the middle third, making ultrasound or imaging studies unnecessary. Finally, to facilitate advancement, we dissected down to the fascia to reduce resistance and achieve better flap mobilization.

The success of the V-Y fasciocutaneous flap for reconstruction is highly dependent on the specific body part and the type of injury. However, in patients with spinal cord injuries and stage 4 PIs, very limited research is available. Even for stage 4 PIs alone, a review of existing studies revealed a high complication rate ranging from 19% to 58%.[6–10] Our own findings, with a 35% complication rate, are in line with these results. The difference is that our easy V-Y flap can cover large defects without (0%) partial or total necrosis. (**See table 2, Supplemental** Digital Content 2, which displays the overview of the flaps and complication rates in the recent literature, **http://links.lww.com/PRSGO/D987**.) However, owing to its retrospective nature, limited sample size, single-center origin, performance by a single surgeon, and heterogeneity in some variables, additional prospective studies are needed to validate these findings and provide robust evidence to establish the broader applicability of this innovative design and technique.

This simple, reproducible design requires only a marker and eliminates the need for complex measurements or calculations, offering a highly efficient and effective local flap. It effectively addresses large defects, promoting successful integration with minimal complications. Its simplicity, minimal resource usage, and ease of reproduction among surgeons highlight its efficiency. The adaptability of the flap to various defect sizes and anatomical regions, combined with a high flap survival

rate (100%), makes it a valuable tool for surgeons. More research and validation are warranted to establish the broader applicability and long-term success of this novel flap design.

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DISCLOSURE

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

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