

# Hinge Flap with Triangular Extension for Reconstruction of Pharyngocutaneous and Laryngocutaneous Fistulas

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**Summary:** Hinge flaps are commonly used for closure of a pharyngocutaneous fistula (PCF) or laryngocutaneous fistula. These flaps are employed to augment the wall of the pharynx or larynx, but the junction between the reconstructed and native lumens can eventually become narrow and irregular after reconstruction with standard hinge flaps. We devised a method of adding a triangular extension to the end of either or both flaps and used it to treat 3 patients. In 1 patient who developed a PCF (4×10 cm) after laryngectomy followed by radiotherapy, the fistula was closed with 2 hinge flaps. One flap had a caudal triangular extension. The residual skin defect was covered by a pedicled latissimus dorsi musculocutaneous flap. Another patient who developed a PCF (2.5×3 cm) after laryngectomy underwent 2-stage reconstruction using a buccal mucosal graft with a triangular extension, followed by 2 hinge flaps. A patient who developed an laryngocutaneous fistula (1×2 cm) after radiotherapy and subsequent partial laryngectomy underwent reconstruction using 2 hinge flaps, each of which had a triangular extension. The skin defect was covered by another flap. Postoperative CT or video fluoroscopic examination of swallowing showed a smooth lumen with no strictures in all 3 patients. The triangular extension of the hinge flap supplements the pharyngeal/laryngeal wall at the junction between the reconstructed and intact regions, thus avoiding postoperative stricture. Especially with PCF reconstruction, restoration of a smooth luminal surface minimizes dysphagia. (*Plast Reconstr Surg Glob Open* 2018;6:e1630;doi:10.1097/GOX.0000000000001630;Published online 12 January 2018.)

## INTRODUCTION

Hinge flaps are commonly used for closure of pharyngocutaneous fistulas (PCFs) and laryngocutaneous fistulas (LCFs) caused by mucosal dehiscence or failure of flap reconstruction after tumor resection.<sup>1–5</sup> When a PCF/LCF occurs and a hinge flap procedure is planned, a period of 1–2 months is required to establish firm adhesion between the mucosa and skin of the flap and to allow an adequate blood supply to develop. This means that the circumference of the fistula has been reduced by contracture at the

time of surgery, with the result that the junction between the reconstructed and normal regions eventually tends to become narrow and irregular. We devised a technique to avoid these problems by supplementing the hinge flap with a triangular extension, which is inserted into an incision at the edge of the fistula.

## PATIENTS AND METHODS

### Surgical Technique

A period of 1–2 months is required to establish firm adhesion at the hinge of the flap before reconstruction of a PCF/LCF can be performed. First, the deficit of the internal wall of the pharynx or larynx is estimated. Then, we outline a crescent-shaped flap on each side of the fistula with a width corresponding to that of the deficit and add a triangular extension to 1 end of either or both flaps. The base of

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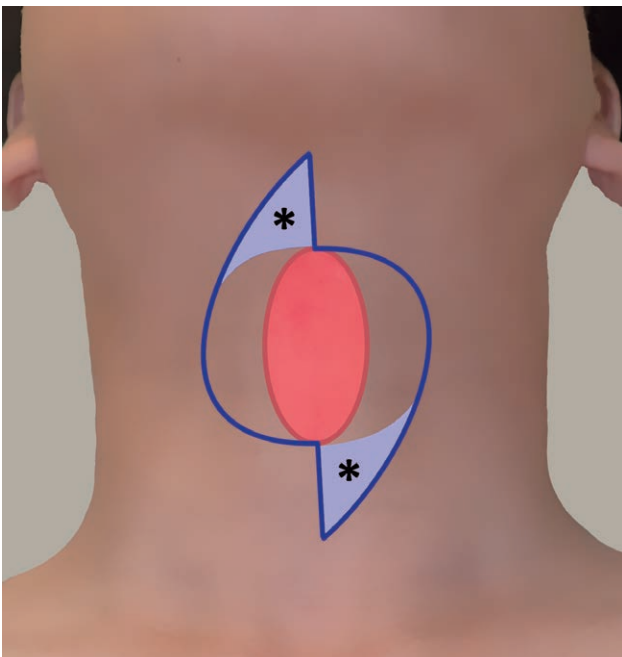
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the triangular extension is attached to the main body of the hinge flap and the length of the extension is 1.5 times the width of the base. If triangular extensions are added to both flaps, they are located point-symmetrically in the superior position on 1 side and the inferior position on the other side (Fig. 1). Flaps of adequate thickness (usually 1–1.5 cm) are raised with triangular extensions. Then each flap is sutured to the mucosa or to the other flap with 3-0 absorbable thread by using a vertical mattress suture that allows the suture line to be inverted into the lumen. Finally, the skin defects at the reconstructed site and the flap harvest bed are covered by another flap or closed directly with sutures (see video, **Supplemental Digital Content 1**, which displays 3D animation of the procedure, <http://links.lww.com/PRSGO/A651>).

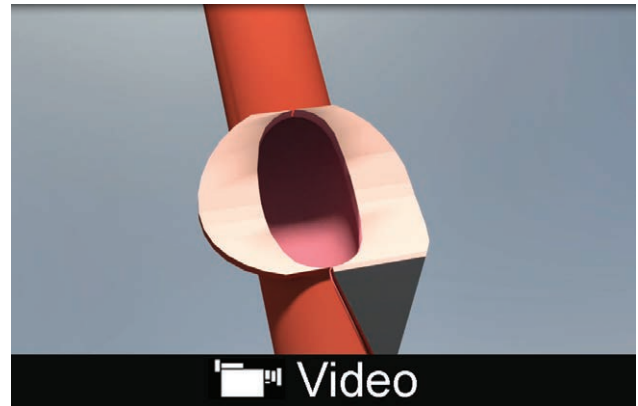
### Patients

Two patients with PCF and 1 patient with LCF were treated by the above procedure. Patient management was performed in compliance with recognized national standards and the principles of the Declaration of Helsinki.

The first patient developed a PCF (4×10 cm) 3 weeks after undergoing laryngectomy followed by radiotherapy. Six weeks later, the fistula was closed with 2 hinge flaps, 1 of which had a caudal triangular extension. Then the skin defect was covered by using a pedicled latissimus dorsi musculocutaneous flap (Fig. 2). The second patient developed a PCF (2.5×3 cm) 3 weeks after laryngectomy without radiotherapy and underwent 2-stage reconstruction. Ten weeks later, buccal mucosa (3×5 cm) was grafted to the right side of the fistula at the first operation. The mucosal graft was designed so that it could later be fashioned into a hinge flap with a caudal triangular



**Fig. 1.** Outline of 2 hinge flaps with triangular extensions (\*). Bilateral triangular extensions are shown, but a unilateral extension could be an alternative. The base of the triangular extension has the same width as the hinge flap at their junction, while the length should be about 1.5 times its width.



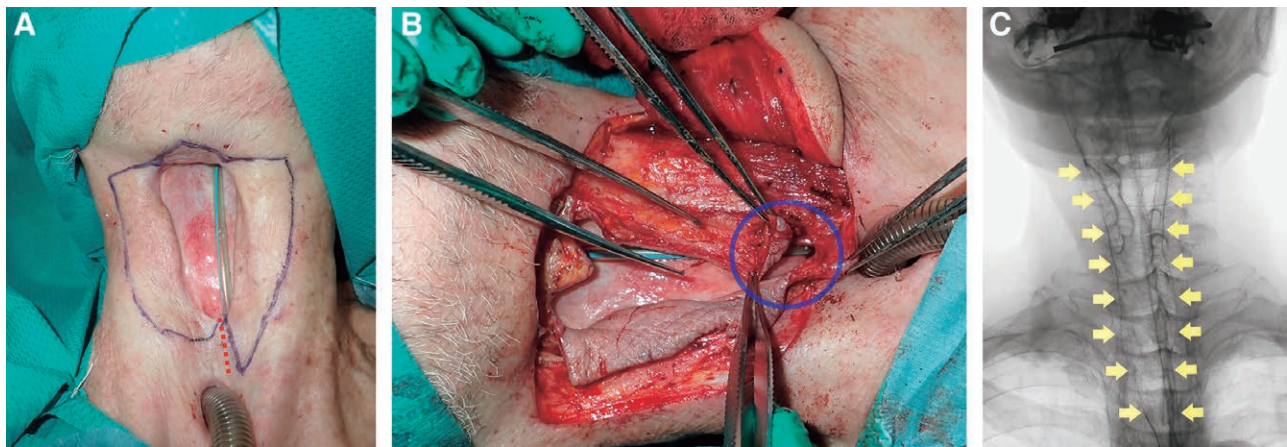
**Video Graphic 1.** See video, Supplemental Digital Content 1, which displays 3D animation of the procedure.

extension. Two weeks after the first surgery, the graft and sub-  
graft tissue were elevated as a mucosal flap, turned inward to close the fistula, and sutured. The residual skin defect was closed by direct suturing. The third patient had an LCF (1×2 cm) due to partial laryngectomy following radiotherapy and underwent reconstruction using 2 hinge flaps with triangular extensions at 6 months after development of the fistula. One triangular extension was located at the superior end of the right flap and the other extension was at the inferior end of the left flap. The skin defect was covered by a pedicled latissimus dorsi musculocutaneous flap. When computed tomography or video fluoroscopic examination of swallowing was performed at least 3 weeks after reconstruction, a smooth lumen with no stricture was seen in all 3 patients.

### DISCUSSION

PCF is a common complication after surgical treatment of cervical malignancies, and there have been numerous reports about methods for closing these fistulas.<sup>6–18</sup> The hinge flap procedure, in which bilateral skin flaps raised alongside the PCF are turned in to line the pharynx, was described in a plastic surgery textbook published in 1948.<sup>1</sup> This procedure effectively augments the wall of the pharynx at the midsection of the reconstructed region, but stenosis and gaps can occur, especially at the caudal end of the flap due to circumferential contracture of the fistula that occurs while waiting for flap maturation. To obtain a smooth anastomosis between the flap and intact tissue, the circumferential contracture should be divided and another flap should be inserted to fill the defect. Adding a triangular extension to a hinge flap serves this purpose effectively. If the triangular extension is considered to be an isosceles triangle with its base at the upper or the lower margin of a hinge flap, the circumference of the reconstructed lumen can theoretically be increased by the width of the triangle's base. The triangular extension also allows reconstruction of a smooth luminal surface in the caudal direction, so that dysphagia is minimized.

A smooth luminal surface is less important with LCF reconstruction compared with PCF reconstruction,<sup>19</sup> but postoperative stricture is more problematic, so the triangular extension may have a greater importance in LCF reconstruction.



**Fig. 2.** An 86-year-old man with a PCF after laryngectomy. A, A caudal triangular extension (base, 3 cm; length, 4 cm) has been added to the left hinge flap (width, 4 cm). The pharynx will be incised along the red dotted line to insert the extension flap. B, Raising the hinge flap and triangular extension. The blue circle indicates the triangular extension and the site of its insertion into the incised pharynx. A latissimus dorsi musculocutaneous flap to cover the skin defect can be seen above. C, Postoperative fluoroscopic examination of swallowing (6 weeks after reconstruction) showed no strictures and smooth reconstruction of the lumen (yellow arrows).

The triangular extension should be connected to the main flap without crossing any scars from previous surgery. If care is taken to ensure that the extension is not too thin, it should receive sufficient blood flow and remain viable like the main flap. Because the triangular extension moves together with the hinge flap and there is no torsion or warping, unlike a transposition flap, it promotes creation of a smooth lumen. Accordingly, we suggest that adding a triangular extension should be strongly considered in most patients undergoing PCF/LCF reconstruction with hinge flaps.

### CONCLUSIONS

When PCF or LCF reconstruction is performed, adding a triangular extension to a hinge flap increases the luminal diameter at the anastomosis between the reconstructed and normal regions, avoiding postoperative stricture. Especially with PCF reconstruction, the triangular extension provides a smooth luminal surface that minimizes dysphagia.

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