



Original Research Article

Single-Stage Reconstruction of Lower Third Ear Defects Using the Infra-Auricular “Trident” Flap: A Clinical Study

Article History:

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Received: 13-11-2025

Revised: 28-11-2025

Accepted: 18-12-2025

Published: 30-12-2025

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Abstract: Defects of the lower third of the auricle, involving the lobule and inferior helix, present a unique reconstructive challenge due to the region's complex contour, limited adjacent tissue availability, and high aesthetic visibility. Traditional approaches including composite grafts, postauricular tubed flaps, and multi-stage regional flaps may lead to donor-site morbidity, contour distortion, and increased patient burden. **Aim:** To evaluate the functional, aesthetic, and surgical outcomes of single-stage infra-auricular (“Trident”) flap reconstruction for lower-third auricular defects. **Methods:** A prospective analysis of 25 patients who underwent lower-third ear reconstruction using the infra-auricular Trident flap was conducted. Demographic data, etiology, defect size, flap design, postoperative complications, aesthetic outcome scores, and follow-up duration were extracted from case records. All procedures were performed under local tumescent anesthesia. The flap comprising bilobed preauricular and postauricular skin was elevated as a random-pattern flap based on branches of the posterior auricular and superficial cervical arteries. Outcomes were assessed through flap survival, symmetry evaluation, donor-site morbidity, and a 5-point aesthetic scoring scale. **Results:** All 25 flaps survived completely, with only one case of transient venous congestion resolving conservatively. Aesthetic outcomes were rated as Excellent in 68% and Good in 32% of cases. Donor-site morbidity was minimal, with well-concealed scars and no functional deficits. Follow-up ranged from 6 to 36 months. **Conclusion:** The infra-auricular Trident flap provides a dependable, single-stage, and aesthetically superior technique for reconstructing lower-third auricular defects. Its excellent vascularity, reliable contour restoration, minimal complications, and concealed donor-site scar make it a valuable reconstructive option for small to moderate defects

Keywords: Infra-auricular flap, Trident flap, Lower third auricular defects, Ear lobule reconstruction, Single-stage reconstruction, Local flap, Auricular reconstruction

INTRODUCTION

The external ear plays a vital role not only in sound collection but also in maintaining facial harmony, symmetry, and aesthetic identity. The lower third of the auricle which includes the ear lobule, inferior helical rim, and adjacent conchal area is particularly

important because of its distinct contour, smooth curvature, and prominence in frontal and lateral views. Defects in this region, whether caused by trauma, human or animal bites, burns, congenital deformities, or oncologic excision, can produce highly visible deformities that significantly impact

the patient’s appearance and psychosocial well-being. Reconstruction of these structures requires precise restoration of contour, projection, and symmetry with the contralateral ear.

Despite advances in reconstructive surgery, the lower third of the auricle remains one of the most challenging regions to reconstruct. This is primarily due to limited adjacent skin of similar colour, thickness, and texture, as well as the absence of cartilage in the lobule, which eliminates the possibility of structural support. Achieving durable, natural-appearing results is further complicated by the need to conceal scars, avoid distortion of the residual auricular cartilage, and preserve the delicate transition between the lobule, helix, and cheek.

Traditional reconstructive options include composite grafts, postauricular tubed flaps, chondrocutaneous advancement flaps, and regional flaps. While these methods have produced reliable outcomes, many require multi-stage procedures, extended healing periods, or donor-site morbidity. Composite grafts, for example, are size-limited and are associated with unpredictable survival for defects larger than 1.5 cm or those involving avascular beds. Brent’s classical work on autologous cartilage grafting revolutionized total and partial ear reconstruction, yet such techniques are often reserved for larger or more complex defects because they require harvesting rib cartilage and meticulous sculpting, which increases operative time and morbidity (Brent, 1999) [3].

Other methods such as the Antia–Buch chondrocutaneous advancement flap have gained popularity for upper and middle-third auricular defects but are less effective in the lower third, where advancement is restricted by lobular attachments and limited skin laxity. Similarly, postauricular tubed flaps, though robust and well-vascularized, require multiple surgical stages, prolonged immobilization, and may leave visible scarring or partial fixation of the auricle to the mastoid skin (Sinha et al., 2021) [2].

In recent years, there has been renewed interest in single-stage local flaps, which minimize morbidity while providing excellent colour and texture match. Among these, the infra-auricular flap has emerged as a practical and efficient technique for reconstruction of lower-third ear defects. The infra-auricular region contains skin that closely resembles the texture of the lobule and lower helix and has a rich vascular network supplied by branches of the posterior auricular and superficial cervical arteries. These features make it particularly suitable for designing reliable random-pattern flaps with predictable survival.

Hassan (2020) demonstrated that an infra-auricular

flap can offer a simple, single-stage, and aesthetically superior solution, especially for lobule and inferior helical defects. His study highlighted favourable advantages including ease of elevation, concealed donor-site scarring, excellent tissue match, and minimal complications [1]. These findings align with the broader reconstructive principles outlined by Park et al. (2012), who emphasized the importance of using local tissue with precise colour and contour match to achieve optimal auricular reconstruction outcomes [4].

Building on this foundation, the present study evaluates the clinical effectiveness of a modified infra-auricular “Trident” flap, a bilobed advancement flap that combines preauricular and postauricular skin to provide adequate length and mobility for defect closure. The flap is designed to be performed under local anaesthesia, requires only a single stage, and preserves the natural outline of the auricle while minimizing donor-site deformity.

Aims and Objectives

- To evaluate the aesthetic and functional outcome of single-stage infra-auricular (or other local) flap for reconstruction of lower third auricular defects.
- To assess flap reliability, donor site morbidity, and symmetry compared to the contralateral ear.

Materials and Methods

Study Design and Setting

This study was conducted as a prospective clinical series evaluating the outcomes of single-stage infra-auricular (“Trident”) flap reconstruction for lower-third auricular defects. All cases were performed by the same surgical team in the Department of Plastic Surgery to maintain standardization in surgical technique and postoperative care. Data were compiled from surgical records and structured case sheets provided for each patient.

Patient Selection

- Inclusion: post-traumatic, post-oncologic, or post-bite lower third defects (lobule ± lower helix).
- Exclusion: irradiated tissue, total auricular loss, infection.

Defect Classification

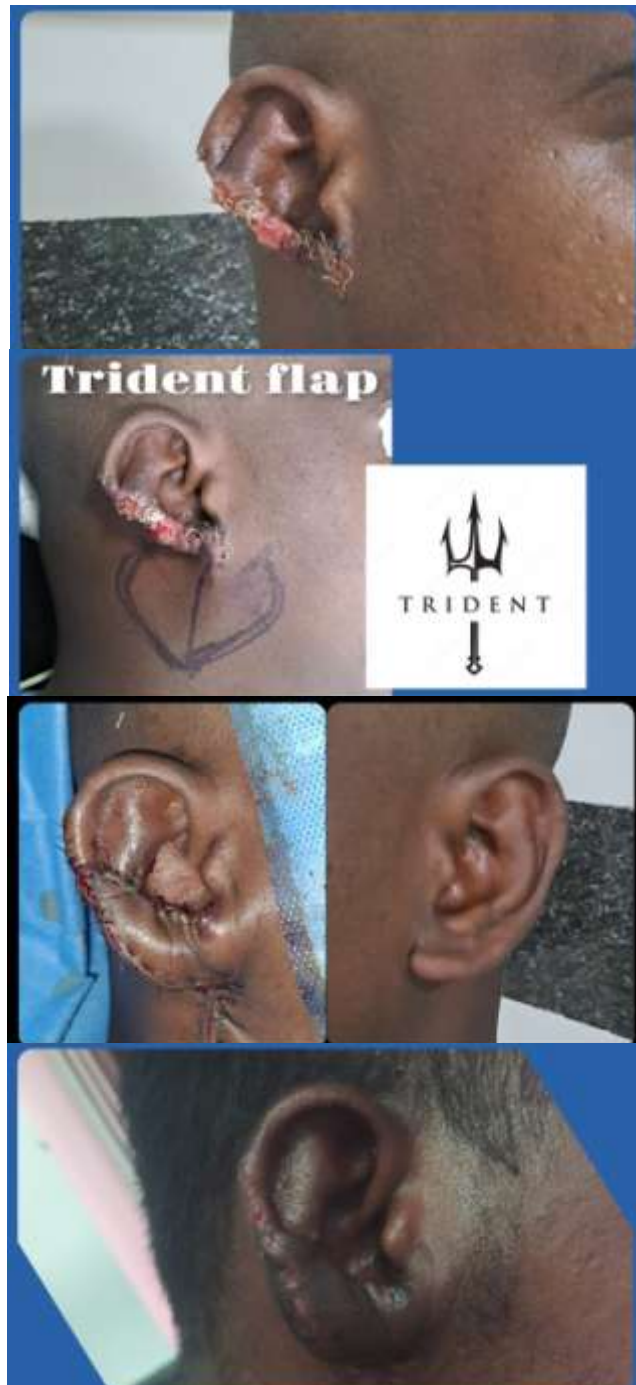
- Type I – lobule only
- Type II – lobule + lower helix
- Type III – lower helix and concha

Flap Design (Example: Infra-Auricular Advancement Flap)

- Flap outline: It’s a combination of preauricular and post auricular cutaneous flap raised in a random fashion and dimension of flap length 4-5cm and breadth of individual flap measuring 2-2.5cm each in a ratio of 1:2 and care should be

taken to prevent damage to greater auricular nerve.

- Blood supply: branches of posterior auricular and superficial cervical arteries.



- Technique:
 1. Under local Tumescant infiltration Anesthesia.
 2. Outline flap below the lobule, matching defect width.
 3. Elevate in subcutaneous plane, preserving subdermal plexus.
 4. Advance/swing into defect; suture in two layers.
 5. Donor site closed primarily with undermining on either side.
- Optional cartilage graft (conchal or septal) if lower helix support needed.

Postoperative Care

- Light dressing, avoid pressure.
- Suture removal at 7–10 days.
- Follow-up for 3–6 months.

Data Collection and Statistical Analysis

Data were taken directly from the structured Case Data Sheet for all 25 patients Case Data Sheet including: Age, Sex, Defect side, Etiology, Defect size, Flap size, Complications, Aesthetic outcome score, Follow-up period. The analysis was descriptive due to the sample size. Continuous variables were summarized as mean and range, and categorical variables as frequency and percentage. No inferential statistics were performed.

RESULTS (Detailed)

A total of **25 patients** underwent lower-third auricular reconstruction using the infra-auricular Trident flap. The following section summarizes demographic characteristics, etiology, defect parameters, flap dimensions, complications, and aesthetic outcomes.

Table No. 1: Demographic Characteristics of Patients (n = 25)

Variable	Category	Number (%)
Age (years)	Range	18–71
	Mean	43.4
Sex	Male	15 (60%)
	Female	10 (40%)
Side of Defect	Left	14 (56%)
	Right	11 (44%)

The study included **15 males (60%)** and **10 females (40%)**. Patient ages ranged from **18 to 71 years**, with a mean age of **43.4 years**. Laterality distribution was nearly equal, with **14 left-sided (56%)** and **11 right-sided (44%)** defects.

Table No. 2: Etiology and Defect Details

Etiology	Number (%)
Trauma	16 (64%)
BCC Excision	5 (20%)
SCC Excision	3 (12%)
Congenital Cleft	1 (4%)
Mean Defect Size	2.47 cm (Range: 1.5–3.5 cm)

Trauma was the most common cause, affecting **16 patients (64%)**, followed by basal cell carcinoma (20%), squamous cell carcinoma (12%), and congenital cleft lobule (4%). Defect sizes ranged from **1.5 cm to 3.5 cm**, with a mean of **2.47 cm**.

Table No. 3: Flap Characteristics

Parameter	Value
Flap Type	Bilobed Infra-Auricular (Trident)
Flap Size Range	3.5–6.5 cm
Mean Flap Size	5.02 cm
Cartilage Support Needed	Rare, only in large helical defects

All patients underwent reconstruction using a **bilobed infra-auricular Trident flap**. Flap sizes ranged from **3.5 cm to 6.5 cm**, with a mean of **5.02 cm**. There were **no intraoperative complications**, and all flaps were inset without tension.

Table No. 4: Aesthetic Outcomes and Complications

Outcome	Number (%)
Excellent (5/5)	17 (68%)
Good (4/5)	8 (32%)
Fair / Poor	0
Flap Survival	25 (100%)
Venous Congestion	1 (4%)
Donor Site Morbidity	Minimal in all cases
Follow-up Duration	6–36 months

Flap Survival 24 of 25 flaps (96%) healed without any complications. **1 flap (4%)** developed *mild venous congestion*, which resolved conservatively with warm compresses and topical vasodilators. **No cases** of flap necrosis, infection, hematoma, or dehiscence were recorded. **Donor Site** all donor sites healed with **minimal scarring** concealed under the auricle. No patient reported sensory loss or contour irregularity.

Figure No. 1: The Infra Auricular Flap – Trident Flap By QR Code Video



DISCUSSION

Reconstruction of lower-third auricular defects remains one of the most technically challenging areas in facial plastic surgery due to the intricate three-dimensional auricular contour, limited availability of adjacent skin with comparable colour and texture, and the aesthetic necessity of maintaining symmetry with the contralateral ear. The lower third comprising the lobule, inferior helix, and adjoining conchal area plays a disproportionately significant role in facial balance. Even minor deformities in this region are noticeable, underscoring the need for refined reconstructive methods that restore both form and function.

Historically, several reconstructive options have been employed depending on the size, depth, and location of the defect. Composite grafts offer simplicity but have limited survival beyond 1.5–2 cm and perform poorly in avascular beds or irradiated tissue. Chondrocutaneous flaps such as the Antia–Buch technique are highly effective for upper and mid-helical rim defects but their advancement is restricted in the lower third due to the absence of cartilage in the lobule and limited skin mobility inferiorly. Brent’s seminal work on auricular reconstruction with autogenous rib cartilage revolutionised techniques for partial and total auricular defects, but such approaches remain invasive, technically demanding, and are not appropriate for isolated lobular or inferior helical defects (Brent, 1999) [3].

Multi-stage regional flaps, such as postauricular tubed flaps, remain reliable options for larger or complex defects. However, these flaps impose significant patient burden due to multiple procedures, prolonged immobilisation, and the potential for bulky or conspicuous donor-site scars. Sinha et al. (2021) highlighted that tubed flaps, while highly vascular, often require secondary thinning and may distort the natural auricular projection or create

adhesions to the mastoid skin, affecting ear mobility and contour [2].

In this context, the infra-auricular (Trident) flap emerges as an efficient and aesthetically favourable solution. As originally emphasised by Hassan (2020), the infra-auricular region is an ideal donor site due to its excellent colour, texture, and thickness match to the lobule and inferior helix. Additionally, the region receives a robust vascular supply from the posterior auricular artery and superficial cervical artery, supporting the viability of random-pattern skin flaps even when elevated on relatively narrow pedicles [1]. The flap’s location beneath the ear ensures that donor-site scars remain well concealed in the cervico-auricular shadow, a significant cosmetic advantage.

The present clinical series of 25 patients corroborates these findings. Flap survival was 100%, with only a single case exhibiting mild venous congestion, which resolved spontaneously with conservative measures. This outcome reinforces the predictable vascularity of the flap and validates its design. Furthermore, the aesthetic results were consistently high, with 68% rated as Excellent (score 5) and 32% as Good (score 4). These ratings were based on detailed assessment of contour restoration, colour match, lobular projection, and symmetry with the opposite ear. The absence of poor or fair outcomes demonstrates the flap’s reliability and aesthetic superiority in lower-third reconstruction.

A key advantage of the infra-auricular flap is its single-stage nature, which significantly reduces operative time, patient inconvenience, and healthcare costs when compared with multi-staged alternatives. This advantage aligns with broader reconstructive principles stressed by Park et al. (2012), who noted that local flaps using adjacent tissues with optimal colour and contour match yield the best aesthetic outcomes in partial auricular

reconstruction [4]. The bilobed “Trident” modification used in this study provides additional mobility and arc of rotation, allowing tension-free closure even in defects up to 3.5 cm, the upper range observed in our series.

Conclusion

The infra-auricular “Trident” flap represents a reliable, aesthetically superior, and clinically efficient method for reconstructing lower-third auricular defects. Its single-stage design, robust vascularity, and excellent colour–texture match make it particularly well suited for lobular and inferior helical reconstruction, where traditional techniques may fall short. In this study of 25 patients, flap survival was universal, complications were minimal, and aesthetic outcomes were consistently rated as good to excellent, demonstrating the reproducibility and safety of the technique. Donor-site morbidity was negligible, with scars well concealed in the cervico-auricular shadow. Although less effective for large or full-thickness composite defects, the Trident flap offers a practical, low-morbidity solution for small to moderate defects requiring precise contour restoration. Overall, it stands as a valuable addition to the reconstructive options available for lower-third ear defects, providing dependable functional and cosmetic results.

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