



AN ANALYSIS OF POST TRAUMATIC EAR RECONSTRUCTION: CHALLENGES ENCOUNTERED AND AESTHETIC OUTCOMES

Plastic Surgery

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ABSTRACT

Background: Ear reconstruction is one of the most challenging procedures for the plastic surgeon. Post trauma ear reconstruction, unlike microtia reconstruction poses unique set of challenges that need to be overcome to provide a functional and aesthetic ear to the patient. In this study we aim to analyse the various difficulties encountered while reconstruction of traumatic ear injuries and the strategies employed to overcome them. **Methods:** Retrospective chart review of all patients who underwent ear reconstruction secondary to trauma from January 2023 to December 2023. **Results:** A total of 30 patients were included. All patients underwent autologous reconstruction. Lower third defects were the most common and postauricular skin flap was the commonest flap used for reconstruction. 6 patients underwent framework creation using costal cartilage and temporoparietal fascia flap was used in 5 patients. Majority of the patients (n=27) reported good to excellent outcomes. **Conclusion:** The reconstructive surgeon must be aware of versatile options in ear reconstruction to provide an aesthetic and functional ear to the patient. A tailored approach is essential to tackle unique needs of each patient.

KEYWORDS

Ear Deformities, Acquired / External Ear trauma/ Esthetic outcome/ Reconstruction

BACKGROUND

Ear injuries are a common presentation in the trauma and emergency departments. The ear is commonly injured due to its unique position on the side of the head combined with its outward projection¹. The external ear is a complex three dimensional organ consisting of intricate cartilage folds covered by a delicate skin envelope, that projects outward from the skull. The external ear is both a functional and an aesthetic unit. The loss of an ear, whether complete or partial, can cause psychological distress irrespective of the size of the defect². Ear reconstruction represents one of the most challenging procedures performed by reconstructive surgeons. Surgical finesse and mastery of various techniques is required to obtain good aesthetic and functional results. The structural complexity of the external ear is attributable to the intricate curves and contours of its cartilage framework and its relationship with a thin soft-tissue cover. Significant developments have occurred in the last century with regard to reconstruction of ear defects. Much effort has gone into achieving better outcomes especially in microtia reconstruction. However, reconstruction of post traumatic ear defects poses a different set of challenges. One of the most difficult tasks in reconstruction of partial ear defects is achieving symmetry with the residual ear. Other factors include composite loss of ear tissue; often, there is a paucity of donor cartilage sources in adults; Additional injuries and scarring in the surrounding areas pose a limitation to the use of local reconstruction options.

In this study, we have aimed to review the various challenges faced while reconstructing post traumatic ear defects, the techniques that have been utilized to overcome them and outcomes thus obtained.

AIM

To analyze the complexities involved in planning and performing reconstruction in patients with acquired ear defects.

The aesthetic outcomes and patient satisfaction post reconstruction

METHODS

This is a retrospective chart review all patients who underwent ear reconstruction following a traumatic ear defect between January 2023 to December 2023. All congenital ear defects and burn deformities were excluded from the study. Institutional ethics committee approval was obtained and informed consent was taken from all patients. The data collected included the type of injury, defect size, flaps performed, complications, secondary procedures, aesthetic outcomes, and patient satisfaction.

RESULTS

In the study period, a total of 30 patients underwent ear reconstruction.

The majority of patients were within the 20-30 years age group (n=12). Male patients (n=21) outnumbered females (n=9). The most common etiology was from assault injuries (n=16) followed by road traffic accidents (RTA) (n=12). Two patients had undergone lobule piercing in beauty salons and developed necrosis of the lobule (Table 1).

Table 1: Etiology Of Ear Defects

ETIOLOGY	NO. OF PATIENTS
Assault	16
RTA	12
Ear Piercing	2

The defects have been classified into upper, middle and lower third defects, which are further qualified by the nature of tissue loss whether involving skin only or with associated cartilage loss. (Table2) (Table 3). Lower third defects including the lobule was the commonest defect (n=9).

Table 2: Type Of Ear Defect

DEFECT TYPE	NO. OF PATIENTS
Upper third	6
Middle third	5
Lower third	9
Combined defects	7
Total loss	3

Table 3: Qualitative Loss

DEFECT TYPE	NO. OF PATIENTS
Skin only	6
Full thickness loss	13
Cartilage loss	8
Total loss	3

Ear reconstruction was performed with autologous tissue in all patients. The postauricular flap was the most commonly used local flap (n=11) and it was utilized for the reconstruction of various defects involving the lower third of the ear and for combined defects involving the helix and lobule (Figure 1).





Figure 1: a: Defect involving lobule and lower third ear; b: postauricular flap; c: second stage flap division and inset; d: late post op

Table 4: Reconstructive Options

Reconstructive Options	No. Of Patients
Postauricular flap	11
Preauricular flap	6
Chondrocutaneous Advancement	3
Diffenbach flap	2
Split thickness skin graft SSG	1
Sternocleidomastoid flap	1
Temporoparietal fascia flap	5
Occipital fascia flap	1

The various local flaps used (Table 4) are based on the type and location of defect which underscore the diversity of techniques employed (Figure 2) (Figure 3).



Figure 2: a: Defect involving upper, mid, lower third of ear; b: Raising a postauricular flap; c: Flap inset; d: Post op; e: Late Post op after flap division

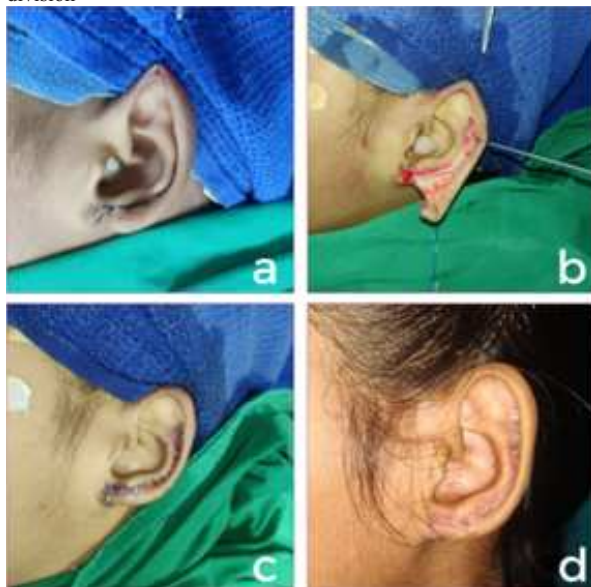


Figure 3: a: Lobule defect; b: Reverse Chondrocutaneous advancement flap; c: Flap inset; d: Late post op

In one patient with defect involving the middle third of ear and mastoid region, precluding the use of local tissue, sternocleidomastoid musculocutaneous flap cover was performed (Figure 4). In a patient

with severe scarring of local tissues, platelet rich plasma (PRP) injections were used to optimize the skin quality before undertaking framework creation.



Figure 4: a: Defect involving entire mid third of ear extending to mastoid region; b: Sternocleidomastoid myocutaneous flap cover; c: Post op photo; d and e: Post second stage division, Note: bulkiness of the flap and lack of definition

7 patients with partial and complete loss of ear required cartilage framework creation for which contralateral costal cartilage graft was used (Figure 5). The temporoparietal fascia flap was employed in addition, to provide vascularised cover over the cartilage framework. In one of the patients where temporoparietal fascia could not be used due to previous injury, the occipital fascia has proven to be useful in covering the exposed cartilage (Figure 6).



Figure 5: a: crumpled ear deformity secondary to trauma related perichondritis; b: Framework creation with costal cartilage; c: Framework elevation with postauricular flap; d: Posterior view showing adequate projection and contour



Figure 6: a: Loss of entire external ear with scarred skin; b: Framework

creation using adult costal cartilage; c:Post op after first stage; d:Inferiorly based Occipital fascia flap for framework elevation; e:Post op result

A significant number of patients (n=26) have undergone staged reconstruction. The second stage procedures involved flap division and inset, and cephalo-auricular angle creation. In addition, some patients (n=12) underwent secondary procedures in the form of cartilage grafting(2), epilation (4), flap thinning(6), and adjustment(4), which were often required to refine the results of the initial reconstruction (Figure 7).



Figure 7: Hair growth on reconstructed ear

There were few complications encountered in these patients (Table 5). 6 patients developed wound infections which were managed with antibiotics and dressing changes. In one of the patients there was cartilage framework exposure in delayed postoperative period which was salvaged by providing temporoparietal fascia flap cover.

Table 5: Complications

COMPLICATIONS	NO. OF PATIENTS
Infection	6
Cartilage Exposure	1
Scar Hypertrophy	7
Suboptimal Aesthetic Outcome	14

The patients were followed postoperatively for a minimum period of 6 months. EAR Q outcome questionnaire (The EAR-Q, authored by Drs. Anne Klassen and Karen Wong, Copyright ©2020, McMaster University and The Hospital for Sick Children, under license from McMaster University, Hamilton, Canada) was administered to all patients at the end of 6 months to assess outcomes. Majority of the patients reported good to excellent outcomes (Table 6).

Table 6: Ear Q Outcome Assessment

(The EAR-Q, authored by Drs. Anne Klassen and Karen Wong, Copyright ©2020, McMaster University and The Hospital for Sick Children, under license from McMaster University, Hamilton, Canada)

EAR Q OUTCOME	NO. OF PATIENTS
GOOD	16
AVERAGE	11
POOR	3

DISCUSSION

Reconstruction of ear defects has always been a challenge to the plastic surgeon given the complex three-dimensional conformation of this organ. A good reconstruction should aim at correcting the deformity with minimal morbidity and restore near normal appearance.

Studies have shown that the most common cause for avulsion injuries of the ear is from assault in the form of bite injuries which is similar to the results in our series¹. Most studies show upper third defects to be common³ while in our series lower third defects and combined defects involving lower two third of the ear were commonly encountered.

Microvascular repair delivers the best results for avulsion injuries of the ear. However, the success of microvascular repair is dependent on the availability of the avulsed part, presentation within the warm ischemia time and availability of donor and recipient vessels for anastomosis⁴. Based on previous systematic reviews, it is clear that avulsions with a residual soft tissue pedicle attachment have better successful outcomes when compared to total avulsions⁵. Reattaching the avulsed ear as a composite graft is an option but it has been shown to be successful only for small defects involving less than one third of the auricle⁶.

In this study we have focussed on ear reconstruction with autologous tissue. The premise of ear reconstruction was and remains twofold: first, to provide a suitable structural framework that resembles the native ear; second, to cover the underlying framework with cutaneous tissue⁷. For partial ear defects with exposed cartilage local flaps have been the go-to options. In our series, the most frequently used flap was the postauricular flap followed by preauricular flap. The postauricular skin has always been noted for auricular reconstruction because of its optimal vascularization, thin pliable skin, good color match and hidden scar. These reasons make it an ideal donor site for ear reconstruction⁸. The preauricular flap also provides adequate coverage with a minimal donor site morbidity, but is limited by its dimensions and visible donor site scar. Despite this, the preauricular flap represents a versatile solution for defects of the anterior ear⁹.

In total and near total amputations of the ear, identifying a suitable supporting framework requires selection of donor tissue that is of appropriate size and appearance. In contemporary practice, costal cartilage remains the workhorse for autologous ear reconstruction. However, in adult patients the costal cartilage has often undergone calcification. This calcification and associated rigid and crispy texture increases the challenges for surgical manipulation, graft survival and suboptimal aesthetic results¹⁰. Despite these limitations, autologous rib cartilage is widely used for the framework creation due to improved biocompatibility, safety and outline of the reconstructed ears¹¹. We have mostly used 6th, 7th, and 8th contralateral costal cartilages in framework creation.

For successful ear reconstruction, it is essential to have a tension-free skin envelope with sufficient blood supply. Trauma reconstruction of the ear is complicated by concomitant injuries of the surrounding tissues thereby eliminating local reconstruction options. In such patients, it is necessary to plan locoregional flaps such as the temporoparietal fascia flap and sternocleidomastoid flap¹². The temporoparietal fascia flap has been the workhorse flap in microtia and ear reconstruction. In situations where even the superficial temporal artery has been injured or in previously operated patients, the occipital fascia flap has shown to provide large, thin, pliable soft-tissue coverage for the cartilage framework¹³.

Majority of the patients in this series have undergone staged reconstruction. Apart from these stages patients undergo secondary revisions for better aesthetic outcomes. These procedures include cephalo-auricular angle creation to achieve projection, flap thinning and adjustment in case of bulky flaps and epilation procedures. It is often seen that, in the postoperative period the thin and pliable skin flaps often thicken and become stiff obviating the need to reconstruct the cartilage support when there is partial cartilage loss.

Alloplastic reconstruction can circumvent many of the challenges of autologous reconstruction. Many surgeons favor the alloplastic approach as it is single stage, avoids donor site morbidity and is shown to have superior aesthetic results. Porous polyethylene (PPE) has proven to be the most successful biomaterial used for this purpose¹⁴. However, these constructs are still foreign bodies which carry potential risk of infection, extrusion and implant fracture. Also limited availability and cost factors preclude the widespread use of implant based reconstruction⁷.

The patient reported outcomes in terms of satisfaction and aesthesia in this series were good to excellent. There is a higher risk of extensive scarring, especially in partial ear reconstruction at the junction of native skin and graft¹⁵. The thick Asian skin contributes to poor definition of the cartilage framework¹⁶ (Figure 8).

The grafted skin always has a color mismatch with the remaining ear¹⁷. Despite these limitations patients report significant improvements in

self confidence and lifestyle following surgical treatment, which makes it a worthwhile quest¹⁸.



Figure 8: a: Poor definition of framework; color mismatch with SSG; b: Poor projection and malpositioned ear

CONCLUSION

The findings in this study underscore the complexity of ear reconstruction, where a tailored approach is essential to address the unique characteristics of each patient's case. The study provides insight into the challenges and strategies to overcome them in post traumatic ear reconstruction. The use of autologous tissue, particularly costal cartilage grafts, and the choice of various flaps highlight the multifaceted nature of reconstructive techniques necessary to achieve both functional and aesthetic outcomes in ear reconstruction.

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