



RECONSTRUCTION OF AURICULAR DEFECTS IN A TERTIARY CARE CENTER- A LONG TERM PROSPECTIVE STUDY

Plastic Surgery

Dr. K.Raja

Assistant Professor, Dept. of Plastic Surgery, Govt.Rajaji Hospital & Madurai Medical College, Madurai

Dr.Ramasamy Lingappan*

Assistant Professor, Dept. of Plastic Surgery, Govt.Rajaji Hospital & Madurai Medical College, Madurai *Corresponding Author

ABSTRACT

Reconstruction of human ear is one of the greatest technical and aesthetic challenges, facing the plastic, reconstructive and aesthetic surgeon. The three dimensional nature of the ear with many curls, peaks, and valleys makes this one of the most elegant body parts. The rigid nature of cartilage along with its elastic nature is a testament to its unique properties which makes it very difficult to reproduce. In this study we are presenting the ear deformities resulting from trauma and the methods of reconstruction followed in our department over a three year period. We have treated 43 patients with various types of flap cover. Ear lobule was the commonest part affected in our study. Primary reconstruction of ear deformities achieved better results than delayed or secondary reconstruction.

KEYWORDS

Ear injuries, Converse flap, Post auricular flap, Diffenbach procedure

Introduction:

Reconstruction of the ear can be a complex process. In certain cases staged reconstruction may be needed. Though reconstruction can be traced back to era of eighth century B.C. as recorded in Sushruta Samhita now even after advent of autologous tissue, alloplastic material, tissue engineering, tissue expansion, prelaminated free flaps, ear reconstruction has been a great challenge.

It is difficult to match the flexibility of the ear while maintaining the rigidity and skin covering. Even minor deformities of pinna cause psychological distress. Functional loss of pinna is a disability as ear supports glasses, head phones, Bluetooth headsets.

AIM OF STUDY:

- To assess the various causes of acquired pinna defects.
- To study the age, sex distribution of the patients
- To evaluate results, outcome of various surgical procedures.
- To study the complications of various procedures.
- To evaluate the advantages of primary reconstruction over secondary reconstruction.

Surgical anatomy of auricle

The external ear is composed of auricle or pinna, external auditory canal and lateral surface of tympanic membrane. The auricle is typically oriented at an anteroposterior rotational angle of 15-20°. The height corresponds to the height of the nose. The pinna is about 6cm from the lateral canthus and about 6-7 cm height from helical crus to lobule. The normal protrusion of pinna from the skull is about 25-30°.

Helix forms the prominent auricular rim. Antihelix forms the prominence anterior to helix and has 2 crura superior and inferior. Triangular fossa is the space between the superior and inferior crura of antihelix. Scaphoid fossa is the space between helix and antihelix. Concha is a deep cavity posterior to external auditory meatus. The conchal cavity is divided into cyma concha superior to crus of helix and cavum concha inferior to crus of helix. Tragus is anterior to concha and partially covers the external auditory meatus. Antitragus is present posteroinferior to the tragus separated by intertragic notch. Lobule is present inferior to the antitragus. The pinna is attached to the temporal bone by fibrocartilaginous tissue.

Blood supply

Auricle is highly vascular and has intercommunication between Posterior auricular artery, superficial temporal artery and Occipital artery. Venous drainage is by the corresponding veins.

Lymphatic drainage

Lymphatics from ear drain into preauricular, postauricular, parotid nodes and subsequently in upper deep cervical nodes in level II nodes.

Nerve supply

The greater auricular nerve supplies most of the auricle from posterior to anterior aspect of lobule, helix and antihelix. The auriculotemporal nerve is a branch of the mandibular division of trigeminal nerve and supplies tragus, helical crus, skin superior to auricle. Lesser occipital nerve supplies skin posterior to auricle. Vagus nerve supplies, posterior external auditory canal. Facial nerve supplies cavum concha.

Etiology of acquired auricular defects

1. **Trauma**
 - Road traffic accident
 - Assault
 - Human / Animal bites
 - Gunshot injuries
2. **Infection**
3. **Tumour**
 - Benign
 - Malignant
4. **Burns**
 - Thermal
 - Electrical
 - Chemical
 - Radiation
5. **Others**

Classification of acquired auricular defects

I. Based on amount of loss

- o Partial loss
- o Total loss

II. Based on component loss

- o Skin
- o Cartilage
- o Both

III. Based on area

- o Upper third
- o Middle third
- o Lower third
- o Combination

IV. Based on parts of the ear

- o Helix
- o Antihelix
- o Concha
- o Scaphoid fossa
- o Triangular fossa
- o Lobule
- o Combination

Principles of reconstruction:

The auricle may be divided into zones and the components lost to plan for various methods of repair

Helical rim and lobule : Creates overall appearance of ear. Mild defects can create largest cosmetic asymmetry. Care is taken to maintain continuity, height and to prevent step deformity. Cartilage graft should be planned wherever necessary.

Antihelix and antitragus: This gives support to ear framework. Loss leads to lop ear deformity. So flaps with cartilage support should be planned.

Cavum concha : This does not give support to the ear. So cartilage support is not needed. It will be enough if skin cover alone is given. The preauricular and post auricular sulcus should be preserved to give the ear normal projection.

Pre-op planning:

Template of pinna defect made and defect quantified by comparing with unaffected pinna or with pinna of same age and stature person if both pinna are lost. Debridement and removal of foreign body wherever necessary has to be done. Cartilage graft whenever necessary either from conchal or costal cartilage. Rule of Firmin has to be followed to plan for site of cartilage graft. For <25% defect ipsilateral or contralateral conchal cartilage can be used. If ≥25% loss of cartilage and biplanar defect is present we have to use costal cartilage graft

Skin cover can be done using surrounding skin, fascia, skin graft or distant or free flaps. Suction drain should be used wherever necessary. Skin should be sutured using 4-0 or 5-0 polypropylene or ethilon

Reconstructive options:

Primary closure : Simple laceration involving skin only can be closed in a single layer. In complex laceration involving full thickness layered closure has to be done. Small skin defects of helical rim can be closed by undermining and advancement. Small defects of <1.5cm involving helix and antihelix may be amenable to primary closure by converting to wedge excision.

Skin grafts

Skin grafts are useful in skin loss in lateral or medial surface when perichondrium is intact. Contralateral postauricular skin can be harvested as full thickness skin graft. Defects between 1.5 – 2 cm involving helix and antihelix can be reconstructed by using composite graft

Local and regional flaps

Local flaps provide good colour and texture match. Preauricular, postauricular, retromandibular and cervical skin have been used. Temperoparietal fascial flap provides a well vascularised flap in vicinity for reconstruction

Helical defects : Upper third defects

Defects <2cm:

Antia Buch's chondrocutaneous advancement flap and Composite grafts

Defects >2cm

Staged tube flap from postauricular skin-Eave's procedure, Converse tunnel procedure, Creckelair banner flap, Cartilage framework covered with temperoparietal fascia with skin grafting or using local flaps

Middle third defects

Composite graft, Staged tubed flap, Bipedicle flap, Antia Buch chondrocutaneous advancement flap, Converse tunnel procedure, Diffenbach procedure and Cartilage graft with temperoparietal fascial flap with skin grafting

Scaphoid fossa and triangular fossa

Defects <2cm – Primary closure

Defects >2cm – Composite graft

Antihelix Defect

Composite grafts, Advancement flaps and Transposition flaps

Tragus and Helical crus

Cartilage graft covered with preauricular skin.

Cavum concha

- Local skin flap
- Skin grafts

Lobule defect

Preauricular flap, Post auricular flaps, Auriculomastoid flap, Lateral neck skin flap, Zenteno Alanis technique, Gavello flap, Two flap technique of Converse, Wynn method, Nelaton and Ombredanne method and Double cross skin flap of Fadi sleilati.

Subtotal or total loss of pinna

Replantation, Staged reconstruction, Single staged reconstruction using cartilage or alloplastic framework with temperoparietal fascia and skin graft or Prosthesis implantation.

Complications: Haematoma, Seroma, Infection, Perichondritis, Flap necrosis and Keloid formation.

Materials and method

The study was conducted in the department of plastic surgery. Government Rajaji Hospital, Madurai Medical College, Madurai. Patients with acquired auricular defects were included in the study. Patients with no tissue loss and managed by primary suturing were not included in this study.

All patients included with acquired defects were due to road traffic accident, assault, human and animal bites, burns, infection and tumour. A total number of 43 cases were included in the study. In stable patients primary single staged repair was done or first stage of the staged reconstruction was done on the day of trauma.

In patients with associated injuries they were taken up after proper resuscitation. Procedures outcomes, complications were explained to the patients and informed written consent were obtained for all patients. Cases were followed up after 1 week, and 2 weeks then monthly for at least 3 months after the final stage of reconstruction.

ANALYSIS:

The data obtained were analyzed on the following factors:

Age and sex of patient, etiology, auricular defects depending on parts of the pinna, single stage or multiple staged surgery, reconstruction methods and complications.

Based on the data obtained, the results of the study were obtained.

RESULTS

AGE : In the forty three patients included in the study the age range was between 14-65 years.

Table I

Sl.No.	Age group	Numbers affected	Percentage
1	0-20	3	7
2	21-40	31	72
3	41-60	8	18.6
4	>60 y	1	2.4
	Total	43	100

Patients of third and fourth decades formed the major group. They formed about 72%.

SEX

Table II

Sl.No.	Sex	Number	%
1	Male	27	63%
2	Female	16	37%
	Total	43	100

Male patients were affected more than female. The male to female ratio was 1.7:1.

ETIOLOGY

Table III

Sl. No.	Etiology	Number	%
1	Assault	15	35
2	Road traffic accident	14	33
3	Human bite	9	21
4	Burns	5	11
5	Tumours	-	-
6	Others	-	-
	Total	43	100

In our study the common causes of pinna defects were due to road traffic accidents, assault, human bite and burns. There were no cases of tumour excision in our study. Assault and human bite were the commonest causes followed by road traffic accident.

SITE OF LESION

Table IV

Sl.No.	Site	Number	Percentage
1	Skin loss only	4	9.3
2	Composite defects	5	11.63
-	Upper third defect	5	11.63
-	Upper & Middle third	5	11.63
-	Middle third	9	20.9
-	Middle third & lobule		
	Lobule only	15	34.85
	Total	43	100

Lobule loss and lobule with lower third helical defects formed the predominant group of the study forming about 56% of total group. Skin loss alone was present only in 4 patients. Composite loss involving upper and middle third were present in rest of the patients.

SIDE OF LESION

Table v

Sl.No.	Side	Number
1	Right	22
2	Left	21
	Total	43

SURGICAL PROCEDURES

Table VI

Sl.No.	Procedure	Number	Percentage
I	Post auricular flap	15	35
1.	Inferiorly based	3	7
2.	Superiorly based	3	7
3.	Bipedicle		
II	Converse tunnel	3	7
III	Diffenbach	2	5
IV	Double cross	9	21
V	Temperoparietal fascia / SSG	4	9
VI	SSG	4	9
	Total	43	100

Of the various procedures inferiorly based post auricular flap was done in 35% patient followed by double cross skin flap in 21% of patients. The other flaps commonly used were superiorly based post auricular flap, Converse Tunnel, Diffenbach procedures and temperoparietal fascial flaps with skin graft. Skin grafting was done in 4 cases. Cartilage grafting were necessary in 7 cases. Cartilage graft were harvested from opposite concha in 3 cases and opposite synchondrosis in 4 cases.

COMPLICATIONS

Table VII

Sl. No.	Complication	Number
1	Wound infection	1
2	Partial graft loss	1
3	Partial flap dehiscence	1
4	Nil	40
	Total	43

There were no major complication in our study except for wound infection, partial graft loss and partial flap dehiscence in one case each.

Middle third defect – diffenbach procedure



Lobule defect – double cross skin flap



Superior third defect: Temporoparietal fascia flap with skin graft



CONCLUSION

- The patients with acquired auricular defects self esteem is affected and have psychological upset. Female patients are very much affected when they are not able to wear ear ring.
- Reconstruction of pinna defects are performed to give an aesthetically good appearing pinna at the earliest.
- Timely coverage of cartilage framework using local flaps prevented perichondritis and deformities.
- For upper third defects superiorly based post auricular flap were ideal.
- For middle third defects Converse tunnel, Diffenbach and bipedicle flaps were done either with or without cartilage graft.
- Double cross skin flap gave good aesthetic results and was very much useful in primary reconstruction of ear lobule in single stage.
- When lobule with helical defect was present staged reconstruction with inferiorly based post auricular flap were ideal.
- For near total loss and scarred skin in adjacent areas as in burns cartilage graft with temperoparietal fascial flap with skin graft were ideal.
- Burns injury of ear should be taken care at initial phases itself to prevent earlier complications and late deformities.
- Even in human bites and road traffic accidents, proper wound debridement antibiotic coverage, primary repair or first stage of the staged reconstruction could be done.
- It is ideal to reconstruct the pinna defects primarily so that patient were pleased and their self confidence were greatly boosted.

BIBLIOGRAPHY

1. Tanzer RC. Total reconstruction of the external ear. *Plast Reconstr Surg Transplant Bull* 1959 Jan;23:1-15.
2. Park C, Mun HY. Use of an expanded temporoparietal fascial flap technique for total auricular reconstruction. *Plast Reconstr Surg* 2006 Aug; 118:374-82.
3. Gault D Chapter 29 reconstruction of the ear in principles a practice of head & neck oncology. In : Rhys Evans P, Gullane P: Montgomery P. Martin Dunitz editors 2003.
4. Weerda H. Surgery of the auricle – injuries, defects and abnormalities. Stuttgart: Thieme,2004.
5. Pennington DG, Lai MF, Pelly AD. Successful replantation of a completely avulsed ear

- by microvascular anastomosis. *Plast Reconstr Surg* 1980; 65:820-03.
6. Kind GM. Microvascular ear replantation. *Clin Plast surg* 2002; 29:233-48.
 7. Mladick RA, Horton CE, Adamson JE, et al. the pocket principle: a new technique for the reattachment of a severed ear part. *Plast Reconstr Surg* 1971; 48: 219-23.
 8. Van Beek AI. Salvage of the severely injured ear (invited comment). *Ann Plast Surg* 1988; 21:178-9.
 9. Tanaka Y, Tajima S. Completely successful replantation of an amputated ear by microvascular anastomosis. *Plast Reconstr Surg* 1989; 84: 665-8.
 10. O'Toole G, Bhatti K, Masood S. Replantation of an avulsed ear, using a single arterial anastomosis. *J Plast Reconstr Aesthet Surg* 2007; 29:1-4.
 11. Cordova A, D'Arpa S, Moschella F. an innervated retroauricular skin flap for total earlobe reconstruction. *Br J Plast Surg* 2003; 56: 818-21.
 12. Dias AD, Chhajlani p. the post- and retro-auricular scalping flap (the PARAS flap). *Br J Plast surg* 1987; 40:360-6.
 13. Geary PM, Davis P. postauricular chondrocutaneous flap in auricular reconstruction. *Br J Plast Surg* 1996; 49:71-2.
 14. Song R, Song Y, Qi K, et al. The superior auricular artery and retroauricular arterial island flaps. *Plast Reconstr Surg* 1996; 98: 657-67. discussion 668-70.
 15. Yotsuyanagi T, Watanabe Y, Yamashita K, et al. retroauricular flap: its clinical application and safety. *Br J Plast Surg* 2001; 54: 12-9.
 16. Moschella F, Cordova A, Pirrello R, et al. the supra-auricular arterial network: anatomical bases for the use of superior pedicle retro-auricular skin flaps. *Surg Radiol Anat* 2003; 24: 343-7.
 17. Brent B, Byrd HS. Secondary ear reconstruction with cartilage graft covered by axial random and free flaps of temporoparietal fascia. *Plast Reconstr Surg* 1983; 72:141-52.
 18. Fadi Sleilati, Immediate ear lobe reconstruction with double crossed skin flap. *JPRAS* 2006 59, 1003-1005.
 19. Burton D Brent, Reconstruction of Auricle Plastic surgery 2006, Stephen J. Mathes Page 633-695
 20. John Marquis Converse Acquired deformities of the auricle – Reconstructive plastic surgery 1107-1121. Vol. III
 21. Haiyue Jiang, Bo Pan, Linlin - Fabrication of three dimensional cartilaginous framework in auricular reconstruction – *JPRAS* 2008 61-S77-S85
 22. David. Gault, Post traumatic ear reconstruction *JPRAS* 2008, 61, S5-S12
 23. Saed Mohammed, Saed Ibrahim -Totally avulsed ear-new technique of immediate ear reconstruction, *JPRAS* 2008, 61, S29-S36.
 24. A. Cordova, S.D. Arpa Retroauricular skin : a flaps bank for ear reconstruction *JPRAS* 2008, 61, S44-S51, *JPRAS* 2008, 61, S44-S51 R.Pirrello