Reconstruction of Acquired Pinna Defects

Dissertation submitted to

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In partial fulfillment of the
regulations for the award of the degree of

MCh (PLASTIC SURGERY)
BRANCH III

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DECLARATION

I solemnly declare that this dissertation ***"RECONSTRUCTION OF ACQUIRED PINNA DEFECTS"*** was prepared by me in the Department of Plastic, Reconstructive and Maxillofacial Surgery, Madras Medical College and Government General Hospital, Chennai under the guidance and supervision of Professor & HOD Department of Plastic, Reconstructive and Maxillofacial Surgery, Madras Medical College and Government General Hospital, Chennai between 2005 and 2008**.**

This dissertation is submitted to the TamilNadu Dr. MGR Medical University, Chennai in partial fulfilment of the University requirements for the award of degree of MCh Plastic Surgery.

Place: Chennai

Date :

CERTIFICATE

This is to certify that this dissertation entitled **" RECONSTRUCTION OF ACQUIRED PINNA DEFECTS"** is a bonafide record of the research work done by **Dr. D.VINOTH KUMAR** for the award of MCh Plastic Surgery, under the supervision of **Professor & HOD, Plastic Surgery Madras Medical College and Government General Hospital, Chennai** between 2005 and 2008.

I also certify that this dissertation is the result of the independent work done by candidate.

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Title of the work : "Reconstruction of Acquired Pinna Defects"

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The members of the Committee, the Secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

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CONTENTS

INTRODUCTION

The pinna is both a functional and aesthetic appendage. The 3-dimensional nature of the ear with its many curls, peaks and valleys makes this one of the most elegant body parts. The rigid structure of the cartilage along with its elastic nature is a testament to its unique properties , which make it very difficult to reproduce.

Even minor deformities of pinna may cause psychosocial stigmatization. The lack of an ear, or part of it, is a significant deformity, and the psychological trauma should not be underestimated. In some, particularly teenagers, concern over a deformed ear lies at the root of serious behaviour problems. Lack of an ear is also a disability as the ear supports glasses, sunglasses, blue-tooth headsets and headphones.

Reconstruction of the ear can be a complex process. Ear reconstruction can be traced back as far as eighth century India and the *Susruta Samhita,* a text of ancient medicine, which described the use of a cheek flap to repair an earlobe defect.

Although auricular reconstruction has been performed for a long time,its technical complexity is still considered a challenge. Many recent innovations have made excellent reconstruction possible. The challenge of matching the flexibility of an ear while maintaining its rigidity and skin covering is the bane of reconstructive surgeons.

AIM OF STUDY

1. To evaluate various surgical procedures for acquired pinna defects and evaluate their aesthetic and functional outcome.

2. To select a treatment protocol based on the algorithmic approach to the problem for improving the outcome.

REVIEW OF LITERATURE

- The *Sushruta Samhita*[23], an Indian text of ancient medicine, mentions the case of partial reconstruction of the earlobe with a cheek flap in 900 BC.

- In 1597, Tagliacozzi of Italy transferred a flap from the arm to reconstruct the auricle of a monk. He also described repair of both upper and lower ear deformities with retroauricular flaps.

- In 1845, Dieffenbach[25] repaired a traumatic defect of the ear with a mastoid flap folded on itself. He described repair of middle third of ear with an advancement flap,which has applications today.

- Local flap ear reconstruction techniques described in the following centuries evolved into the use of autologous cartilage for total ear reconstructions by Gillies[31] in 1920.

- Roux and many of his contemporaries of the mid-19th century considered reconstruction of the auricle a surgical impossibility, but by 1930 Pierce[34] had reported post-traumatic repairs using

autologous rib cartilage for reconstruction of the concha, antihelix and a thin roll of supraclavicular skin for helical reconstruction.

- In 1940,Young[35] and Peer[38] conceived the idea of framework prefabrication before the actual auricular reconstruction . Peer placed diced autogenous costal cartilage in a fenestrated two piece ear shaped Vitallium mold, which was implanted in a subcutaneous abdominal pocket. When fusion of the fragments by connective tissue was complete, the framework was used in auricular reconstruction. But contraction of the fibrous tissue surrounding the multiple cartilage islands distorted the resultant framework.

- During the 1940s there were numerous reports of ear reconstruction with fresh and preserved cartilage homografts and heterografts, the results of which were uniformly dismal, characterized by late resorption and high complication rates.

- In 1958, Converse[18] described the 'Tunnel procedure' for correcting upper and middle helical defects, using a cartilage graft shaped to the size of the helical defect tunneled underneath the skin of the mastoid area and joined to corresponding ends of the defect.

- Crikelair[24] described the 'Banner flap' of supra-auricular skin based on the auriculocephalic sulcus to reconstruct upper third auricular defects. The raised skin is folded over the defect with a cartilage graft under it.

- In 1959, Tanzer[39] ushered in the modern era in ear reconstruction with the successful use of autologous costal cartilage grafts.

- Brent[1,15,26,32] advanced the standards of ear reconstruction with autogenous materials and was the first to report the successful use of tissue expansion in reconstruction of the ear. Many of these innovative techniques used for total reconstruction of congenital ear defects can be applied to acquired defects.

- The modern era of auricular reconstruction began with Tanzer's classic descriptions of the principles and technique of total ear reconstruction with autologous costal cartilage.

- The prefabrication concept is rekindled through modern "tissue engineering" technique in which cartilage cells are grown in the laboratory and seeded on a synthetic biodegradable ear form that is implanted beneath the skin.

- Replantation of amputated segments of auricle was practiced in the 17th century.
- Mladick[2,3,4] and Carraway advocated dermabrasion first and then reattachment of the amputated ear to its stump.

- Baudet[7] advised removal of the posteromedial auricular skin and fenestration of the cartilage and replanted the amputated auricle.

- Brent modified the fenestrations by removing portions of cartilage in between the helix and antihelix ,in the regions of triangular fossa, cymba concha and cavum concha thereby preventing the punched out deformity.

MATERIALS AND METHODS

This study was conducted in the Department of Plastic Surgery, Government General Hospital and Madras Medical College during the period of September 2005 to April 2008.

All patients who presented with acquired deformities of Pinna were included in this study. This includes patients who presented with pinna injuries following Road traffic accidents and chronic defects following trauma, burns, human bites, infections and tumours.

Patients with large or torn ear lobule hole also were included.

A total of 160 cases were included in this study.

Pinna defects – 120 patients – 145 pinnas

Ear lobule repair – 40 patients – 75 ear lobules

All patients were assessed with a thorough history, clinical examination, pre operative planning.

Routine investigations done for all patients preoperatively.

In stable patients, primary repair of pinna injuries done on the same day itself.

Patients with associated severe head injuries were excluded from the study. In some patients ,after Neurosurgeon's intervention, soft

tissue repair done by Plastic Surgeons.

Patients who presented with keloids in the pinna are excluded from the study.

Informed consent obtained from all the patients.

Patients with simple defects were operated in a single stage. Patients with composite defects of Pinna needed 2 or 3 stages of reconstruction, with an interval of 1 to 3 months in between each stage based on the type of reconstruction. Proper instructions were given to the patients in the initial stage of reconstruction itself.

Follow up on 2^{nd} week, 1^{st} month and then at 2^{nd} month for cases which needed reconstruction with cartilage grafts, flap covers.

SURGICAL ANATOMY OF THE PINNA [14]

The shape of the upper two thirds of the auricle is determined by a single piece of elastic cartilage covered by skin envelope. The structural support of the auricle depends on three cartilaginous arches, including conchal, antihelical and helical arches which are arranged in three laterally progressive levels. The lower portion is made of soft tissue , the lobule.

The external ear is composed of the auricle, external auditory meatus, and lateral surface of the tympanic membrane. The auricle is typically oriented at an anteroposterior rotational angle of 15-20°. The distance from the lateral canthus of the eye to the top of the helical crus is about 6 cm. The typical height of the auricle from the top of the helix to the bottom of the lobule is about 6 cm. The normal protrusion of pinna from the skull is 30°.

PARTS OF PINNA

1. Helix: prominent auricular rim
2. Antihelix: prominence anterior to helix
3. Fossa triangularis: superior space between superior and inferior

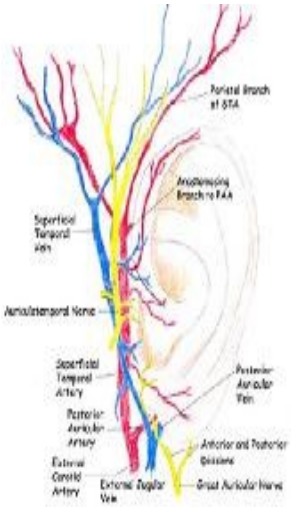
antihelical crus

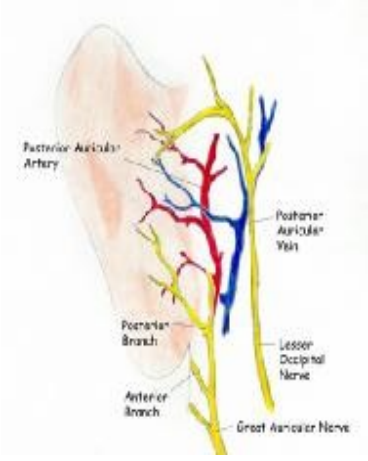
4. Scapha: depression between helix and antihelix
5. Concha: deep cavity posterior to external auditory meatus
    a) Cymba conchae: portion superior to crus of helix
    b) Cavum conchae: portion inferior to crus of helix
    c) Crus of helix beginning of helix that divides concha
6. Tragus anterior to concha and partially covering external auditory meatus
7. Antitragus : posteroinferior to tragus: separated by intertragic notch
8. Lobule: inferior to antitragus

The auricle is attached to the temporal bone by its fibrocartilaginous tissue.

ANATOMY OF PINNA :

Illustration 1: BLOOD SUPPLY & NERVE SUPPLY OF PINNA





SKIN :

The skin of the auricle adheres tightly to the underlying cartilage and contains less subcutaneous tissue. The posterior/medial ear has more subcutaneous tissue, has a rich blood supply, and is more loosely tethered to the framework.

CARTILAGE:

The external ear contains a single piece of elastic cartilage with closely adherent perichondrium. The upper two thirds of the ear contain cartilage; the lower third (lobule) is absent of cartilage. The cartilage recieves its nutrients directly from its overlying perichondrium.

MUSCLES :

The auricle is connected to the scalp by 3 extrinsic muscles: the anterior, superior, and posterior auricular muscles. They have become vestigial and have no function.

Auricularis anterior – stretches between epicranial aponeurosis

and helix.

Auricularis superior arises from epicranial aponeurosis and attached to the upper part of the internal surface of auricle.

Auricularis posterior – stretches between the mastoid process and the posterior aspect of the internal surface of the pinna.

Intrinsic muscles have both their attachments in the pinna itself. They are helicis major, helicis minor, tragicus, antitragicus, transverse auriculae and oblique auriculae.

LIGAMENTS:

The anterior ligament extends from the tragus to the root of the zygomatic process of the temporal bone. The posterior ligament passes from the posterior surface of the concha to the lateral surface of the mastoid process.

BLOOD SUPPLY :

The rich blood supply to the auricle consists of interconnections between

1) Posterior auricular artery (PAA) ,

2) Superficial temporal artery (STA),

3) Occipital artery.

The PAA supplies most of blood to the anterior ear. The STA gives off an auricular branch just anterior to the tragus.

Venous drainage is brought about by the corresponding veins.

LYMPHATIC DRAINAGE:

Lymph vessels of the ear end in the Preauricular, Postauricular and upper deep cervical nodes.

NERVE SUPPLY :

The auricle also has a rich nerve supply, which is made up of

multiple cranial nerves as well as branches of the cervical plexus.

The **greater auricular nerve** supplies most of the auricle, from the posterior/medial aspect to the anterior/lateral lobule, helix, and antihelix.

The **auriculotemporal nerve** is a branch of the mandibular division of the trigeminal nerve (CN V3), which supplies the tragus, helical crus, and skin superior to the auricle.

The **lesser occipital nerve** supplies skin posterior to the auricle.

Cranial nerves **(CN) VII and X** supply most of the innervation to the cavum conchae and posterior external auditory canal arising from the middle ear.

SURGICAL PRINCIPLES

ETIOLOGY OF ACQUIRED PINNA DEFECTS :

1. Trauma – (simple / composite defects / pinna loss) due to road traffic accidents , human bites, dog bites, assault, blunt trauma, Burns .

2. Tumour –

   Benign

   Malignant -Basal cell ca., melanoma, squamous cell ca.

3. Infections.

CLASSIFICATIONS AVAILABLE FOR ACQUIRED PINNA DEFECTS

A. TYPE I CLASSIFICATION

1.	CENTRAL DEFECTS	CONCHA, ANTIHELIX, EAR CANAL , COMBINED
2.	PERIPHERAL DEFECTS	HELIX – U/3, M/3, L/3; LOBULE
3.	SUBTOTAL LOSS	SOME PORTIONS OF PINNA EXISTS
4.	TOTAL LOSS	COMPLETELY ABSENT

B. TYPE II CLASSIFICATION

1.	PARTIAL AURICULAR DEFECTS	UPPER / MIDDLE / LOWER THIRDS
2.	SUBTOTAL DEFECTS	
3.	TOTAL LOSS OF AURICLE	

C. TYPE III CLASSIFICATION

1. EXTENT OF DEFECT

Defect of cutaneous covering

With or without intact cartilage structure

Full thickness defect

2. LOCATION OF DEFECT

Helical rim – superior or lateral

Cavum conchae , triangular fossa, scapha , antihelix

Lobule

Posterior ear

PRINCIPLES OF RECONSTRUCTION :

The auricle can be divided into zones in order to better enable the surgeon to plan reconstruction. These zones are anatomical subunits that require different methods of repair.

1.The helical rim and lobule :

This creates the overall appearance of the ear compared to the opposite side. Mild defects or subtle deformities in this subunit can create the largest cosmetic asymmetry.

Therefore, care is taken in this subunit to maintain continuity, reduce step-off deformities, maintain height, and prevent profile or smooth line abnormalities. Flap cover with or without cartilage has to be provided to get aesthetically pleasing results.

2. The antihelix and antitragus :

These complex cartilage folds give structure to the ear support. Losing cartilage in this region has the probability to produce lop-

ear deformities, cauliflower ear, and changes in protrusion of the helical rim. Hence flaps with cartilage support has to be provided in this regional defects.

3. The conchal bowl or cavum conchae :

It offers little to the shape, support or size of the ear. Cartilage in this subunit can be used as grafts in reconsruction of ipsilateralor contralateral defects . Hence soft tissue cover alone is needed for this regional defects.

The relationship of the periauricular skin and postauricular sulcus should be preserved with reconstructive efforts. Thin and well-vascularized skin is a necessity. Hence scar tissue, poorly vascularized tissue, and noncompliant skin must be replaced with flaps or full thickness skin grafts.

There are two reconstructive options -

1.To have the ear rebuilt from patient's own tissues (autogenous ear reconstruction) or

2.To have a prosthetic or false ear anchored to the bone by titanium fixtures.

Anesthesia

Local anesthesia or regional blocks are the mainstay for surgical treatment of the auricle. General anesthesia is offered as needed for patient comfort (ie, children), extended length of procedure and complex reconstructions. Complete regional anesthesia requires infiltration of local anesthetic (commonly, 2% lidocaine with 1:100,000 epinephrine) circumferentially around the auricle in the subcutaneous plane.

The great auricular nerve can be located in the postauricular sulcus and infiltration anesthetizes the medial aspect of the auricle as well as contributions to the lobule, helix, and antihelix. The auriculotemporal nerve approaches anterior to the tragus, where a wide infiltration anesthetizes the tragus, helical crus, and the superior-lateral portion of the auricle.

If the conchal bowl need be addressed, additional agents must be infiltrated widely around the posterior portion of the external auditory

meatus, thus anesthetizing sensory branches of CN VII and X.

General treatment principles:

The ear must be cleansed thoroughly with iodine-containing solutions.

Debride and remove any foreign body .

Irrigate with large quantities of sterile saline.

The perichondrium is sutured with small absorbable sutures (5-0, 6-0 monofilament).

The skin is then closed with nonabsorbable suture (5-0, 6-0 nylon).

Use vertical mattress sutures on the helical rim to prevent notching.

Daily cleaning recommended.

Mastoid dressing, bolster dressing and suction drains as required to prevent hematoma or seroma.

Use a broad-spectrum antibiotic for 1 week.

Sutures can be removed between 7 to 14 days.

Specific Techniques

MANAGEMENT OF PINNA DEFECTS :

RECONSTRUCTIVE OPTIONS :

1. Primary closure

2. Skin grafts

3.Local and regional flaps

4.Chondrocutaneous flaps

5. Replantation

PLANNING : Pre operative planning is the key to get better results. Template of the pinna defect made and defect is quantified by comparing with the other pinna or with same age and stature person's pinna.

Cartilage grafts can be harvested from Concha (ipsilateral/ contralateral side), Rib cartilage or from the amputated pinna itself.

TREATMENT :

1. PRIMARY CLOSURE :

Simple lacerations can be closed in a single layer with or without a bolster dressing.

In Complex lacerations involving cartilage,multiple-layered closures including perichondrium are required with a bolster dressing. These injuries do not have missing skin or cartilage in the defect. Small skin defects of helical rim can be closed primarily by recruiting skin from the medial side by means of undermining and advancement.

Small defects may be amenable to primary closure once the defect has been converted to a full-thickness wedge excision.

Small defects in the helix or antihelix less than 1.5cms are best treated with wedge excision and primary closure .Defects between 1.5cm and 2cms involving the helix or antihelix may be reconstructed by using a composite graft from the contralateral ear.

PRIMARY SUTURING IN LAYERS :

2. SKIN GRAFTS[9]:

Cutaneous defects of the adherent lateral auricular surface are best treated with skin grafts provided there is intact perichondrium. The contralateral postauricular skin can serve as a full-thickness skin graft donor site.

When lateral perichondrium is lost due to the nature of the defect, the cartilage may be removed if it is not a determinant of auricular shape, and the full-thickness skin graft can be placed on the medial perichondrium or medial skin.

3. LOCAL AND REGIONAL FLAPS:

Local flaps provide excellent aesthetic camouflage in most auricular defects, because of their optional match with surrounding tissue in terms of texture, colour and thickness.

Postauricular and preauricular areas have relative tissue excess that may be used for flap harvesting.

Many local flaps are available for repair of full-thickness auricular loss. Vascular supply must be maintained and decreased tension with closure is necessary for viability.

All flaps used to reconstruct the auricle must provide cutaneous coverage and maintain auricular structure including form and size.

Options for Reconstruction based on Location

HELICAL DEFECTS :

UPPER THIRD DEFECTS

- Defects < 2 cm
    - Antia-Buch chondrocutaneous advancement flap, Composite grafts
- Defects > 2 cm
    - Staged tube flap from postauricular skin, Converse tunnel procedure, Banner flap, Cartilage framework covered with Temporoparietal fascial flap. A full-thickness skin graft is then placed over the flap and a bolster dressing is applied.

MIDDLE THIRD DEFECTS -

Composite graft

Staged tube flap

Antia-Buch chondrocutaneous advancement flap

Converse tunnel procedure

Mastoid flap

Scaphoid fossa and triangular fossa of the antihelix .

Defects < 2 cm

- primary closure

Defects > 2 cm

- a composite graft may be taken from the contralateral ear

Antihelix defects, middle third

Composite grafts, advancement flaps, and transposition flaps

Tragus and helical crus

Cartilage grafts covered with Preauricular skin flaps

Conchal bowl, cavum conchae

Local skin flaps , skin graft

For composite defects - local advancement flaps with skin grafting

For defects involving two or more regions, staged reconstructions using rib cartilage and flap cover needed.

Lobule defects :

- Two flap technique of Converse[18]

- Lateral neck skin flaps – Zenteno Alanis[33]

- Auriculomastoid flap – Brent[40]

- Post auricular flaps[29]

– Preauricular flaps

Cleft ear lobe /Large Ear lobe hole :

- Primary suturing after freshening the edges,

- Pardue skin flap [37]

- Turn over flap technique

- Advancement flap with Z plasty

SUBTOTAL & TOTAL LOSS OF PINNA :

Replantation

Reconstruction with autogenous rib cartilage in stages (as in Microtia)

Prostheses implantation

COMPLICATIONS:

Complications with auricular reconstruction include infection, hematoma, scarring, keloid formation and poor cosmetic outcome. When the auricular cartilage is involved in the injury or the repair, the risk of peichondritis and chondritis can occur.

Surgical techniques :

1. Bipedicled tubed flap: [13,21]

This flap is used to reconstruct helical rim defects such as those that typically result after burn injuries. It consists of raising a strip of

postauricular skin alongside the defect that is long enough to cover the helical defect . It is left attached at both ends as a bipedicled flap. Then the flap is detached from one end and sutured to the corresponding helical edge. Later the opposite border is detached and inset to its corresponding edge.

Disadvantages associated with this reconstruction include multiple stagings.

BIPEDICLED TUBED FLAP FOR HELIX & LOBULE RECONSTRUCTION

2. Banner flap:

This flap consists of supra-auricular skin based on the auriculocephalic sulcus used to reconstruct upper third auricular defects. The raised skin is folded over the defect. This flap first was described by Crikelair [24] and can be used with a small cartilage graft to ensure structural stability .

3. Tunnel procedure:

This technique was proposed by Converse[18] in 1958 for correcting upper and middle helical defects. It uses a cartilage graft shaped to the size of the helical defect tunneled underneath the skin of the mastoid area and joined to corresponding ends of the defect . In a second stage, the auricle is seperated with the tunneled graft from the mastoid area which gives the required reconstruction. Donar site covered with skin graft.

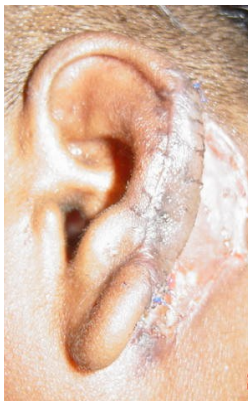
4. Mastoid flap:

Also termed the postauricular attachment technique, this

technique is used to correct broad defects involving the middle auricular margin. In the first stage, the postauricular skin parallel to the axis of the defect where the edge of the defect meets the postauricular skin is incised. The anterior auricular skin is sutured to the postauricular skin on the posterior edge of the incision and posterior auricular skin is sutured to the anterior edge of the incision. In the second stage, the posterior auricular skin needed to fill the defect is incised and sutured to the pinna. A skin graft usually is needed to cover the resulting mastoid and postauricular area defect.

HELIX DEFECTS : MASTOID FLAP





RECONSTRUCTION USING RIB CARTILAGE GRAFT (TUNNEL PROCEDURE)


Chondrocutaneous flaps :

Antia-Buch[16] chondrocutaneous advancement flap:

This flap is used for the reconstruction of helical defects of 2 cm diameter or less . In this technique, a wedge excision is combined with a chondrocutaneous helical flap based on posterior auricular skin and perforating branches from the PAA. The flap is rotated and advanced along the intact conchal cartilage and the opposing margins sutured together.

The success of this technique depends on freeing the entire helical flap from the scapha and on undermining the posterior auricular skin superficial to the perichondrium. A V-Y advancement of the helical root can supply additional length.

Argamoso and Lewin[17] modified the Antia-Buch flap for use in middle-third helical reconstructions using a combination of superiorly based and inferiorly based chondrocutaneous flaps rotated together at the site of a wedge excision or defect.

Disadvantage – This procedure results in the reduction of the size of the ear.

The temporoparietal fascial flap (TPFF) [28]:

The temporoparietal fascia is the most superficial fascial layer beneath the subcutaneous fat and above the deep temporal fascia in the temporal region and is continuous with the superficial musculoaponeurotic system (SMAS) inferiorly and the galea superiorly.

The superficial temporal artery supplies this area of the scalp and maintains a consistent posterior branch on which the temporoparietal fascial flap (TPFF) is normally based.

The TPFF is harvested through a temporal extension of a preauricular facelift incision. The fascia is incised along the periphery of the dissection to match the dimensions of the defect.

The flap can then be transposed or turned down and sutured to the periphery of the cutaneous defect. A split-thickness skin graft can then be applied to the TPFF.

SUBTOTAL AND TOTAL LOSS OF PINNA:

Auricular injury involving sub-total or complete amputation needs a more complex reconstruction.

Mladick and Baudet Techniques :

In 1971, Mladick[2,3,4] et al proposed the principle of a retroauricular pocket for non-microsurgical replantation.

The amputated part was completely deepithelialized, followed by anatomic reattachment and burial in a retroauricular pocket. A second stage procedure involved elevation of the replanted cartilage from the retroauricular pocket and split-thickness skin grafting.

In 1972, Baudet[7] et al reported a case of ear replantation where the posterior pinna skin is excised from the amputated portion of the auricle, fenestrations are made in the cartilage to allow improved vascular access to the anterior pinna skin, and a postauricular skin flap is elevated. The anterior skin is then sutured to the amputated stump and to the postauricular flap.

After three months, the ear is elevated and the postauricular area is reconstructed with a split-thickness skin graft.

Brent modified the above technique by making fenestrations in between the helix and antihelix, thereby preventing the puched out appearance deformity .

Microvascular Techniques [19,20]

Arterial anastomosis makes use of the primary supplying branches off of the external carotid which are the superficial temporal artery and the posterior auricular arteries. Venous anastomosis is also important and is often more difficult than arterial anastomosis.

Microsurgical replantation of the ear is technically challenging, but it allows for a single procedure option for auricular reconstruction. A more natural appearing pinna usually results with this technique compared to other techniques for auricular reconstruction.

Important **prerequisites** for successful replantation include short ischemic intervals, appropriately preserved amputated parts (in saline on ice), and compliant patients.

Disadvantages – Technically demanding, longer duration and expensive equipments needed.

ALLOPLASTIC RECONSTRUCTION:

Alloplastic implants made of polyethylene , silicone or polyethylene are used instead of the costal cartilage. The porous polyethylene implant can be easily shaped,sterilized, and implanted underneath appropriate soft tissue coverage. This implant allows for tissue ingrowth into the material which anchors it into position and provides resistance to infection.

Advantages include widespread availability, consistent predetermined shape and shortened operating time, minimized donor site morbidity, precise creation of a complex structure.

Disadvantages are increased risk of infection, extrusion, and uncertain long-term durability.

AURICULAR PROSTHESES

Osseointegrated percutaneous implants is a solution for older patients and in instances in which surgical reconstruction is impractical or contraindicated. Prostheses lack the warmth and texture of autogenous reconstructions, wear and tear and needs replacement.

LOBULE DEFECTS:

TWO FLAP TECHNIQUE OF CONVERSE:

Flaps to reconstruct the lobule defect is elevated on the posteromedial aspect of the auricle and in the retroauricular area Each of the flaps is sutured to an edge of the vertical incision, thus anchoring the new earlobe. The two flaps are sutured to each other.

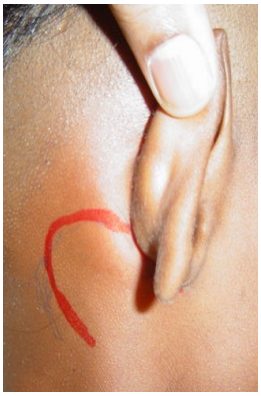
AURICULOMASTOID FLAP [40]– BRENT:

The flap is elevated from the mastoid region as a curtain from the inferior auricular border. The flap is folded under and sutured.

Mastoid defect is covered with a skin graft.

LOBULE DEFECTS RECONSTRUCTION

POSTAURICULAR FLAP:



TORN EAR LOBE REPAIR:

STRAIGHT LINE REPAIR:

Ear lobe repair consists of excising the skin of the opposing surfaces of the cleft and approximating the two sides with or without a small Z-plasty within the suture line.

TURN OVER FLAP TECHNIQUE:

Two flaps are elevated , one based on anterior side of the cleft edge and other on the posterior side of ear lobe. Both flaps are turned out through the ear hole and sutured to the edges.

TURN OVER FLAP TECHNIQUE:

PARDUE REPAIR [37]:

Earlobe repair with preservation of the ear ring opening done by raising a small superiorly based transposition flap at one side of the cleft and suturing the distal end of the flap to the opposite side such that the suture line is not dependent area of the perforation.The raw areas of the cleft are approximated with or without a Z-plasty.

This technique provides a skin lined canal for a new earring opening, thereby avoiding the need for a new perforation of earlobe.

STRAIGHT LINE REPAIR AFTER FRESHENING THE EDGES:




PARDUE REPAIR:




OBSERVATION & RESULTS

1. Total number of patients operated following RTA, burns, infection, tumour is 120 (Ears - 145)

   Side:

   Right ear - 44

   Left ear - 51

   Bilateral - 25

   Sex:

   Males - 104

   Females - 16

2. No. of cases operated for large earlobule hole is 40.

   (Earlobules - 75)

   Side:

   Bilateral - 35

   Right ear lobule - 4

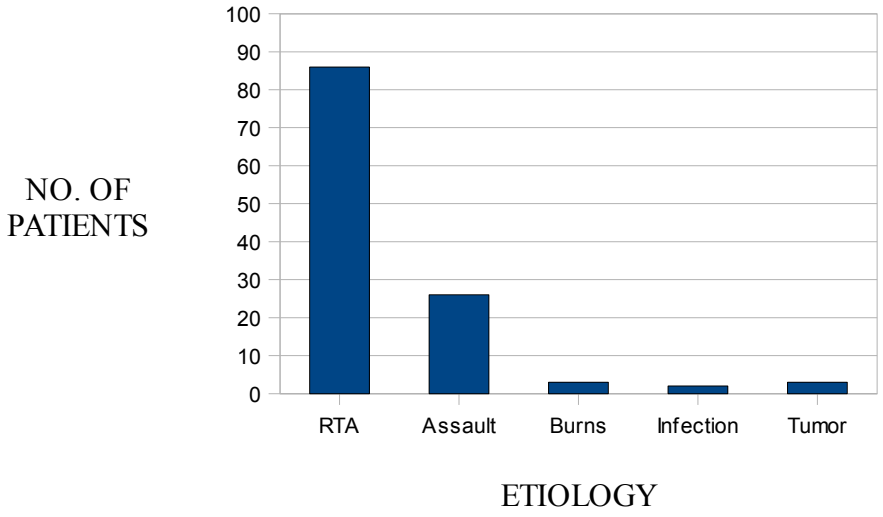
   Left ear lobule - 1

   All are female patients.

ETIOLOGY:

Etiology		No. of patients	
1. Road traffic accidents	-	86	(71.6%)
2. Assault	-	26	(21.7%)
(Human bite – 14)			
(Other reasons – 12)			
3. Burns sequelae	-	3	(2.5%)
4. Infection sequelae	-	2	(1.7%)
5. Tumour (Benign)	-	3	(2.5%)
(Naevus - 2)			
(Pyogenic granuloma- 1)			

This study shows that road traffic accidents is the main etiology for pinna injuries in 120 patients.



AGE INCIDENCE:

Below 15 years - 9 cases

16 – 30 years - 50

31 - 45 years - 33

46 – 60 years - 19

Above 61 years - 9

Mostly the active, working groups between 16 to 45 years of age are predominantly affected.

PINNA DEFECTS:

Pinna injuries without tissue loss - 105

with skin loss alone - 5

with composite defects - 35

helix defects alone - 18

helix & antihelix - 6

subtotal loss - 6

Lobule defects - 4

conchal defect - 1

SURGICAL PROCEDURES:

Wound debridement & Primary suturing - 105

Skin grafts - 5

Split skin grafting - 3

Full thickness skin graft - 2

Flap cover

Postauricular flaps without cartilage graft - 20

Helix defect - 16

(upper third - 6 ; middle third - 10)

Superiorly based PA flap - 5

Inferiorly based PA flap - 3

Bipedicled tubed flap - 4

Mastoid flap - 4

Lobule defect - 4

PA flap - 2

Auriculomastoid flap -1

Bilobed flap -1

Conchal perforation closure - 1

(Conchal skin turn over flap & skin graft)

Flaps with cartilage support - 12

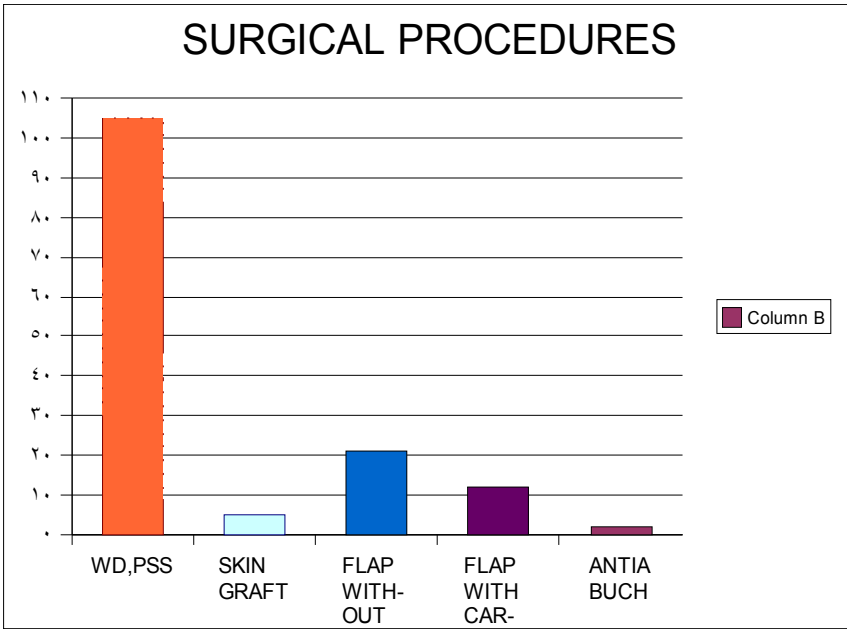
Converse tunnel procedure - 6

(For combined Helix & Antihelix defects)

Complete reconstruction (as for Microtia)- 6

(for subtotal & total pinna defects)

Antia Buch's Chondrocutaneous flap - 2



COMPLICATIONS:

Wound Infection	- 6
Hematoma	- 1
Flap necrosis (partial)	- 3

EAR LOBULE REPAIR:

SURGICAL TECHNIQUE	- No. of ear lobules
Straight line repair (Edges freshening & repair)	- 41
Turn over flap technique	- 14
Pardue technique	- 16
Repair with Z plasty	- 4
Total	- 75

Complications:

Notching - 2 cases In straight line repair method.

DISCUSSION

An analysis of the study resulted in the following points .

AGE:

In this study the age of the patients varied from 5 years to 70 years with the mean age of 35 years.

In ear lobule repair cases, age varied from 22 years to 66 years with the mean age of 44 years.

SEX:

Nearly 85% of the operated cases were males in pinna injuries patients.

All patients who underwent ear lobule repair were females. This is due to the usage of heavy ear rings or accidental pulling of earrings in females.

ETIOLOGY:

Road traffic accidents continue to be the major cause of pinna defects. Males may be more commonly affected owing to the high incidence of road traffic accidents and alcohol ingestion.

A better adherence to traffic rules, banning drunken driving could decrease the incidence of these injuries.

Other etiologies being assault, human bites.

All patients who underwent ear lobule repair were females. This is due to the usage of heavy ear rings or accidental pulling of earrings or abnormal perforation sites in females.

SITE:

In patients presenting with composite defects, helical defects were predominant involving upper and middle thirds.

PHASE OF RECONSTRUCTION:

Most of the cases were operated on the same day of injury. About 72.4% of pinna injuries needed only wound debridement and primary suturing.

Cases with composite defects of pinna which did not need cartilage framework were subjected to first stage of reconstruction on the same day after wound debridement. Patients with such composite defects of Pinna involving helix and antihelix needed 2 stages of reconstruction, with an interval of 1 month in between each stage

Only 11% of cases were reconstructed using cartilage grafts.

These cases needed 2 or 3 stages for complete reconstruction with an interval of 2-3 months.

All the ear lobules repaired in single stage.

COMPLICATIONS:

The overall incidence of complications in this series was 6.9% of pinnas.

Infection was the most common complication involving 5 pinnas (4.1%). Meticulous debridement,minimal tissue handling and proper antibiotics should be done to avoid this complication.

Partial flap loss in only 3 (2%) pinna, which can be prevented by proper preoperative planning, execution and postoperative care.

In patients who underwent ear lobule repair, 2 cases developed notching in straight line repair , which can be avoided by incorporating a Z plasty in between or by doing flap technique.

CONCLUSION

- Ear reconstruction in acquired pinna defects needs proper preoperative planning, meticulous tissue handling and correct surgical techniques to achieve good results.

- In trauma, proper wound debridement and primary suturing in layers prevented multiple stages of reconstruction to reduce the morbidity to the patient.

- In Patients presenting with composite defects of Pinna, first stage of reconstruction is attempted on the day of injury, utilizing the cartilage of the damaged pinna if possible underneath the flap or banking it in a clean site. This reduces one stage of reconstruction later and also avoids the need for cartilage graft from other sites.

- Timely coverage of exposed cartilage framework of Pinna using skin grafts or with local flap cover prevented the deformities which may need multiple stages of reconstruction.
- In Burns , the damaged ears should be managed properly to

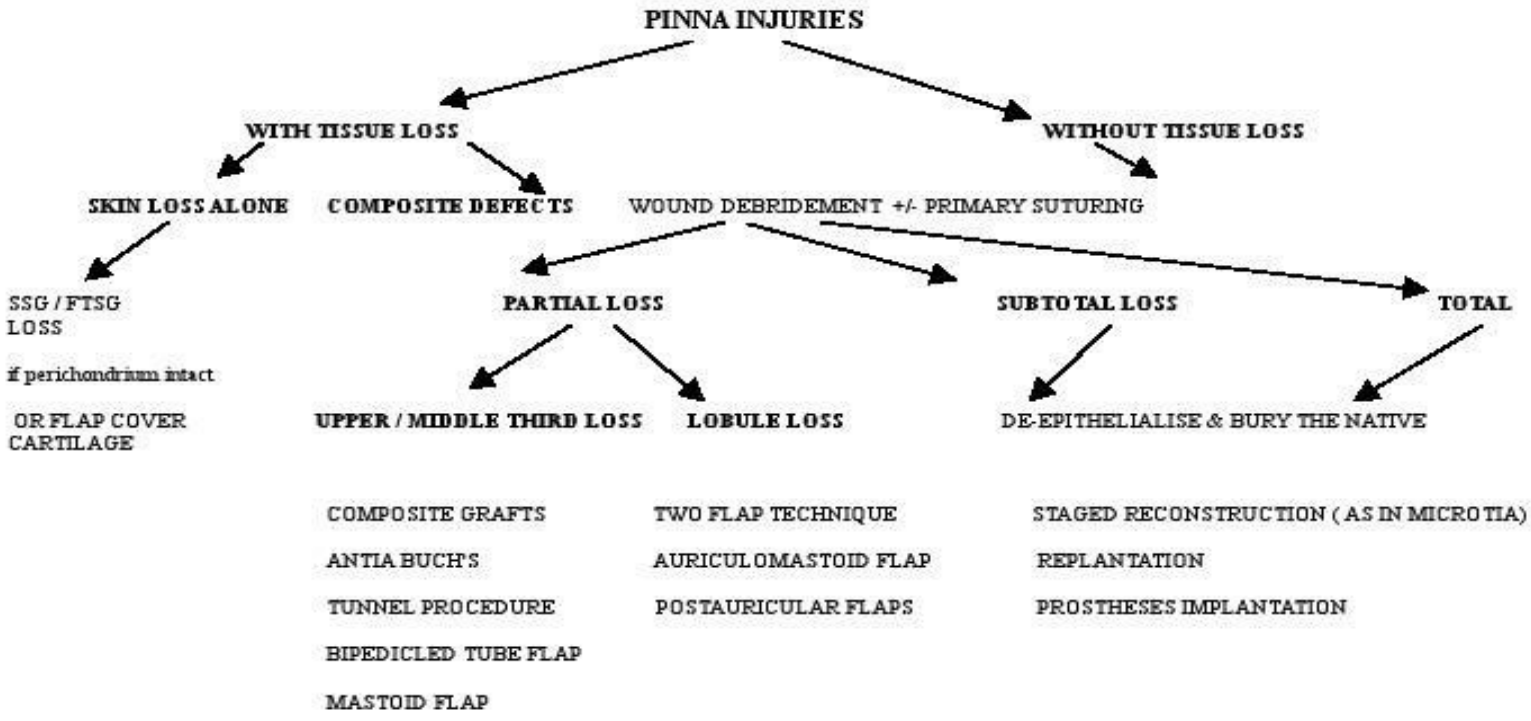
prevent infection, dessication and loss .After scar maturation, reconstruction to be attempted in stages methodically.

- In Human bites, tetanus immunization, proper debridement with suturing of skin advised initially, followed by reconstruction at a later date.

- All techniques for Ear reconstruction in our series have produced aesthetically acceptable results.

- Strict road safety measures, wearing of helmets, banning drunken driving could decrease the incidence of Road traffic accidents thereby decreasing the main etiology of Pinna injuries.

PROTOCOL FOR RECONSTRUCTION OF ACQUIRED PINNA DEFECTS



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PROFORMA

RECONSTRUCTION OF ACQUIRED PINNA DEFECTS

NAME OF PATIENT - AGE- SEX -

ADDRESS - IP NO. -

D.O.A. -

D.O.S. -

D.O.D -

COMPLAINTS -

ETIOLOGY -

ROAD TRAFFIC ACCIDENTS

HUMAN BITE

ASSAULT WITH WEAPONS

BURNS

INFECTION

TUMOUR

GENERAL EXAMINATION -

LOCAL EXAMINATION -

PINNA DEFECT :

HELIX – UPPER 1/3 , MIDDLE 1/3, LOWER 1/3

<2CMS / >2CMS

ANTIHELIX

LOBULE - DEFECT / TORN EAR LOBULE

CONCHA

COMBINATION OF THE ABOVE

SUBTOTAL / TOTAL LOSS

DIAGNOSIS -

TREATMENT PLAN -

1.

2.

INVESTIGATIONS -

Hb,

B.Sugar, Urea, Creatinine,

BT, CT

ECG

X Ray Chest – PA

Anaesthesia - GA/LA

SURGERY -

Postoperative period -

Complications -

Results - Satisfactory / Unsatisfactory

Follow up -2 weeks , 1 month, 2 months

MASTER CHART

No.	Age/sex	P.S No	Etiology	Injury	Surgery	stages	Comp.
1	22/M	1474/05	RTA	Avul- R	WD,PS	1	-
2	25/M	1497	RTA	Lac- R	WD,PS	1	-
3	27/M	1521	Burns	ST loss	Staged reconstn.	3	-
4	25/F	1540	Pyo.gr	Benign	Excision,PS	1	-
5	33/M	1412	PT	Conc.Perf	Conc. Skin Flap	1	-
6	45/M	1540	RTA	Lac-L	WD,PS	1	-
7	55/M	1575	RTA	Lac-L	WD,PS	1	-
8	60/M	1577	RTA	Lac-R	WD,PS	1	-
9	33/M	1620	RTA	H.Loss-L,m/3	Bipedicled tube flap	3	-
10	18/M	1457	RTA	Lac-L	WD,PS	1	-
11	25/M	1497	RTA	Lac-R	WD,PS	1	-
12	45/M	1540	RTA	Lac-L	WD,PS	1	-
13	25/M	1681	RTA	Lac-L	WD,PS	1	-
14	70/M	1715	RTA	Avul-R	WD,PS	1	-
15	54/M	950	RTA	Lac-R,L	WD,PS	1	-
16	26/M	973	RTA	Hloss-L,m/3	PA FLAP	2	-
17	45/M	1001	RTA	Lac-L	WD,PS	1	-
18	27/M	1002	RTA	Lac-R	WD,PS	1	-
19	45/M	1064	RTA	Lac-RL	WD,PS	1	-
20	8/M	02/06	RTA	Lac-L	WD,PS	1	-
21	50/M	99	RTA	Lac-L, loss m/3	WD,PA flap	1	+
20	30/M	120	RTA	Lac-L	WD,PS	1	-
23	24/M	147	RTA	H.Loss-R,u/3	PA Skin Flap	2	-
24	70/M	460	RTA	Avul-R	WD,PS	1	-
25	21/M	755	RTA	Avul-L	WD,PS	1	-
26	30/M	829	RTA	Lac-R	WD,PS	1	-
27	32/M	1105	RTA	C.Avul-R	Staged reconstn.	3	-
28	10/M	1200	RTA	Avul-R	WD,PS	1	-
29	45/M	1239	RTA	Lac-L	WD,PS	1	-
30	25/M	1375	RTA	Lac-L	WD,PS	1	-
31	68/M	1432	PT	Sloughbil.,m/3	WD,PA flap	1	+
32	42/M	1724	RTA	Lac-L	WD,PS	1	-
33	25/M	1725	RTA	Lac-R	WD,PS	1	-
34	20/M	1775	RTA	Avul-L	WD,PS	1	-
35	70/M	1807	RTA	Lac-R	WD,PS	1	-
36	13/F	1267	PT	Lobule loss R	Auriculomastoid flap	1	-
37	24/M	1249	Infn.	ST loss	Staged reconstn.	3	-
38	65/M	1862	RTA	H loss R,m/3	WD,PA flap	1	
39	40/M	1957	RTA	Lac-R,L	WD,PS	1	-
40	40/M	1805	RTA	Avul-R	WD,PS	1	-
41	24/F	1799	Burns	H loss L,m/3	Tubed arm flap	3	-
42	5/M	1841	RTA	Lac-R	WD,PS	1	-
43	22/M	2098	RTA	Lac-L,skin loss	WD,PA flap	1	+
44	45/M	2127	RTA	Lac-R	WD,PS	1	-
45	34/M	2322	Assault	Lac-L	WD,PS	1	-
46	30/M	2244	RTA	H,AHLoss-L	Converse proc.	1	-
47	42/M	2347	RTA	Lac-R	WD,PS	1	-
48	28/M	2219	RTA	Lac-L	WD,PS	1	-
49	25/F	2307	PT	Lob.lossR	PA flap	2	-
50	34/F	2316	RTA	Lac-L	WD,PS	1	-
51	29/M	2303	Assault	Lac-R	WD,PS	1	
52	20/M	2376	RTA	Lac-L	WD,PS	1	-
53	28/M	2419	RTA	Avul-L	WD,PS	1	-
54	40/M	2903	H.bite	ST loss L	Converse proc.	3	-
55	21/M	2968	RTA	Lac-L	WD,PS	1	-

56	15/M	2958	Burns	STlossL	Staged reconstructn	1	-
57	55/M	2978	RTA	Skin Loss	WD, FTSG	1	-
58	40/M	3035	RTA	STAvul.R	WD,PS	1	+
59	70/M	3170	RTA	Lac-L	WD,PS	1	-
60	4/F	3173	RTA	STAvul.R	WD,PS	1	+
61	24/M	3193	RTA	Skin Loss-R	WD,SSG	1	-
62	31/M	3224	RTA	Lac-R	WD,PS	1	-
63	20/M	3323	RTA	Lac-R,L	WD,PS	1	-
64	27/M	3429	RTA	Lac-L	WD,PS	1	-
65	40/M	3559	Assault	H,AH Loss R	WD, Converse procedure	2	-
66	30/M	3609	RTA	Lac-R	WD,PS	1	-
67	18/F	48/07	Infn.	H Loss R	WD,PA flap	3	-
68	60/F	277	RTA	Lac-R	WD,PS	1	-
69	36/M	3610/06	PT	HLoss R,u/3	PA flap	2	-
70	68/F	376/07	RTA	Skin loss	WD,SSG	1	-
71	42/M	387	RTA	Lac-L	WD,PS	1	-
72	22/F	577	PT	H,AHLoss R	Converse procedure	2	-
73	39/M	598	RTA	HLoss L,m/3	Antia Buch	1	+Infn.
74	20/M	727	RTA	Lac-L	WD,PS	1	-
75	27/M	1143	RTA	Lac-L	WD,PS	1	-
76	23/M	988/06	PT	HLoss L	Antia Buch	1	-
77	26/M	1458/07	Assault	Lob lossR	Bilobed flap	1	-
78	35/F	1673	RTA	Lac-L	WD,PS	1	-
79	40/M	1987	RTA	SkinlossL	PA Flap	2	-
80	25/F	2183	PT	HLoss L, m/3	Bipedicled PA flap	3	-
81	54/M	2807	PT	HLoss R,m/3	PA flap	2	-
82	25/F	3012	RTA	Lac-R,L	WD,PS	1	-
83	32/M	3215	RTA	Avul-R	WD,PS	1	+
84	25/M	3613	RTA	T.Avul.L	WD,Staged reconstn	4	-
85	23/M	2467	RTA	Lac-L	WD,PS	1	-
86	10/F	2532	RTA	Lac-L	WD,PS	1	-
87	26/M	2738	RTA	Avul-L	WD,PS	1	-
88	50/M	2812	Assault	Lac-L	WD,PS	1	-
89	48/M	2869	Assault	Lac-R	WD,PS	1	+Infn.
90	33/M	3078	RTA	Lac-Bil.	WD,PA flap- R	1	-
91		3098	RTA	Lac-L	WD,PS	1	-
92	51//M	3189	H.bite	H,AH Loss	WD, Converse proc.	3	-
93	30/M	3245	Assault	Lac-L	WD,PS	1	-
94	27/M	3383	RTA	T.Avul-L	WD,Staged reconstn.	4	+Infn.
95	78/M	3457	Tumour	Naevus	Excision,FTSG	1	-
96	50/M	3531	RTA	Lac-R	WD,PS	1	-
97	45/M	3695	RTA	Lac-Bil.	WD,PS	1	-
98	30/M	3722	RTA	Avul-L	WD,PS	1	-
99	24/M	3832	Assault	Lac-L	WD,PS	1	-
100	35/F	3907	RTA	Lac-L	WD,PS	1	-
101	26/M	3944	RTA	STLoss-R	WD,Staged reconstn.	4	-
102	23/M	75/08	RTA	Lac-L	WD,PS	1	-
103	45/M	108	H.bite	H,AH L	WD,Converse proc.	3	-
104	50/M	118	RTA	Avul-R,loss u/3	WD,PA Flap	2	-
105	40/M	135	RTA	Avul-L	WD,PS	1	-
106	46/F	137	RTA	Skin Loss-L	WD,SSG	1	-
107	28/M	355	RTA	Lac-R	WD,PS	1	-
108	28/M	391	RTA	Avul-L	WD,PS	1	-
109	20/M	393	RTA	Avul-R	WD,PS	1	-
110	50/M	62	RTA	Skin loss Bilateral	WD,SSG	1	
111	28/M	412	Assault	Lac-L	WD,PS	1	--
112	50/M	650	RTA	Avul-R, u/3	WD,PA flap	2	-
113	40/M	542	RTA	Lac-L	WD,PS	1	-
114	27/M	726	RTA	Lac-R	WD,PS	1	-
115	35/M	99	RTA	Lac-L	WD,PS	1	-
116	35/M	929	RTA	Lac-L,skin loss	WD,SSG	1	-

117	35/M	1045	Assault	Lac-Bil	WD,PS	1	-
118	34/M	1163	RTA	Avul-bil	WD,PS	1	-
119	35/F	1279	Tumour	Naevus L	Excision&PS	1	-
120	26/M	1186	RTA	Lac- L	WD,PS	1	-

KEY:

R – Right, L- Left RTA – Road traffic accident

Lac. – Laceration Avul. – Avulsion

H – Helix, AH – Antihelix

Lob. – Lobule WD,PS – Wound debridement, Primary suturing

H.Bite – Human bite, P.N. – Partial necrosis of flap

EAR LOBULE REPAIR - MASTER CHART

No	Age/sex	PS No	Ear	SURGERY	COMP.
1	45/F	435/06	Bil.	Straight line repair	-
2	52/F	536	Bil.	Straight line repair	-
3	63/F	622	Bil.	Straight line repair	-
4	39/F	786	Bil.	Turn over flap repair	-
5	55/F	945	Bil.	Straight line repair	-
6	56/F	1005	Bil.	Straight line repair	-
7	48/F	1225	R	Turn over flap repair	-
8	58/F	1465	Bil.	Straight line repair	-
9	42/F	1798	Bil.	Straight line repair	-
10	22/F	1995	Bil.	Pardue repair	-
11	40/F	2065	Bil.	Straight line repair	-
12	31/F	556/07	Bil.	Straight line repair	-
13	22/F	2561	Bil.	Pardue repair	-
14	38/F	502	Bil.	Straight line repair	-
15	34/F	556	Bil.	Straight line repair	-
16	32/F	1149	Bil.	Turn over flap repair	-
17	56/F	1151	R	Straight line repair	+notching
18	42/F	2044	Bil.	Straight line repair	-
19	35/F	2311	Bil.	Turn over flap repair	-
20	49/F	2369	Bil.	Straight line repair	-
21	35/F	2780	Bil.	Straight line repair	-
22	24/F	3031	Bil.	Pardue repair	-
23	45/F	1523	Bil.	Straight line repair	-
24	32/F	1117	Bil.	Turn over flap repair	-
25	60/F	2105	R.	Turn over flap repair	-
26	37/F	2463	Bil.	Straight line repair	-
27	45/F	2607	Bil.	Straight line repair	+notching
28	36/F	2605	Bil.	Pardue repair	-
29	58/F	2062	Bil.	Straight line repair	-
30	53/F	2887	Bil.	Z plasty repair	-
31	52/F	2967	Bil.	Straight line repair	-
32	70/F	3331	Bil.	Straight line repair	-
33	28/F	3525	Bil.	Pardue repair	-
34	55/F	3936	Bil.	Z plasty repair	-
35	58/F	436/08	Bil.	Straight line repair	-
36	36/F	1280/08	Bil.	Pardue repair	-
37	34/F	1328/08	L	Pardue repair	-
38	66/F	3139/07	Bil.	Turn over flap repair	-
39	29/F	3710/07	Bil.	Pardue repair	-
40	48/F	1143/08	R	Pardue repair	-