

How to Evaluate an Acquired Ear Deformity

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Abstract

Trauma and tumor are the most common causes of acquired ear defects that surgeons are frequently called on to treat. Trauma may result in hematoma or laceration of the ear. In addition, both trauma and tumor excision may result in skin or cartilage loss.

Keywords: Acquired ear deformity; Trauma.

INTRODUCTION

Acquired ear deformities present unique and varied problems which tax the ingenuity of the plastic surgeon. Case individualization is necessary, and a systematic assessment of the residual tissues is a requisite when planning an appropriate reconstruction. Trauma and tumor are the most common causes of acquired ear defects that surgeons are frequently called on to treat.¹ Trauma may result in hematoma or laceration of the ear. In addition, both trauma and tumor excision may result in skin or cartilage loss. Cases performed by one surgeon have been used to demonstrate the evaluation of acquired ear deformity.

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MATERIALS AND METHODS

This template of evaluation was made after going through standard text books in plastic surgery and extensive Google search. The common acquired ear deformities were trauma, hematoma, laceration, tumor of the ear. The demonstrated template is a case of tumor of the ear. It's an example of template to show how to evaluate a case of acquired ear deformity.



INTRODUCTION

Before starting history or examination first introduce the patient under following headings:

- Name:
- Age:
- Gender:
- Occupation:
- Address
- Education status
- Known Comorbidities

Patient might come to emergency or out patient department with following acquired deformities possible:

1. Only deformity

- Closed injury of the ear due to blunt injury, contusion, fall, assault, burn (flame, radiation, scald, chemical, flash type of electrical, frost bite), tumor etc.
- Open injury of ear which healed: piercing of ear, laceration, abrasion, stab injury, avulsion, assault, surgery, bite, heavy earrings etc.
- Infection – Exogenous: Due to
 - Bacteria (Staphylococcus, streptococcus, pseudomonas/mixed) leading to cellulitis, malignant otitis externa
 - Fungal: Candida
 - Viral: Herpes zoster

2. Endogenous: TB, Leprosy

- Only defect / loss
- Loss of auricular skin/ cartilage: minor traumatic injury (abrasion, avulsion), burns (thermal burns, scald burn, electrical burn), bite (human bite, animal bite), etc.
- Full thickness defect of auricle into six groups (less than 25% or more than 25%).
 1. Upper third defect
 2. Middle third defect
 3. Lower third defect
 4. Helical rim
 5. Ear lobe loss
 6. Total loss

Causes of full thickness loss: sharp slash, flying glass, gunshot, flame or radiation burn, human or

dog bite.

3. *Deformity with defect/loss causes are due to causes mentioned above.*

I will approach the patient under the following headings:

- Chief complaints
- History of presenting illness
- History of treatment
- History of past
- Personal history
- Family history
- Diagnosis

CHIEF COMPLAINTS

1. Unilateral/bilateral Deformity /Defect of ear since/Defect with deformity since duration.

History of Presenting Illness

Patient was apparently well duration ago, when he/she got injury/swelling/ulcer/inflammation/other causes to right/left ear, treatment given following which the deformity/defect developed.

According to the possibility if the chief complaints I will proceed in history of presenting illness.

1. History Related to Deformity only

- Detailed history of closed injury
 - History of blunt trauma, tumor, burn, irradiation.

History of blunt trauma followed by swelling: direct impact/fall.

Any external injury/swelling/hearing loss/bleeding from ears.

Ask for any history of brain/cervical spine injury.

Any history of Hearing impairment:

- History of change in shape and progress
- History of increased in size
- History of pain (nature of pain, confined/referred, intermittent/continuous pain)
- History any other associated symptoms

History of tumor in ear: Rapid/ slow growing, when first noticed, any surgery done previously, any irradiation given.

History of Burns: The Mode of burns (Thermal,

Flame, Scald, Electrical, Chemical Blast).

Duration of the contact with the source

How it was extinguished/ Contact stopped/
Any symptoms of Facial, Scalp, Neck, air way/
Inhalational Injury or Poisoning.

- What was Total Body surface area involved?

Is the sensation preserved over the ear (loss of pain is a sign of second degree deep burn or above).

2. Detailed history of open injury

History of type of injury

Time lapsed between injury and deformity

History regarding duration to heal

History of any wound which took time to heal

History of Bite: Human Bite, animal bite (If animal rule out the risk of Rabies).

- Was The wound cleaned properly?
- Was the individual previously vaccinated for Tetanus/ was given any Tetanus Toxoid or Tetanus immunoglobulin injection given now?
- Was the alleged animal vaccinated for rabies?
- Was the individual previously given any anti rabies vaccine?
- Was any prophylactic antibiotics given?

Was the wound sutured or closed previously, or was the wound left open.

History of laceration/Cut Injury: The alleged weapon, is it corresponding with the nature of the wound (Medicolegal importance).

- Was the wound cleaned properly?
- Was the individual previously vaccinated for Tetanus/ was given any Tetanus Toxoid or Tetanus immunoglobulin injection given now?
- Was any prophylactic antibiotics given?
- Was the wound sutured or closed previously, or was the wound left open
- History of Ear blockage
- History of Ear Piercing – When was it done, where was it done, how was it done, what method was used?
- Done by whom? professional/quack/ medical

- What type of pierce was used?
- When was the deformity seen after the procedure?
- History of heavy earrings
- Detailed history regarding any endogenous infection/Exogenous.

Endogenous Infection.

- *History related to leprosy*

Is there any hypopigmented patch anywhere in body with decreased sensation, decreased peripheral nerve sensations.

History of trophic ulcer in hand, foot.

- *History related to TB*

Any history of chronic cough

Any history of lymphnode enlargement

Any history of ear discharge

- *History related other infection*
 - History of abscess
 - History of pain
 - History of discharge

Exogenous Infection

- What was the infection
- How it was caused
- Where was it treated
- What treatment was taken, duration, compliant or non-compliant
- Any discharge either purulent, serous

2. Detailed history regarding only defect/loss

- History if only skin or cartilage loss
 - History of burn – as above
 - History of any RTA- abrasion or avulsion, any treatment given, when it was given.

Ask if High velocity/ Low velocity, Ask for any history of ENT bleed, Loss of consciousness, vomiting, seizures, headache, any associated injuries to chest abdomen or long bones.

Any history of Hearing impairment

- Was the wound cleaned properly?
- Was the individual previously vaccinated for Tetanus/ was given any Tetanus Toxoid or Tetanus immunoglobulin injection given now?
- Was any prophylactic antibiotics given?

- Was the wound sutured or closed previously, or was the wound left open

History related to avulsion injury

History of complete avulsion/partial avulsion

History of immediate repositioning/delayed repositioning

History of reach to hospital from time of injury

History human bite or animal bite as above

- History related to full thickness loss
 - History of any sharp slash, flying glass, gunshot, flame or radiation burn, human or dog bite, trauma.

If avulsion injury History of avulsion as given above:

- Any history of tissue repositioning and suturing or any history of attempt for replantation
- When the primary treatment done
- History time lapsed between the injury and reach to hospital
- History of any surgical resection for any tumor
- History of any discharge/any ulcer
- History of any other associated injury
- History of loss of consciousness
- History of Deformity with defect
- Ask history about the etiology as above
- History of unable to wear mask/spectacles
- History of any other injuries
- History of tendency of keloid formation

Treatment History: Treatment history based on etiology.

Treatment history for deformity:

- Any treatment of burn ear
- Previous treatment Surgical / medical
- What surgery was done
- When it was done
- What is the difference after the surgery?
- Was there any history of recurrent ear surgeries?

Defect only

- Was any skin, flap, or cartilage used for surgery previously
- Any history of skin grafting
- Any history of tumor resection

- History repositioning of avulsed ear/reimplantation
- Deformity with defect
- Treatment history as above

Past History

No past history of DM, Hypertension.

Any History of Immunocompromising conditions, bleeding disorders.

Any History of chronic Infections: Tuberculosis, Leprosy, fungal etc.

(Ask the treatment details).

Ask for any history of the ear infection.

Personal History

History of smoking, alcohol

Bowel and bladder habits

Marital status

Family History

Any history of Comorbidities, Similar illness, Keloid tendency in the family.

General Examination

Once patient received in emergency or OPD after taking the history, the general status is checked and examined.

Patient is conscious, oriented, afebrile, hydration fair, Built and nourishment.

Vitals

Pulse: Rhythm volume character, vessel wall conditions

BP: Normal or high

No Pallor/ icterus/ cyanosis/ clubbing/ lymphadenopathy/ oedema

Head to Toe Examination

Any evidence of asymmetry of the face, any external injury

any gross defect/deformity over the ear, nose, skull, chest, lower limbs

the finding of ear will be described later

Systemic Examination

Cardiovascular system: S1, S2+. No added sounds

Respiratory system: no chest wall anomalies.

Bilateral Air entry equal. Chest wall circumference:

Per Abdomen: soft, no mass palpable, non-tender

Central Nervous system: no focal neurological deficits, no evidence of facial nerve palsy

Musculoskeletal system: No spinal anomalies

Regional Examination

Regional Examination (Face) is done with adequate lighting, with patient in the sitting, lying down and standing position.

Regional examination

In the Examination of face mention shape, if face is in the midline.

On inspection of the face in frontal profile:

- Face: washed with warm saline/ water
- Cleaning of dried blood clots/scabs
- Check for presence of edema, ecchymosis, deformity, facial asymmetry.
- Bleeding areas, CS Fleak.
- Associated soft tissue injury.
 - Scalp appears normal, hairs appear normal in colour, texture and distribution, hair line appears receded.
- Lacerations & contusions.
- Depressed fracture of the skull
 - In upper third of the face (hair line to nasion): Frontal prominence is there, eye brows appear normal, temporal region appears normal.

Raccoon eyes

Middle third (nasion to subnasale): nose appears normal, upper and lower lids appear normal, inter-canthal distance appears normal, eyeball appears normal, zygomatic region appear normal.

- Bilateral circumorbital ecchymosis, gross edema 'Moon face.' Lengthening of middle third of the face 'Dish face deformity. Any swelling in medial canthal area The examination of Ear will be discussed in detail in local examination.
 - Lower third (subnasale to menton) upper and lower lips normal, chin central position, cheeks appear normal, nasolabial folds normal.
- Inspect for Asymmetry and deviation of mandible.
- Lacerations.

- Condylar depression (the condyle can be dislocated anterior to the articular eminence).
 - Functional examination of face normal frowning, eye closure, cheeks puffing, smile normal.

On inspection of the face in right lateral profile

Upper Third

Scalp: Appears normal

Temporo-parietal region: Appears normal/scarred

Forehead: Appears prominent

Eyebrow: Normal

Middle Third

Zygomatic region: Appears normal

Cheek region: Appears normal

The examination of Ear will be discussed in detail in local examination

- Check for Battle's sign.
- Ecchymosis near mastoid process
- Eyeball: Appears normal
- Eyelids: Along with lashes: Normal

Lower Third

Nasolabial angle: Appears normal

Lips: Normal

Chin: Normal projection

Cervico: Mental angle: Normal

On inspection of the face in left lateral profile

Upper third

Scalp: Appears normal

Temporo: parietal region: Appears normal

Forehead: Appears prominent

Eyebrow: Normal

Middle third

Zygomatic region: Appears normal

Cheek region: Appears normal

The examination of ear will be discussed in detail in local examination

Which will described and examined later

No bruising over mastoid region

Eyeball: Appears normal shape

Eyelids: Along with lashes: Normal

Lower Third

Nasolabial angle: Appears normal

Lips: Normal

Chin: Normal projection

Cervico-Mental angle: Normal

On inspection of the face in Posterior profile

Bilateral ear projection and cephalo-conchal angle: Normal

Occipital region appears normal

Vertex/Parietal region: Normal

Hairline and hair distribution: Normal

Neck symmetry: Normal

No ulceration, No swelling

Inspection in Bird's eye view

Scalp and hair distribution: Normal

Anterior hairline appears low set

Forehead appears prominent

Eyebrows appear normal

Eyeballs appear normal/ any exophthalmos

The nose appears in the midline, Nasal tip (position, angle, projection) and the lateral segment appear normal

Cheek regions appears normal

Zygoma and temporal region appear normal

Inspection in Worm's eye view

Mandibular region: mandible appears symmetrical both sides / not

Lips appear normal

Cheek region appears normal

Nose: tip, nostril floor, Membranous septum and lateral segment appear normal

Zygomatic region appears normal

Right ear normal size and projection

left ear appears normal in size with discontinuity in helix and normal projection

Orbital region appears normal

Frontal region appears normal with receded hair line

Palpation**Upper Third**

Scalp region: Findings of inspection confirmed

Any laceration size of laceration measured and extent

Any depression

• **Frontal region:** Findings of inspection confirmed

▪ Skin: normal

▪ No bony deformity/swelling palpable

▪ Frontalis muscle present, contraction present

▪ Frontal sinus: Normal (torch test)

▪ Sensation normal

• **Eyebrow region:** Findings of inspection confirmed

▪ Hair: normal in texture and distribution, Plucking test: Normal

▪ Supraorbital margin: Normal

▪ Sensations: Normal

▪ No tenderness

▪ No bony deformity/swelling palpable

Middle Third

• **Orbital region:** Findings of inspection confirmed

▪ **Upper eyelid:** All Soft tissue structures from the skin to conjunctiva are normal including lid margin and eyelashes. Upturning test: Normal, Punctum is visible and normal. Upper eyelid movements are normal. Sensations normal. Position of upper eyelid normal in front gaze.

▪ **Lower eyelid:** All Soft tissue structures from skin to conjunctiva are normal including lid margin, eyelashes and punctum. Pull down test Normal. Sensations normal.

Eyeball/Globe Examination

Pupil: normal size, shape, symmetry, direct and indirect light reflex present

Iris: normal size and shape, colour brownish with no hyper or hypopigmentation, no nodules

Sclera: colour normal, surface smooth, no abnormal pigmentation or nodularity

Sclerocorneal junction normal

Cornea-sensation present, cornea clear

Palpebral fissures: size ____cm, shape ____cm, medial and lateral canthal: Normal, equal bilateral, punctum: Normal

Fornices: Both superior and inferior fornices

normal, no foreign body.

Orbital Rims: No tenderness, no step deformity, no mass palpable in the orbital margins.

Extraocular muscle function: Normal

- Vision
- Visual acuity
- Schirmer test

NOSE

External examination

- Finding of inspection confirmed, nose in midline
- Skin: Appears normal in all region including colour, texture, mobility with no swelling, tenderness and hypo or hyperpigmentation
- Bone (including nasal, vomer, frontal and maxillary spine) are normal with no elevation/depression, no tenderness or crepitus, no step deformity
- Cartilage (Upper and lower lateral): Normal
- Cottle test: Negative
- Nasal valve angle normal 10-15 degree
- Nasolabial angle
- Nasocollumellar angle
- Nasal lobule to nostril ratio= Normal (1:2)
- Tip projection = Alar base width

Bimanual palpation

Instrument is placed in the nose and pushed laterally in the medial canthal area to test for instability and crepitation, which suggests an unstable nose fracture.

Palpation of Nose

- Simple method to gather information on the function of the internal patency of the nose.
- The nose can be retruded and impacted at the nasofrontal suture area with lack of support for the nasal septum and cartilages.

Internal examination

- Normal nostrils, normal hair
- Membranous and cartilaginous septum normal/ hematoma
- On examination with Thudicum speculum-Septum/turbinate normal
- Tilt test with positive halo sign (as illustrated)
- Comparison of the concentration of glucose between fluid and patient's serum

- Laboratory analysis for beta-transferrin

Zygomatic region

Inspection findings confirmed

No bony abnormalities/step deformity/Mass

No evidence of buccinator hypertrophy

No maxillary sinus tenderness

- Depressed malar prominence
- Subcutaneous emphysema
- Orbital rim step-off

Lower Third

Lip and chin

Function of orbicularis oris

Inspection findings confirmed

Mandible:

- Areas of tenderness, step deformity.
- Abnormal mobility.
- Inferior border continuity.
- Angle of mandible.

Intraoral examination

- Palatal hematoma and/or palatal lacerations can be noted in the sagittally split palate.
- Blood Clots / Avulsed teeth
- Eccymosis/ Hematoma

Buccal Sulcus at buttress region, Sublingual region, Greater palatine foramen

- Step Defects in Occlusion
- Gagging of occlusion
- Anterior open bite & Shift of midline
- Buccal & lingual sulcus tenderness, alteration in contour, crepitus
- Mandible palpation
- Mobility of maxilla

Differentiating Leforts

Pull forward on maxillary teeth

- Mobility of the midface may be tested by grasping the anterior alveolar arch and pulling forward while stabilizing the patient with the other hand. testing for mobility of the midface Distance between the posterior edge of the soft palate and posterior edge of the pharyngeal wall Presence of passavant's pad.

Amount of adenoid tissue (if visible)

Size and state of the tonsils

Local examination of the ear

- Inspection

Frontal, oblique, full lateral and posterior:

- The skin over the FTP areas, scarred or normal
- Hair distribution over the scalp and sideburns
- Muscles: masseter and temporalis, Temporalis Fascia area any scar present/ not
- Mouth opening
- Neck movements, eye closure
- Superficial temporal artery pulsation: seen?
- Examination of normal ear
All the features of auricle were normal at normal place and position

- Ear examination of affected ear

Left ear: helix, antihelix, concha, scaphoid, triangular fossa, tragus, antitragus, lobule present/ absent any disfigurement.

- Examine for laceration or collapse of the external canal.
- Examine the tympanic membrane for rupture or a hemotympanum.

Note: Blood in the ear canal may indicate skull base fractures or external auditory canal lesion resulting from a condylar fracture enumerate the deficiency describe any ulcer, swelling, discharge

External auditory meatus visualized normal/ stenosed

Preauricular side burn normal, scalp looks normal

Postauricular angle 21-30 degree from scalp

No sinus, scars noted in the preauricular/ postauricular region

PALPATION

No warmth, No tenderness

Inspection findings confirmed

Measure the ear remnant as well as the normal ear

Lateral Protrusion of the Helix from the scalp

Postauricular angle 21-30 degree

Long axis tilt of the normal ear 20 degree posteriorly

The distance of the ear from the side burn, from the lateral orbital margin, eyebrow, ala of nose.

If any swelling the swelling is soft, firm

- Any fluctuation
- Any displacement
- Compressible/not

If any ulcer base of ulcer confirmed

External auditory canal Examination

Lymphnode: preauricular/postauricular/neck nodes

The template of the normal ear is placed on the affected ear and the deficiency is marked and the percentage of the defect is quantified

Defect / deformity / deformity with defect of:

1. Upper^{3rd}
2. Middle^{3rd}
3. Lower^{3rd} auricular
4. Lobule Defect: Partial, Total

Total Ear defect amounts to:

1. Less than 25%
2. More Than 25%
3. Total loss

Superficial temporal artery pulsations +

Skin elasticity is assessed

No evidence of facial nerve palsy

Hearing Test

Rinne's test

Weber's test

Examination of The Donor Areas

Chest, Temporalis fascia, opposite ear, retro-auricular areas, nose, upper arm, thighs.

Diagnosis

Acquired Defect / deformity/ deformity with defect of The Right Ear (<25%, >25% or Total) post burn/ trauma/ swelling/ surgery/ infection/ etc involving the superior/middle/inferior 3rd with/ without hearing loss.

Investigations

To add on to my diagnosis

Hearing assessment

HRCT temporal bone

USG abdomen

Cardiac echo

Chest X ray

For anesthetic fitness

CBC, BUSE, LFT, viral markers, blood grouping typing

DISCUSSION

Trauma to the ear

Trauma may be physical or chemical as in thermal injury, or it may be mechanical as in wrestling, boxing, motor vehicle accidents, brawling, sports or job related accidents, pierced ears, and human or animal bites.²

Human and animal bites

Emergencies caused by human and animal bites involve about 1% of all emergency injuries. The most common bites are by dogs, with children being the most affected. The incidence of dog bites in the United States is 1 to 2 million per year. Infection is the most common complication of bites, occurring in about 1.6% to 30% of cases.³ Conservative debridement and immediate prophylactic antibiotics are important to prevent infection.

Blunt trauma

The main complication of blunt trauma of the ear is the formation of hematoma.

Hematoma of the ear (Cauliflower ear)

The main complication of blunt trauma of the ear is the formation of hematoma. Blunt trauma (or excessive traction on the auricle) causes a shearing force that separates the cartilage from the overlying perichondrium.⁴ The force also tears blood vessels in the perichondrium. Blood fills the space between the perichondrium and cartilage and further separates the cartilage from the perichondrium, producing a convex surface that replaces the normal contour of the lateral surface of the ear. Subsequently, the blood clot becomes fibrosed, causing thickening, which obliterates the convolutions of the ear. Postoperative bleeding may follow the same mechanism. Because the cartilage does not contain blood vessels, but depends on the perichondrium for oxygen and nutrition, separation of the cartilage from its covering perichondrium by the accumulated blood deprives the cartilage of its blood supply. This results in cartilage necrosis or infection.⁵

Signs and symptoms

These include painful swelling that obliterates the normal contours of the lateral surface of the ear. It may appear immediately or several hours after the trauma.

Treatment

The goal of treatment is to remove the accumulated blood and to maintain pressure on the area for several days to prevent recurrence. If the blood is simply aspirated, the clotted blood may be replaced by seroma formation. Although some prefer to treat hematomas initially by aspiration and pressure dressing, the author prefers to do incision of the skin and perichondrium and to drain the blood. It is preferable to place the incision in the inner side of the antihelix and parallel to it to hide the scar. The wound is then inspected for further bleeding that may need cauterization, and a suction tip is inserted under the skin flap. Cotton soaked in saline, molded to the lateral surface of the ear, is then applied. Head dressing is also provided. Other authors prefer to apply one or two mattress sutures placed through the hematoma area and tied over pledgets of fluffed gauze to furnish adequate compression. The late treatment of the cauliflower ear deformity consists in carving out the thickened tissue (consisting of fibrous tissue and new cartilage) and application of pressure dressing.⁶

Laceration of the ear

Lacerations of the ear may be minor to extensive. Clean lacerations caused by sharp objects are repaired using 6-0 nylon sutures with exact approximation of the edges. When the skin edges are crushed, minor debridement of the edges may be necessary. When the skin and the cartilage are involved in a clean laceration, the author prefers to approximate the edges of the cartilage and to do skin to skin repair.⁷ When the helical rim is involved, a key suture should be placed initially at the rim and preferably using a vertical mattress suture to evert the wound edges that are flattened after the edema subsides and levelled with the wound. If the wound edges, by comparison, were inverted, the inversion persists as a depressed scar, trapping the shadows as light is cast across the surface and causing grooving of the helical rim. Mladick believes that suturing the cartilage is detrimental, and the author agrees. When the laceration involves the external canal, traversing the cartilage or the bony cartilaginous junction, stenosis of the

canal may result prolonged stenting of the canal is indicated to prevent its stenosis. When the wound is in the form of partial skin avulsion, the avulsed skin can be repositioned and sutured in place as a full thickness skin graft.⁷

Thermal injury of the ear

Flame, flash, blast, scalds, and steam burns

Burns of the ear invariably demonstrate a mixture of the three degrees of burn. They are characterized by central coagulation, with peripheral areas of stasis and hyperemia. Thermal deformity of the burned ear may result from direct thermal injury. Because the cartilage is avascular, it accumulates its nutritional substance from the overlying perichondrium. Disruption of this mechanism propagates further tissue loss and deformity. Chondritis may develop, leading to resorption of ear cartilage and ultimately deformity of the ear.⁸

MANAGEMENT

In addition to the general management of burns, the most important factor in treating burned ears is to prevent suppurative chondritis from developing.⁹

Topical Antibiotics

Mafenide (Sulfamylon) cream is the best topical antibiotic agent suitable for the ear because of its ability to penetrate the eschar and the cartilage. Mafenide cream has a broad antibacterial spectrum with good bacteriostatic effect and relatively low toxicity. It should be applied twice daily because of its active penetration; little of the agent is left on the wound after 3 hours. Avoidance of pressure on the ear is essential. This can be done by minimizing the dressing, using a soft pliable dressing, and preventing the use of a pillow.¹⁰

Management of the eschar

Premature excision of the eschar should be avoided because the eschar acts as a biologic coverage to the underlying cartilage, preventing it from desiccation. When the eschar is suppurative, then debridement is indicated. *Pseudomonas* is the usual infective organism in this situation.¹¹ When only the skin is lost from a burn, and the perichondrium is intact, granulation and epithelialization occur. If the skin and the perichondrium are lost, the area does not heal and surgical debridement and late reconstruction are indicated.

Management of suppurative chondritis

Iontophoresis uses polar charged antibiotic compounds, such as penicillin and gentamycin, which are pulsed across avascular membranes, and has been recommended by many authors. If the condition of the patient is not ready for reconstruction and there is loss of skin and perichondrium, the author prefers to cover the bare cartilage with a split thickness skin graft to act as a temporary biologic dressing until reconstruction can begin.¹²

Chemical burns

Chemical burns may be caused by acids, alkalis, or organic compounds. The severity of chemical injuries is related to (1) the agent involved, (2) concentration of the agent, (3) volume of the agent, (4) duration of contact, and (5) how fast water irrigation is started after the burn and for how long. Unlike acids, alkali burns are unusually severe because penetration of the OH ion is deep and progressive. Immediate irrigation with water is essential. Irrigation should be continuous until definitive treatment is begun or until the patient experiences a decrease in pain or burning sensation. This irrigation is very important not only to minimize any tendency for the burn to progress in depth, but also to provide some degree of comfort.¹³

Electrical burns

Most tissue damage is caused by heat generated by current flow; that is why the thermal damage is extended in depth and plane and may involve deeper structures. Not only acute but chronic radiodermatitis may result from exposure to ionizing radiation. Chronic radiodermatitis may occur and is characterized by atrophy of the skin. Malignant change may develop later as a result of radiation injury.

Frostbite

The effect of cold thermal injury (frostbite) on the skin of the ear may occur as a result of direct cellular injury through crystallization of tissue water, or indirect effects secondary to microvascular changes leading to thrombosis and ischemia. The frozen ear does not become painful until it begins to warm. Immediate treatment is started with rapid warming. The use of low molecular weight dextran or heparin is important because it limits thrombosis and diminishes the amount of tissue loss. The rewarming is accomplished by cotton soaked with warm saline and treated aseptically.

Tumors of the ear

Benign tumors¹⁴

Keloid¹⁵

Keloid is defined as a benign tumor of dense fibrous tissue, developed in the dermis as an excessive overaccumulation of collagen during the healing process. It represents a failure of the normal check reins of healing. The cause of keloid is unknown. Excessive scar tissue was described in the Smith Papyrus in Egypt about 1700 BC. Trauma to the dermis is always the inciting factor. This trauma may be caused by surgical incision, burn, laceration, pustules, ear piercing and even spider bite. Local and general factors may influence the creation of keloid. Local factors include the following:

Surgery: the pattern and direction of the surgical incision, tension of closure, and localized contusion may influence the development of keloid.¹⁵

Thickness of the skin involved.

Infection

Foreign body, especially keratin (from hair and sebaceous glands)

Anatomic sites: keloid is more common in the earlobe.

General factors are as follows

Races: keloid occurs in all races except albinos, but occurs 15 times more often in patients with darker skin compared with lighter skin. Keloids occur exclusively in humans.¹⁶

Sex: keloid occurs with the same prevalence in males as females.

Age: keloid occurs at its highest incidence in the second decade.

Hormones: estrogen and androgen may influence the occurrence of keloid because it is seen most often in youth, regresses after menopause, and enlarges during pregnancy.¹⁷ Connective tissue disease: connective tissue diseases are usually associated with keloid formation.

Ear piercing is the most common cause of the earlobe keloid. Keloid appears as a mass of fibrous tissue in an area of previous trauma. It is itchy, tender, tense, and red. The keloid varies in size from small to large. Small abscesses with draining sinus tracts are not uncommon.

Treatment

Because the cause of keloid is still unknown, there are many modalities of unsatisfactory treatment.¹ Simple excision is one of the most long standing forms of treatment. The recurrence rate of surgery alone, however, is as high as 45% to 100%.¹⁸ It should be noted that the medial surface of the ear is not immune against keloid formation, as many authors believe. Keloid of the medial surface of the ear frequently occurs. The author noticed that keloid may occur as pedunculated keloid with narrow base (this type of keloid can be excise easily and the ear can be reconstructed) or keloid with wide base (this type of keloid is made more difficult to excise and the ear is much more difficult to reconstruct). Surgery is usually combined with other treatment modalities.² Pressure is used after keloid excision on the earlobes. Using pressure day and night for 4 to 6 months is beneficial in reducing abnormal scarring. The mechanism of pressure is not clear, but the success rates of at least partial reduction of scars are from 60% to 85%.³

Intralesional corticosteroid injections may be used alone or combined with other therapies, of which the combination with surgery is the most commonly used method. The recurrence rates with corticosteroid injections alone are 9% to 50%. Injection is most effective on younger hypertrophic scars, and can only flatten older scars and provide symptomatic relief. In cases of painful injections, the steroid can be mixed with lidocaine. The complications of corticosteroid injections are (1) atrophy of surrounding tissue (if accidentally injected); (2) depigmentation of the skin; (3) telangiectasia, necrosis, and ulceration; and (4) cushingoid features. Corticosteroid injections in combination with surgery show a recurrence rate of 0% to 100%. Triamcinolone acetone (Kenalog cream or ointment, 0.1%; or Aristocort, 0.5%) can be applied topically for a long time without systematic effects. It only affects the symptoms of keloid, but not its mass.⁴ Radiation is mainly reserved for keloid resistant to other treatment, because the potential morbidity from radiation, especially in children, is high. It has the possibility of carcinogenicity and possible interference with growth in children. The response to radiation alone is 10% to 94%. Surgery followed by radiation has a higher success rate of 25% to 100% when treatment is started immediately after surgery. Complications of radiotherapy include hyperpigmentation, pruritus, paresthesias, and pain.⁵ Treatment with silicone materials was introduced by Perkins et al. When silicone is applied over hypertrophic scars or keloid, it decrease its volume in 60% to 100% of cases without complications except for rashes.

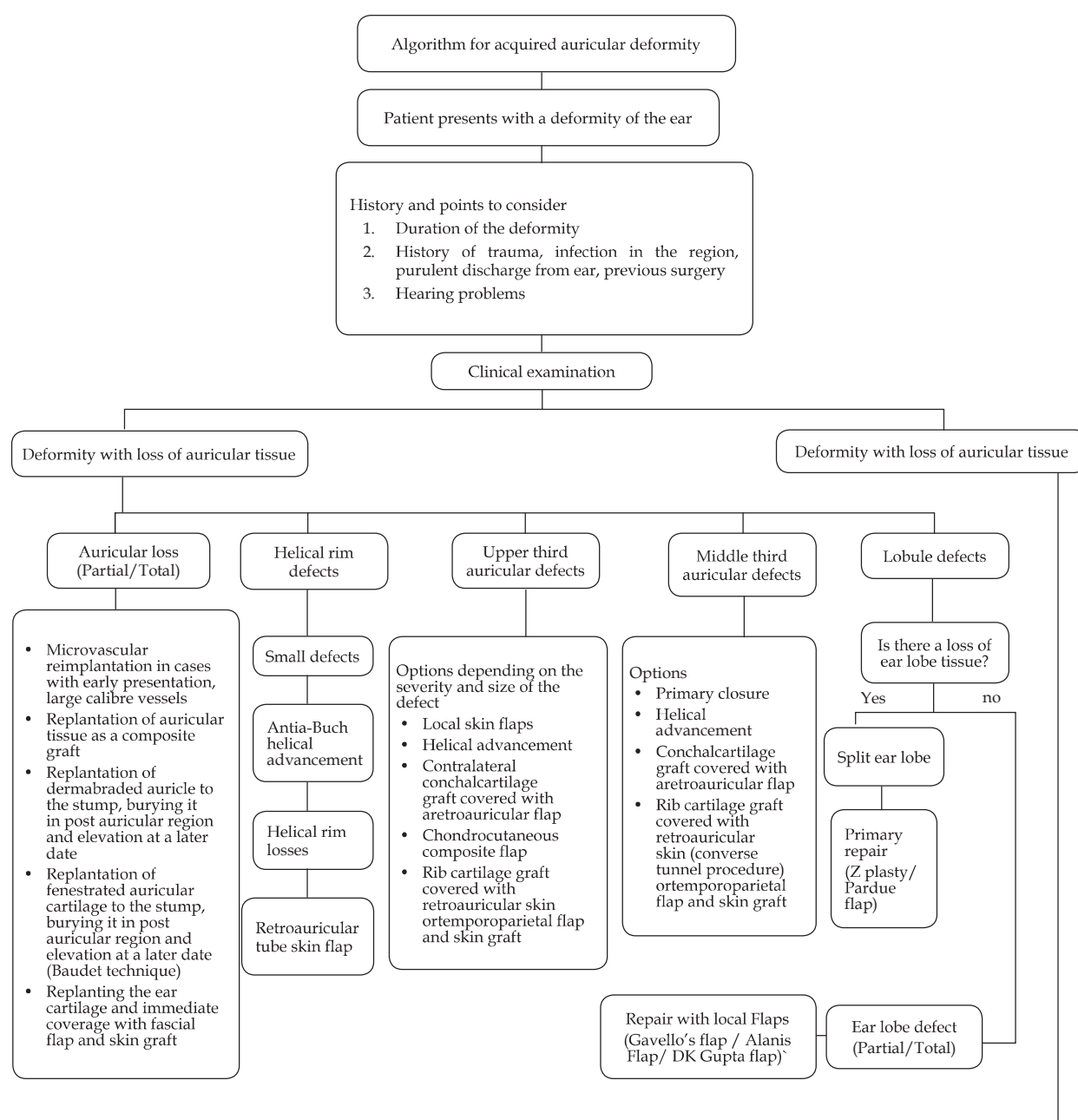
When silicone is applied after surgical excision, it can prevent the formation of the hypertrophic scar or keloid in 75% to 85% of cases. The silicone must be worn 24 hours a day for at least 3 months using tape. Its mode of action is unknown.⁶ The recurrence rate of keloid after laser treatment is from 45% to 93%, which is still unacceptable.⁷ The response rate after cryotherapy is comparable with that of laser. Both laser and cryotherapy are painful.¹⁹

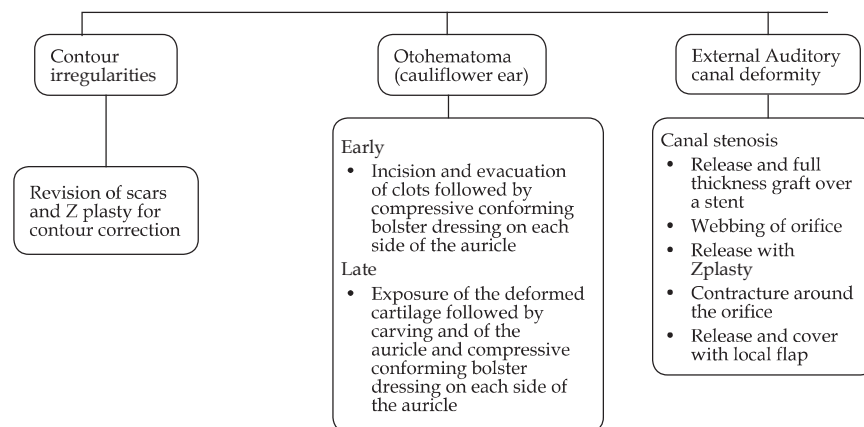
Pigmented lesions

Lesions in this category include junctional, intradermal, and compound nevi, and melanotic freckle of Hutchinson.

Epidermal and Adnexal Lesions

Chondrodermatitis nodularis chronica helicis is a common chronic inflammatory, painful, popular lesion on the upper rim of the ear. The lesion is firmly attached to the cartilage and is treated by simple excision of the underlying degenerated cartilage alone without removal of the overlying skin. Persistence and recurrences are common. Taylor treated 12 lesions with carbon-dioxide laser. The pain from the lesions was gone immediately following laser surgery and there were no complications or recurrences of the lesion after 15 months of follow-up. Epidermoid cyst may become





Source: @ Chapter 13- Acquired ear defect (auricular reconstruction), *Treatment Planning in Plastic Surgery by Dr Ravi Kumar Chittoria*²¹

infected, after which it is difficult to enucleate the entire cyst wall because of adherence to surrounding tissues. It is important to remove the lining sac to prevent recurrence. Seborrheic keratosis is another epidermal and adnexal lesion.²⁰

Vascular lesions

These include such lesions as hemangioma, lymphangioma, and arteriovenous fistula. These lesions should be diagnosed, differentiate from malignant lesions and they should be properly managed.

Management treatment Planning Algorithm

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