Section 1

Section Outlines

- Development of the Ear
- Anatomy of the Ear
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- History Taking with Symptomatology of Ear Diseases
- Examination of the Ear
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Introduction

Preliminary Considerations in Examination

HISTORY TAkING

Before proceeding to the examination of a patient, a detailed and proper history taking is a must. The relevant points to be noted may vary from one organ to another, hence are described at the beginning of each section.

The examination room should be reasonably large and noise free.

Most of the ear, nose and throat areas lend themselves to direct visualization and palpation but a beam of light is needed for proper visualization of the inside of the cavities.

Hands should be free for any manipulation. This is achieved, if a beam of light is reflected by a head mirror or head light. Usually the head mirror is used. The head light serves the same purpose in the operation theater.

HEAD MIRROR

It consists of a concave mirror on a headband with a double box joint. The head mirror should be light as it is worn for long periods of time and may cause headache. The purpose of the double box joint is to enable the mirror to be as close to the examiner's eye as possible. The center of the mirror has a hole about 2 cm in diameter.

The focal length of the head mirror is generally 8 to 9 inches (25 cm). It is the distance at which the light reflected by the mirror is sharply focussed and looks brigh test. It is also the distance where most people can see and read clearly.

The head mirror is worn in such a way that the mirror is placed just in front of the right eye (in right handed persons). The examiner looks through the hole in the mirror and thus binocular vision is retained.

LIGHT SOURCE

The light is provided from an ordinary lamp fixed in a metallic container with a big convex lens and fitted on a movable arm which slides on a rod with a firm base (Bull's eye lamp) or a revolving light source provided with ENT treatment unit **(Fig. 1)**. This light source is kept behind and at the level of the patient's left ear. Light from this source is reflected by the head mirror worn by the examiner.

POSITION OF THE PATIENT

The patient should remain comfortably seated. Young children usually do not permit the

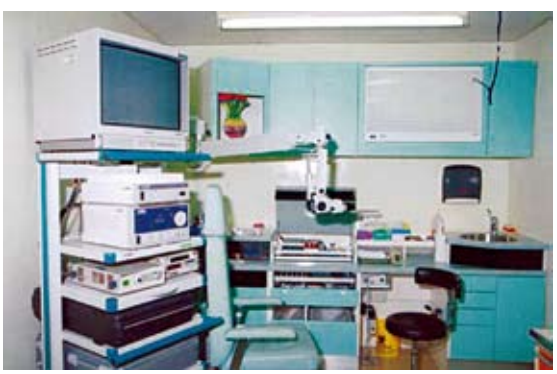

Fig. 1 ENT treatment unit

Fig. 2 Mother holding child for examination

Fig. 3 Position of the patient for ENT examination

examination in this position and need assistance. The assistant sits in front of the examiner and holds the child in his/her lap **(Fig. 2)**. The legs of the child are held inbetween the thighs of the assistant. One hand of the assistant holds the child's hands across his chest while the other hand stabilizes the child's head.

POSITION OF THE EXAMINER

The examiner sits in front of the patient on a stool or revolving chair **(Fig. 3)**. The legs of the examiner should be on the right side of the patient's legs.

EXAMINATION EQUIPMENT

The following are the instruments routinely used for ENT examination **(Fig. 4)**.

1. Tongue depressor
2. Nasal specula
3. Ear specula
4. Holm's sprayer
5. Laryngeal mirrors
6. Postnasal mirrors
7. Seigel's speculum
8. Eustachian catheter
9. Ear forceps
10. Nasal forceps
11. Tuning forks
12. Probes
13. Ear syringe

Fig. 4 Common instruments used in ENT outdoor examination

14. Auroscope

Besides, a sterilizer, Cheatle's forceps, spirit lamp and few small labeled bottles containing the commonly used solutions, paints and ointments are also needed.

SUCTION APPARATUS

A suction apparatus with suction tubes and catheters of various sizes is very helpful for cleaning the discharges to allow proper examination. It is also used for removing wax from the ears of the patients who have wax along with CSOM, where water should not be syringed in.

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Chapter 1

Development of the Ear

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The knowledge of the development of the ear is important for the diagnosis and therapy of the various diseases of the ear. It is also necessary to know the various anatomical variations that the surgeon may encounter on the table.

The two functional parts of the auditory mechanism have different origins. The sound conducting mechanism takes its origin from the branchial apparatus of the embryo, while the sound perceiving neurosensory apparatus of the inner ear develops from the ectodermal otocyst.

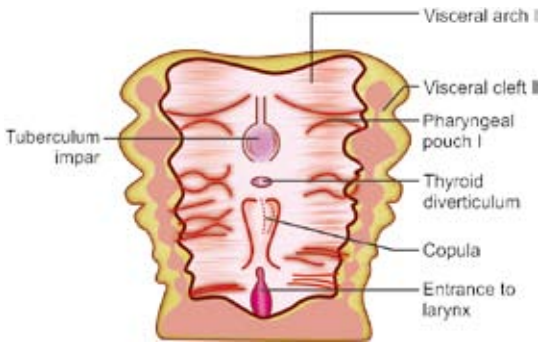
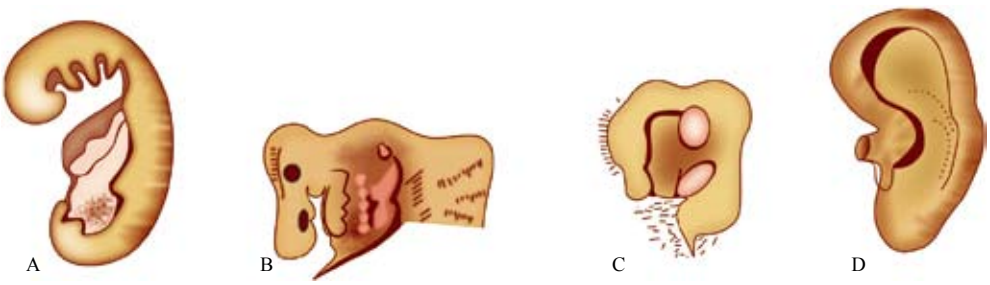


Fig 1.1 Visceral arches, clefts and pharyngeal pouches

Development of the External and Middle Ear

The structures of the outer and middle ear develop from the branchial apparatus **(Figs 1.1 and 1.2)**. During the 6th week of intrauterine life, six tubercles appear on the first and second branchial arches around the first branchial groove. These tubercles fuse together to form the future pinna.

The first branchial groove deepens to become the primitive external auditory meatus, while the corresponding evagination from the pharynx, the first pharyngeal pouch, grows outwards. By the end of the second fetal month, a solid core of epithelial cells grows inwards from the primitive funnel-shaped meatus towards the epithelium of the pharyngeal pouch. By the 7th month of embryonic life, the cells of the solid core of epithelium split in its deepest portion to form the outer surface of the tympanic membrane and then extend outwards to join the lumen of the primitive meatus. Thus, congenital atresia



Figs 1.2 A to D Development of the pinna: (A) Primordial elevations on the first and second arches; (B and C) Progress of embryonic fusion of the hillocks; (D) Fully developed configuration of the auricle

of the meatus may occur with a normally formed tympanic membrane and ossicles, or with their malformation depending upon the age at which development gets arrested.

The first pharyngeal pouch becomes the eustachian tube, middle ear cavity and inner lining of the tympanic membrane. The cartilages of the first and second branchial arches proceed to form the ossicles.

The malleus and incus basically develop from the Meckel's cartilage of the first branchial arch. From the second branchial arch develop the stapes, lenticular process of the incus and the handle of malleus.

The foot plate of the stapes is formed by the fusion of the primitive ring-shaped cartilage of the stapes with the wall of the cartilaginous otic capsule. The ossicles are fully formed at birth.

As the ossicles differentiate and ossify, the mesenchymal connective tissue becomes looser and allows the space to form the middle ear cavity. The air cells of the temporal bone develop as out-pouchings from the tympanum, antrum and eustachian tube. The extent and pattern of pneumatization vary greatly between individuals. Failure of pneumatization or its arrest is believed to be the result of middle ear infection during infancy. The mastoid process is absent at birth and begins to develop during the second year of life by the downward extension of the squamous and petrous portions of the temporal bone. This is of importance in infants where the facial nerve is likely to be injured during mastoidectomy through the postaural route. In order to avoid injury to the facial nerve, the usual postaural incision is made more horizontally.

The best indication of the degree of middle ear malformation in cases of congenital atresia is the condition of the auricle. As the auricle is well-formed by the 3rd month of fetal life, a microtia indicates arrest of development of the branchial system earlier in embryonic life with the possibility of absent tympanic membrane and ossicles.

Points of Clinical Importance

- Hearing impairment due to congenital malformation usually affects either only the sound conducting system or only the sensorineural apparatus because of their entirely different embryonic origin, but occasionally both can be affected
- The particular malformation present in each case depends upon the time in embryonic life, at which the normal development was arrested, as well as upon the portion of the branchial apparatus affected
- Failure of fusion of the auricle tubercles leads to the development of an epithelial-lined pit called preauricular sinus
- Failure of canalization of the solid core of epithelial cells of the primitive canal leads to atresia of the meatus
- At birth, only the cartilaginous part of the external auditory canal is present and the bony part starts developing from the tympanic ring which is incompletely formed at that time.

Development of the Inner Ear

At about the 3rd week of intrauterine life a plate-like thickening of the ectoderm called otic placode develops on either side of the head near the hindbrain. The otic placode invaginates in a few days to form the otic pit. By the 4th week of embryonic life, the mouth of the pit gets narrowed and fused to form the otocyst that differentiates as follows **(Fig. 1.3)**:

i. At four and a half weeks the oval-shaped otocyst elongates and divides into two portions—endolymphatic duct and sac portion, and the utriculosaccular portion.

ii. By the seventh week arch-like out-pouchings of the utricle form the semicircular canals. Between the seventh and eighth weeks, a localized thickening of the epithelium occurs in the saccule, utricle and semicircular canals to form the sensory end organs.

Evagination of the saccule forms the cochlea, which elongates and begins to coil by the 11th week. A constriction between the utricle and saccule occurs and forms the utricular and saccular ducts, which join to form the endolymphatic duct.

The mesenchyme surrounding the otocyst begins to condense at the sixth week and becomes the precartilage at the seventh week of

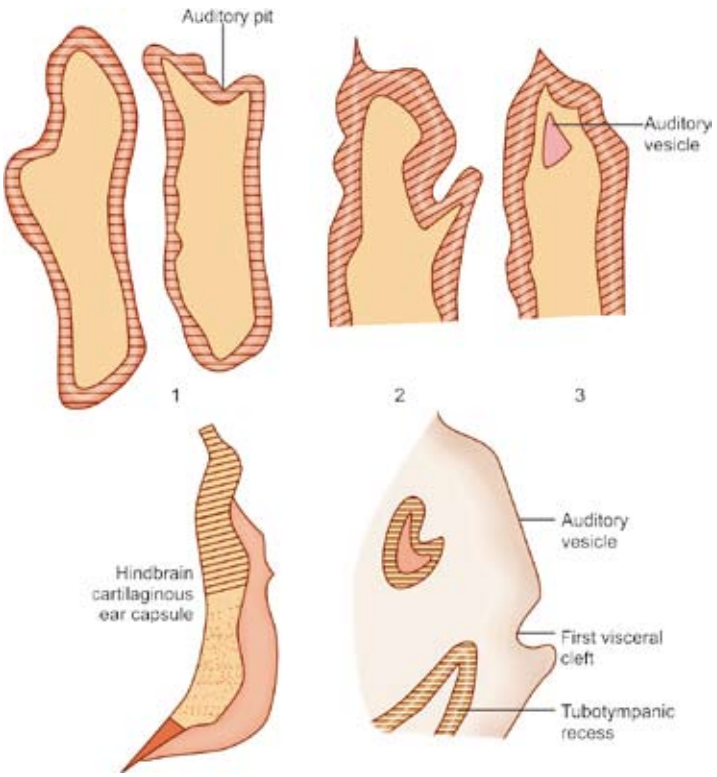


Fig. 1.3 Development of the inner ear

embryonic life. By the 8th week, the precartilage surrounding the otic labyrinth changes to an outer zone of true cartilage to form the otic capsule. The inner zone loosens to form the perilymphatic space.

The perilymphatic space has three prolongations into surrounding osseous otic capsule, viz. the perilymphatic duct, the fossula ante fenestram, and the fossula postfenestram.

Development of the Bony Labyrinth

In the otic capsule, the cartilage attains maximum growth and maturity before ossification begins. The endochondral bone initially formed from the cartilage is never removed and is replaced by periosteal haversian system as occurs in all other bones of the body, but remains as primitive, relatively avascular and poor in its osteogenic response. The first ossification center appears around the cochlea in the 16th week. By the twenty-third week, the ossification is complete.

Points of Clinical Importance

- The labyrinth is the first special organ which gets differentiated when the other organs have not yet budded out in the embryo
- The vestibular apparatus gets developed before the cochlea and is less prone to disease than the cochlea
- The labyrinth is fully formed by the fourth month of intrauterine life and maximum anomalies of the labyrinth occur during the first trimester of pregnancy.

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