

Investigations of Ear Diseases

The main symptoms of ear diseases are:

1. pain
2. discharge
3. deafness
4. itching
5. vertigo
6. tinnitus

examination of the ear:

1. Introduce yourself to the patient.
2. Position the patient.
3. Ascertain which is the better ear and start with this.
4. Inspect the pinna, mastoid and external auditory meatus and canal.
5. Pneumatic otoscopic examination of the tympanic membrane.
6. Fistula test.
7. Free field voice tests.
8. Tuning fork tests.
9. Facial nerve examination.
10. Postnasal space examination.

Investigations For Ear Diseases divided into 5 groups of investigations:

1. Audiological Tests

A. Subjective Tests

1. Pure Tone Audiogram

The pure tone audiogram is probably the cornerstone of clinical auditory assessment. It is a psychoacoustical test which aims to establish the subject's pure tone hearing threshold, that is the minimum sound level at which a specific response can be obtained.

It has 2 aims:

1. to determine the type of deafness (conductive or SNHL or mixed type).
2. to quantify the severity of deafness.

2. Speech Audiogram

Speech audiometry implies the formal qualitative assessment of a subject's perception of speech. It measures the actual disability produced by the hearing impairment. It is useful in a variety of contexts including:

- Assessment and diagnosis of peripheral and central hearing disorders.
- Prediction of the usefulness of a hearing aid.
- Evaluation of the benefit which might be obtained by an operation (pre- and postoperative assessment).
- Medicolegal assessment.

B. Objective Tests

1. Tympanometry

This test is the most commonly used aspects of impedance audiometry and is particularly useful in evaluating children with otitis media with effusion. Here compliance is measured continuously while the pressure in the EAM is automatically varied from + 200 to -400 mm H₂O. This gives **a graphical result which can be classified into one of three groups:**

a) **Type A.** Maximal compliance occurs when the pressure in the EAM is between + 50 and -100 mm H₂O. A normal maximal compliance value is between 2 and 4 ml. A low value for maximal compliance indicates stiffness of the middle-ear system as in tympanosclerosis or otosclerosis. A high or unrecordable of compliance indicates excess mobility of the middle-ear system as in ossicular discontinuity or atelactasis.

b) **Type B.** A low-value flat or horizontal compliance trace occurs, implying persistently low compliance. This is usually taken to indicate fluid in the middle-ear cavity, and in young children (<7 years) with glue ear can be correlated with audiometric hearing loss.

c) **Type C.** This group give a peak compliance when the pressure in the EAM is <-100 mm H₂O. This indicates a significant low pressure in the middle-ear system and is a sign of Eustachian tube dysfunction. The C curve can be subdivided into C1, when the peak is between -100 and -199 mm H₂O, and C2, when the peak occurs at less than - 200 mm H₂O.

- Also known as acoustic reflex or stapedial reflex
- Measured using same equipment/probe as tympanometry
- Looking for sharp reduction in middle ear admittance in response to loud sound due to contraction of middle ear muscles.
- Should not be present with conductive loss, severe or profound sensorineural hearing loss, or auditory neuropathy/asynchrony.
- Ideally is not used as a stand-alone test, but as a cross-check against ABR, OAE, etc.
- Best elicited in infants using a 1000 Hz probe-tone and broadband noise stimulus.

3. Evoked response audiometry

In response to sound stimulation, electrical signals are produced by various parts of the auditory system from cochlea to cortex. Evoked response audiometry (electric response audiometry) is a technique designed to measure these signals. There are 3 main responses can be recorded:

a) **electrocochleography (ECochG) aims to measure the signal produced by the cochlea and cochlear nerve in response to acoustic stimulation.**

b) **Brainstem electric response audiometry (BERA)** records the signal produced in the brainstem detected by electrodes placed over mastoid, forehead and vertex.

c) **Cortical electric response audiometry.** Surface electrodes are placed, with active on the vertex, reference on either mastoid process and

ground forehead.

4. **Otoacoustic Emissions (OAE)**

Using modern computing technology and signal averaging techniques, Outer hair cell vibrations can be detected in the external auditory meatus as Otoacoustic Emissions (OAEs). They were first described by David Kemp in 1978 and represent an objective measure of cochlear function. Acoustically evoked OAEs are almost never found in ears with a hearing level worse than 40 dB.

Advantages:

- Quick
- Easy to test
- Not require anaesthetic, in contrast to evoked response audiometry.

Clinical uses:

In clinical practice it is used in the screening of neonates and high-risk infants for hearing loss.

2. **Vestibular Tests**

A. **Caloric Test**

Caloric testing forms the cornerstone of investigation for any vestibular pathology and is therefore useful in all patients with vertigo.

Procedure and result :

The patient lies on a couch with the head-rest upwards at 30° to the horizontal. This brings the horizontal semicircular duct into the vertical plane. Water the desired temperature (37 ± 7 C°) is run into the ear from a douche-can placed 2 feet above the patient's head. A continuous stream is directed against the tympanic membrane for 40 sec. Nystagmus (COWS= Cold- opposite, Warm-Same) usually results if the labyrinth is normal and commonly lasts for about 2 min from the beginning of stimulation. Each ear is tested separately by hot and by cold stimulation, an interval of 5 min being allowed between each separate stimulation. The duration of the nystagmus in each ear is recorded graphically.

Canal paresis is present if the duration of nystagmus is reduced equally for hot and cold tests. The condition may be unilateral or bilateral.

Directional preponderance is present if the nystagmoid responses towards one side are shorter duration than those towards the other.

B. **Rotation (rotator chair) Test**

This test is used to evaluate the pathway between the horizontal SCC and the eyes muscles. This pathway is known as the **horizontal vestibuloocular reflex** because the patient is positioned so that only the horizontal SCC is stimulated.

Rotational testing has three main functions:

1. to confirm the bilateral impairment of horizontal functioning of the SCC.
2. to provide evidence of a central vestibular dysfunction.
3. to quantify the progress of a known vestibulopathy.

C. **Electronystagmography (ENG)**. This technique is based upon the positive potential which exists between the cornea and retina. Electrodes are attached to the skin at each outer canthus close to the eyes. Changes in the corneoretinal potentials are recorded at the electrode sites as the eyes move from straight-ahead gaze. The changes in the electric potential are used to follow nystagmus, and

after amplification are recorded permanently on a moving strip. Full ENG testing includes a series of tests including different head positions, eyes open and closed, and caloric tests.

3. Radiological Investigations

Following the increased use of complex diagnostic techniques such as CT & MRI, plain films are rarely used for diagnostic purposes in ENT.

4. Bacteriological Investigations. Ear swab for culture and sensitivity.

5. Biochemical and Haematological Tests.