

PRIMARY EAR AND HEARING CARE TRAINING RESOURCE

ADVANCED LEVEL



Chronic Disease Prevention and Management

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CONTENTS

Foreword	4
Preface	6
Acknowledgements	7
Purpose of Advanced Level Training Resource	8
Critical Outcomes	9
1 Prevalence, causes and prevention of deafness and hearing impairment	11
2 Examination of the ear	21
3 Detection, screening and testing of hearing impairment	32
4 Ear conditions – diagnosis and treatment	40
5 Ear operations	59
6 Noise-induced hearing impairment	65
7 Aural habilitation, rehabilitation and education	67
8 Hearing aids	76
Annex: Development of a National Programme for Prevention of Deafness and Hearing Impairment	86

FOREWORD

The World Health Organization estimated that in 2005 there were 278 million people in the world with disabling hearing impairment (moderate or worse hearing loss in the better ear). At least two-thirds of these are in developing countries. Many more have mild hearing loss and many kinds of ear diseases. These problems can cause life-long and sometimes life-threatening difficulties to people with them; they may have a profound effect on the ability of individuals to communicate with others, on their education, on their ability to obtain and keep employment, in social relationships and through stigmatization. These problems also produce surprisingly large economic burdens on society as a whole.

In developing countries there are few programmes to prevent and treat ear diseases and help people with hearing impairment, and, in many of these countries, few or no trained health workers to implement them.

Some of the most effective and cost-effective interventions against ear and hearing disorders can be implemented at the primary level by trained primary ear and hearing care (PEHC) workers or primary health care (PHC) workers or their equivalent. If these interventions are used on a large scale they will have a major impact on the burden of ear disease and hearing loss. However most developing countries do not have PEHC workers and the topic is hardly addressed in the training of PHC workers. Workers in Community-based rehabilitation (CBR) programmes rarely deal with this field.

The WHO Primary Ear and Hearing Care Training Resource is intended to address this urgent need. It consists of manuals and other materials for interactive and culturally appropriate training of village health workers, PEHC, PHC and CBR workers, and also more experienced personnel working at primary level. It comprises basic, intermediate and advanced level components.

The resource focuses on community involvement and raising awareness, and covers basic measures for prevention and management. A section on hearing aids is included for communities where there are no other trained personnel to help people use them effectively. The resource has been developed by a wide

process of consultation in many developing countries, and has been field tested in Africa and Asia. It will be made freely available to projects and programmes that wish to conduct training in this field.

WHO stated, in 1978, that “Primary Health Care is essential health care made universally accessible to individuals and families in the community by means acceptable to them, through their full participation and at a cost that the community and country can afford. It forms an integral part of the country's health system of which it is the nucleus and of the overall social and economic development of the community.”*

It is hoped that the resource will contribute to primary health care and will stimulate and enable greater priority to be given by developing countries to addressing ear and hearing disorders, and hence start to make a substantial reduction in their burden in the developing world.

* *Primary health care. Report of the International Conference on Primary Health Care: Alma-Ata, USSR, 6–12 September 1978.* Geneva, World Health Organization, 1978 (Health for All Series, No. 1), p.34.

PREFACE

This advanced level training resource is designed to provide much needed information for the further training of primary ear and hearing care workers in developing countries. It is intended to continue the training of those primary health workers who have already been trained with the Intermediate level of the Resource, but it can also be a stand-alone training tool.

It addresses the occurrence, causes, prevention, detection, diagnosis, treatment and management of common ear diseases and hearing impairment. It also provides further information about aural rehabilitation and deaf education and a separate module on the provision, use and maintenance of hearing aids and services for them.

This information will enhance the knowledge and skills of primary ear and hearing care workers to help parents, care givers, teachers and employers, and community members to support and understand the needs of people who have ear diseases and/or are hard of hearing.

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PURPOSE OF ADVANCED LEVEL TRAINING RESOURCE

The purpose of this level of the training resource is to provide advanced training for primary ear and hearing care workers (PEHC) or primary health care (PHC) workers in developing countries.

A large proportion, at least 50%, of cases of ear disease and hearing impairment are preventable. Many more can be given effective management, or remediation. The role of the PEHC or PHC worker is essential for the delivery of many of the key interventions for prevention, detection, diagnosis, treatment and rehabilitation of ear and hearing disorders.

Such trained primary ear and hearing care or primary health care workers will be better able to support the patient, family and community in learning to manage common ear disease and hearing loss. They will also know better when to refer for further treatment and support.

This level of the training resource emphasises the need for prevention, diagnosis and treatment of common ear diseases and hearing loss. Simple surgical procedures that can be performed by PEHC or PHC workers, are described. Early detection of hearing loss is emphasized and hearing screening and testing methods are explained.

The advanced level of the resource shows health workers how, with understanding and the necessary support, people with hearing loss can play productive roles in the home, school, society and in the work place.

CRITICAL OUTCOMES

- Become a competent Primary Ear and Hearing Care or Primary Health Care worker and work effectively as a member of a team for the effective treatment of the patient
- Identify and find how to use the best methods for raising awareness about ear disease and/or hearing problems,
- Learn how to prevent and manage ear diseases and hearing problems
- Organise and manage oneself and one's activities responsibly and effectively
- Collect, analyse, organise and critically evaluate information regarding ear disease and/or hearing problems
- Communicate effectively with patients using visual and/or oral language skills
- Use appropriate technology effectively and critically, showing responsibility towards the health of the patient
- Be culturally sensitive across a range of social contexts



I PREVALANCE, CAUSES AND PREVENTION OF DEAFNESS AND HEARING IMPAIRMENT

I.1 GLOBAL BURDEN

Hearing loss¹ is one of the commonest disabilities in the world and is often referred to as the hidden disability. The World Health Organisation estimated that in the year 2005 there were 278 million people in the world with disabling hearing impairment (moderate or worse average hearing impairment of 41db or greater in the better ear in adults and 31 dB or greater in children up to age 15 years); of these the loss began in childhood in 68 million people, and in adulthood in 210 million people. A further 364 million people are estimated to have a mild hearing loss (see figure for WHO definitions of grades of hearing impairment). Two thirds of the burden of hearing impairment is in developing countries and the estimates have increased progressively since they were first made in 1986.

Grades of Hearing Impairment

Grade 0	25dB or less	No/slight problems	
None	Hears whispers		
Grade 1	26–40 dB	Hears/repeats words in normal voice at 1m	
Slight			
Grade 2	Child 31–60 dB	Hears/repeats words in raised voice in 1m	} Disabling hearing impairment
Moderate	Adult 41–60 dB		
Grade 3	61–80 dB	Hears words shouted into better ear	
Severe			
Grade 4	81 dB or more	Cannot hear/understand shouted voice	
Profound			

Average 0.5, 1, 2, 4 kHz in better Ear

Since 2001, WHO has included adult-onset hearing loss in the tables of the global burden of disease in the World Health Report. The causes of the global

¹ DEFINITIONS: *Hearing loss* means any reduction of or difficulties with hearing. *Hearing impairment* means any level or grade of hearing loss. *Deafness* here means profound hearing impairment.

burden of disease are compared according to the percentage of total Disability Adjusted Life Years (DALYs) in the world that each cause contributes. DALYs are a measure of the years of healthy life lost (YLL) due to premature death together with the years lived with disability (YLD); hence this method takes much more account of the burden of chronic conditions, including disability, than with previous indicators that focused only on death rates. In the global burden of disease, adult-onset hearing loss ranks 12th in the year 2005, coming after perinatal conditions, lower respiratory infections, HIV/AIDS, depression, heart disease, diarrhoea, strokes, road accidents, tuberculosis, malaria, chronic lung disease in that order of ranking. If one excludes YLL and focuses on disability alone and using the assessment of years lived with disability, adult-onset hearing loss ranks third at 4.8% of total YLD (after depressive disorders and other unintentional injuries which rank first and second with 12.1% and 4.8% of the total).

Thus hearing loss imposes a huge social and economic burden on society so the prevention of hearing impairment by governments and other organizations would be an excellent investment.

MEASURING THE BURDEN

Reliable, standardised, population-based data on the causes of hearing impairment are scarce. WHO has published a protocol developed by an expert group for conducting population-based prevalence, causes and needs surveys of ear and hearing disorders. This protocol includes software for data entry and analysis and comprises a section on survey methods, and a questionnaire for each person to record information on their hearing level, ear examination, family history, diagnosis of ear diseases and cause of hearing impairment, and actions needed. A set of coding instructions provide definitions and instructions for each item in the questionnaire. So far, surveys using this protocol have been carried out in more than ten countries and figures for disabling hearing impairment have been determined. More population-based information of quality is needed.

1.2 TYPES AND EFFECTS OF HEARING IMPAIRMENT

Hearing impairment (including deafness) may be sensori-neural (due to damage to the inner ear or the auditory nerve), conductive (due to blockage or reduction of sound waves passing through the outer or middle ear), or a mixture of the two. They have a profound effect on individuals: they may delay development

of speech and language, slow educational progress, cause difficulty in obtaining, performing and keeping a job, cause social problems, and lead to being stigmatized (unfairly thought of as undesirable or discreditable) at all ages.

1.3 EARLY IDENTIFICATION

There is good evidence that early identification of hearing impairment leads to significant improvement in language and education, but late identification of hearing impairment leads to poor remediation. Therefore neonatal hearing screening services have been set up in most developed countries to identify children with a congenital hearing impairment. However these services are expensive to implement and identification of hearing loss during the first year of life may be a more feasible option.

1.4 CAUSES

(1) Sensori-neural hearing loss. This is the result of an abnormality of the cochlea in the inner ear or the auditory pathway (the auditory nerve which takes nerve impulses to the auditory centre in the brain). In general, 1 in 1,000 babies born have profound hearing loss, the majority of which is sensorineural. It is also common in later life.

a. Inherited Causes

The majority of cases of this congenital hearing loss will be caused by dominant, recessive or sex-linked genes (recessive genes need to be inherited from both parents to show an effect, whereas dominant genes show an effect when inherited from only one parent; sex-linked genes are attached to the y or x chromosomes, the “sex” chromosomes). Most inherited hearing loss is the result of abnormal, autosomal (i.e. not sex-linked) recessive genes while the remaining hereditary causes are caused by autosomal dominant genes giving rise to some well known syndromes causing hearing loss (e.g. Waardenbergs or Ushers syndromes).

b. Acquired congenital hearing loss

- maternal rubella, maternal syphilis, cytomegalovirus (CMV), toxoplasmosis
- birth trauma and hypoxia, and hyperbilirubinemia (neonatal jaundice), (more common in developing countries)

c. Acquired after birth

- Meningitis, malaria, cytomegalovirus, or other infections such as mumps, toxoplasmosis and measles occur. These are particularly common in poor developing countries.
- iodine deficiency leading to endemic cretinism, – one sixth of the world population is at risk of iodine deficiency; the numbers with related hearing loss are not known.
- Excessive noise, either social or industrial. Most developed countries have legislation limiting the noise exposure at work to no more than 90dBA. Unfortunately these laws are often not enforced resulting in severe, high-frequency hearing loss in old age. It has been shown that the damage caused to the hearing by noise adds to the natural hearing loss of old age (presbycusis). In recent years the impact of social noise has become apparent and studies indicate that young people are losing some high frequency hearing from loud music in enclosed places such as clubs, or when using personal stereos. Much talk is made about the need to raise awareness of the problem but very few countries have sufficiently robust legislation to protect the public.
- Ototoxicity is a common cause of hearing loss. It is well known that many powerful drugs such as some antibiotics, or cytotoxics (anti-cancer drugs) can damage the hearing with some people being more susceptible than others. However, in life threatening conditions hearing loss may be a lesser consideration. Some infections like meningitis and malaria can themselves cause hearing loss but the treatment can sometimes do the same. Drugs that are known to cause hearing loss most often are the drugs whose names end with micin or mycin (e.g. gentamicin, streptomycin). If the drugs are given in a properly controlled fashion, they should not affect hearing. Control is best done by regularly measuring blood levels of the drug during treatment in order to reduce the dose if levels go too high. In developing countries, drug choice is often directed by cost, and effective, non-ototoxic drugs are expensive.
- Presbycusis is the hearing impairment of ageing and is sensori-neural in type. The cause is unknown and there is no specific treatment apart from hearing rehabilitation.

(2) Conductive hearing loss is common and accounts for much moderate hearing impairment. Most of these conditions, which can affect the outer and middle ear, can be treated successfully and restore normal hearing.

- Impacted wax (wax that blocks the whole ear canal and affects hearing). This is probably the commonest cause of mild to moderate hearing loss,

although in some communities it has protected hearing from being damaged by noise.

- Otitis media with effusion is common and may lead to hearing impairment.
- Ear infections are common in poor countries and frequently lead to chronic suppurative otitis media (CSOM) and hearing impairment; sometimes 5% or more of all children have discharging ears from CSOM. Risk factors include poor personal hygiene, contact with dirty water, upper respiratory tract infections. It is usually preceded by acute otitis media (AOM) and results in a perforation of the tympanic membrane and a moderate hearing loss in the affected ear. AOM is common in HIV positive babies and in malnourished children. It is common when babies are not breastfed, when there is overcrowding, when there is smoking in the home, and when children are in contact with other children who have runny noses and coughs. Treatment recommended is detailed in sections 4.1, 4.2, and 4.3. If the ear dries up the perforation may remain and provide a site for further infection.
- Cholesteatoma is a more serious ear disease but is less common. It can have a devastating effect on hearing as well as causing brain abscess and facial palsy.
- Tumours. Malignancy of the ear is rare but when present is extremely painful and difficult to treat. Tumours of the brain are uncommon but tumours of the VIII nerve, such as acoustic neuromas, often present as unilateral hearing loss usually accompanied by tinnitus and vertigo. They must be managed in a specialised unit, if possible. Acoustic Neuromas are slow growing and a “Watch and See” policy is usually kept.
- Otitis media with effusion and chronic suppurative otitis (chronic discharging ears) are prevalent in people with HIV/AIDS. Although the evidence is still not conclusive, sensori neural hearing loss from HIV/AIDS and/or from some anti-retroviral drugs may occur.

PREVENTION

At least 50% of the burden of hearing loss can be prevented. Programme planners are often not aware of the opportunities for prevention; management and rehabilitation of hearing loss and ear disease and their prevention should be the goal in the strategic management of this often unseen disability.

An example of prevention reducing hearing impairment occurs following the introduction of immunisation programmes against rubella, where a significant reduction is found in the number of children born deaf. Immunisation against rubella, mumps and measles is reasonably cheap and effective.

Prevention can be considered as primary, secondary and tertiary prevention.

Primary prevention prevents the occurrence of the disease or other factor that would otherwise lead to hearing impairment. It includes interventions such as hearing conservation for noise induced hearing loss, immunization against infections causing hearing loss, treatment of acute otitis media and the rational use of ototoxic drugs. Secondary prevention includes actions to prevent a disease actually causing a hearing impairment, or to prevent a hearing impairment becoming a disability (that is, preventing a hearing impairment in the ear affecting the ability of a person to hear well), and includes activities such as early detection by screening, prompt treatment of infections such as meningitis or chronic suppurative otitis media and sometimes surgery to prevent or minimize the degree of hearing impairment.

Pre-Natal Prevention

Disorder	1 ^y prevention	2 ^y prevention	3 ^y prevention
Rubella	Immunisation		
Syphilis	Health education, Treatment of the mother		
Toxoplasmosis	Health education, treatment of the mother	Early detection by screening all or high-risk groups and treatment, if available	Hearing aids Special education Rehabilitation
Iodine deficiency	Nutrition, Supplementation		
Ototoxicity	Avoidance, rational use		
Genetic causes	Health education, Counselling, identification of carriers		
Congenital malformations	None	Surgery, when appropriate	

Peri-Natal/Neonatal Prevention

Disorder	1 ^y prevention	2 ^y prevention	3 ^y prevention
Low birth weight	Nutrition, ante-natal care		
Birth trauma, hypoxia	Improved birth practice,		
Herpes simplex	Caesarian section	Early detection by screening all or high-risk groups and treatment, if available	Hearing aids Special education Rehabilitation
Cytomegalovirus	Personal hygiene health education		
Jaundice	Detection of at-risk groups		
Ototoxicity	Avoidance, rational use		
Noise-induced hearing loss from noisy incubators	Reduction in noise		

Prevention in Childhood

Disorder	1 ^y prevention	2 ^y prevention	3 ^y prevention
Impacted ear wax, Otitis externa, Foreign bodies	Personal hygiene Health education (e. g. avoid use of ear buds)		
Acute & Chronic otitis media	Personal hygiene, better living conditions, Proper management of upper respiratory tract infections (URTIs), better nutrition, breast feeding	Health education & screening for early recognition of disease and hearing loss, prompt treatment of disease and/or complications Case follow-up	Surgery, Hearing aids, Special education, Rehabilitation Social integration as appropriate
Measles, mumps	Immunization		
Cerebral Malaria	Vector reduction and prophylaxis		
Meningitis	Prophylaxis, Immunization		
Ototoxicity	Avoidance, Rational use		

Prevention in Adults

Disorder	1^y prevention	2^y prevention	3^y prevention
Ototoxicity	Avoidance rational use	Early detection	↑ Rehabilitation (hearing aids, cochlear implants) Special education Social integration/ accessibility
Noise – induced hearing loss	Education, hearings conservation laws	Early detection	
Presbycusis		Avoid ototoxic agents & noises	↓
Trauma	Helmets, seat belts laws	Surgery	
Otosclerosis		Surgery	

Tertiary prevention can be considered to prevent a disability becoming a handicap for an individual functioning in his or her environment and includes provision of hearing aids services, special education, accessibility and social integration. This framework is illustrated in the tables 1–4 which show the activities that can be done for each type of prevention according to different causes. WHO has recently developed a new classification of disability (*The International Classification of Functioning, Disability and Health*) which takes a more positive approach to disability and addresses social, environmental and personal factors. However the classification used here is still useful in understanding the different types of management and rehabilitation that should be used.

Table 5: Main causes of hearing loss

High proportion	Moderate Proportion	Low Proportion
Genetic causes	Excessive noise	Nutritionally-related
Otitis media	Ototoxic drugs & chemicals	Trauma-related
Presbycusis	Ante- & peri-natal problems	Menière’s disease
	Infectious causes	Tumours
	Wax and foreign bodies	Cerebrovascular disease

In order to further develop the public health approach to prevention, WHO has grouped the different causes according to their frequency (see table 5). This enables the development of strategies for prevention to focus on causes with high and moderate frequency and to ignore those of lower frequency even though for individuals these may of course mean significant disability. WHO is therefore developing a selection of effective strategies for prevention against ototoxic drugs, chronic otitis media, noise induced hearing loss and has already developed guidelines for appropriate and affordable hearing aids for developing countries. Implementation of these interventions includes primary ear and hearing care, as part of a programme for prevention.

1.5 PROGRAMME FOR PREVENTION

The components of a programme for prevention should include primary ear and hearing care, health education, surveillance and treatment of infectious diseases, immunization, maternal health and antenatal and perinatal care, genetic counselling, hearing conservation, screening and detection, referral for secondary and tertiary services and training and refresher courses at all levels. These components will also link to habilitation and rehabilitation programmes, community-based rehabilitation (CBR) and provision of hearing aids services and educational services. Most of these topics are covered in this training resource. A more detailed prevention programme is given in the ANNEX “Setting up a National or District Programme for deafness and hearing impairment”.

The WHO initiative for appropriate and affordable hearing aids and services for developing countries is another example of using the public health approach to prevention. WHO developed the guidelines on hearing aids and services for developing countries, these were launched in 2001, 2nd edition in 2004 (English & Chinese Versions). The guidelines describe basic requirements for behind the ear and occasionally body worn hearing aids, the setting up of services for delivery, fitting, follow-up and repair, and a section on training. The guidelines are specifically targeted at children and infants but also cover all ages.

To address the complex issue of providing sufficient numbers of affordable hearing aids and services in the developing world a global partnership has been set up called WWHearing – World wide Hearing Care for Developing Countries. This body includes key stakeholders: policymakers, service providers, trainers and users in developing countries, major donors and appropriate expert advisers. WHO is an interested observer and representatives of associa-

tions of commercial manufacturers and not-for-profit organizations that manufacture or assemble hearing aids will be involved through a project to be set up by WWHearing in agreement with WHO. WWHearing will encourage and assist the setting up of public/private partnerships. It will encourage and assist the setting up of public/private partnerships between national governments of developing countries and hearing aid manufacturers in order to provide affordable and appropriate hearing aids and services in large enough quantities.

2 EXAMINATION OF THE EAR

2.1 SIGNS AND SYMPTOMS

- Earache
- Fever
- Ear discharge
- Itching
- Blocked ear
- Hearing impairment
- Tinnitus
- Vertigo
- Facial palsy

EARACHE:

Earache is most often due to **acute ear infections** or an **acute worsening of chronic ear infections** and the cause is readily found.

However, when the otoscopic findings are normal, you have to look further and think of **referred earache**, which is earache that arises from parts of the head and the neck other than the ear. Look into the mouth. Inspect the teeth and gums for decay and infection, especially the **wisdom teeth**. If the cause is located in the mouth or throat the pain is worse during swallowing and radiates to one ear. Check the **tonsils** for **inflammation (swelling and sores)** and growths. Earache after tonsillectomy is common. For inspection of the **hypopharynx** one needs a laryngeal mirror, but in case of tumours the offensive smell of necrotic tissue gives an indication. Examine the **neck**, jaw and behind the ear. Palpate the neck for enlarged glands.

Earache can be localised just in front of the ear and radiating to the temporal bone and mandible, especially during chewing. Ask the patient to open the mouth and press with the index finger on the **temporomandibular joint**. When this is abnormally painful, then the diagnosis is temporomandibular pain-dysfunction syndrome.

Earache behind the ear on the lowest part of the mastoid process arises from the attachment of the **sterno-cleido-mastoid muscle** (tendinitis).

If a cause cannot be found, all the previously mentioned causes have been excluded and there is a shooting pain deep in the ear, then it could be **neuralgia**. Test also for facial weakness (see section on facial palsy).

Beware, that in infants, crying as well as dyspepsia can be the only symptom

of an acute otitis media. Tugging the ear may occur, but is an unreliable symptom of otitis media. When a baby sleeps well through the night, it probably has no ear infection.

Chronic otitis media is painless, unless during an acute exacerbation.



Ear discharge from CSOM

EAR DISCHARGE:

Copious discharge or mucoid discharge always arises from the middle ear and is a sign of **acute or chronic otitis media**.

Otitis externa causes a scanty discharge. **Fungus** (*Aspergillus fumigatus*, *A. niger* or *A. flavus*) can easily be recognised. This is not the case with moulds (*Candida*). A scanty, creamy discharge can be *Candida*.

An offensive smelling discharge is suggestive of **cholesteatoma**.

Eczema or allergy of the skin of the pinna and ear canal gives a watery discharge, a “weeping ear”. A watery discharge after a skull trauma is leakage of **cerebrospinal fluid** (liquorrhea, CSF). Differentiation with middle ear discharge is made with a gluco-stick (CSF contains glucose). A bloody discharge is seen after **trauma** or a severe ear infection.

ITCHING:

Itching is a symptom of **otitis externa** (infectious or eczematous).

EAR PRESSURE:

Pressure in the ear can be caused in any part of the ear, i.e. ear canal, middle ear, or inner ear. For instance **ear wax**, **Eustachian tube dysfunction**, **otitis media with effusion**, **hydrops** of the inner ear (Ménière’s disease) all give a feeling of ear pressure.

HEARING IMPAIRMENT AND TINNITUS:

Here the same applies as for ear pressure. Tinnitus is the name for noises or sounds in the ear which are auditory sensations which occur when no external sounds are present. Diagnosis is made using otoscopy and audiological tests.

FEVER:

Fever can accompany **acute otitis media** and is often preceded by an **upper respiratory tract infection**. A child with fever and belly pain around the umbilicus can have an acute otitis media and needs otoscopy to examine the ear drum.

DIZZINESS AND VERTIGO:

- When a patient complains of **dizziness**, the first thing to do is to find what exactly is meant. Ask the patient to describe the dizziness. The inner ear is only responsible in 50–60% of cases of dizziness, other causes are neurological or circulatory.
- **Vertigo** is a type of dizziness that is caused by a lesion or abnormal function of the peripheral or central **vestibular system**. Typical vertigo is the illusion of movement of the surrounding environment or oneself. A sign is **nystagmus** (rapid jerking eye movements), often with severe sickness and vomiting.
- Vertigo can be caused in the peripheral vestibular system (inner ear and vestibular nerve) or in the central nervous system (brain).
- Vertigo associated with sudden head movements lasting only seconds or less than a minute is specific for a disorder in the peripheral vestibular organ and is called **benign paroxysmal vertigo**.
- Vertigo lasting for **several hours** is associated with an inner ear disorder
- Vertigo lasting **several weeks** can be a labyrinthitis or a neuritis of the vestibular nerve.
- Continuous vertigo lasting **more than three weeks** is caused by a disorder in the central nervous system.
- If someone feels “dizzy”, but without nystagmus, then the cause lies outside the vestibular system (The individual’s internal medical and neurological status needs to be examined). Observe also if there is **hyperventilation**.
- Examples of peripheral vestibular causes are hydrops of the inner ear (**Ménière’s disease**), **motion sickness**, **labyrinthitis**, **neuritis**, **inner ear concussion**. Examples of central vestibular causes are **neurological disorders**, as for instance **cerebrovascular insufficiency**, **alcohol intoxication**, **neurosyphilis**, **brain tumours**.

FACIAL PALSY:

Weakness or inability to move the muscles of one side of the face is a sign of facial palsy (Bell’s palsy, facial nerve paralysis). These signs develop over a couple of days and become apparent when one asks the patient to close the eyes, to lift the eyebrows and show the teeth. Most often the paralysis is unilateral. There is a feeling of stiffness. There may be earache. Check the pinna, ear canal and eardrum for Herpes zoster eruptions, or other abnormalities, in particular otitis media, cholesteatoma and tumours. Bilateral facial palsy is a sign of neurological disease.



Facial palsy from cholesteatoma

COMPLICATIONS OF OTITIS MEDIA:

Acute and chronic otitis media with and without cholesteatoma can give rise to serious and even fatal complications. The infection can spread to the **mastoid**, the **facial nerve**, the **labyrinth**, the **lateral sinus**, the **meninges** (the membranes around the brain) and the **brain**, causing **mastoid abscess**, **facial nerve paralysis**, **hearing impairment and vertigo**, **lateral sinus thrombosis**, **meningitis**, **subdural or epidural abscess** and **brain abscess**. Warning signs of impending intra-cranial complications are a malodorous ear discharge, earache in the setting of a chronic ear disease, fever and headache.

In case of:

- painful swelling behind the ear
- increased fever
- headache
- neck stiffness
- sudden hearing loss
- vertigo
- facial nerve paralysis
- ataxia
- decrease or loss of consciousness

**REFER IMMEDIATELY
TO THE HOSPITAL!
BRAIN ABSCESES,
ESPECIALLY, HAVE A
HIGH RATE OF MOR-
TALITY.**

Describe the difference between earache and referred earache.

Explain the different types of discharge found in these conditions:

Otitis externa

Fungus

Otitis media

Eczema

2.2 OTOSCOPY

CHECK THE OTOSCOPE:

- Check the brightness of the otoscope light and replace the battery, if necessary. If the light is not bright enough, you may overlook pathology and even a normal tympanic membrane will look dull and not translucent. The area where you work should not be too bright. Otoscopy in full sunlight will fail. Darken the room a bit if necessary or sit in the shade of a tree.

HOW TO POSITION THE CHILD:

- Have small children sit on the lap of the mother and held in the right way with the arms, legs and head restrained to avoid moving and kicking. Be seated yourself at the same level as the patient and explain what you are going to do.

HOW TO HOLD AND TO HANDLE THE OTOSCOPE:

- Choose the largest speculum that fits in the ear canal without hurting. Take a clean speculum for every patient.
- If the patient is complaining about one ear, check first the good ear, after which you can use the same speculum also for the other ear. If there is bilateral ear discharge use a separate speculum for each ear to prevent contamination.
- Hold the otoscope like a pencil. In this way you can rest the side of your hand against the head of the patient and avoid trauma by a sudden movement of the patient. Often you see the otoscope being held in the palm of the hand, like a dagger. It then becomes a dangerous instrument.
- With the other hand pull the pinna upwards and outwards to stretch the ear canal for a better view. In infants pull slightly downwards.
- Before introducing the otoscope into the ear canal, shine first from a short distance into the opening and inspect the outer-most part of the ear canal, where boils, papillomas and fibromas may be found. Then introduce the otoscope gently into the ear canal, but not beyond the cartilaginous part. You may press the tragus a bit aside with the speculum. Avoid touching the very sensitive bony part of the ear canal.
- Have your eye very near to the lens of the otoscope. This will increase your field of vision.



How to hold the child for otoscopy



How to hold the otoscope

WHAT TO LOOK FOR:

- Check the ear canal for skin condition, wax, foreign body, pus, fungus, swelling, granulations, polyps and other growths. Remove wax, if it is blocking your field of vision. Be careful with polyps. Multiple, granulomatous polyps can be a sign of tuberculosis.

NOTE: Do not do a biopsy of a polyp before having done a needle aspiration. If you can draw blood then the polyp is a glomus tumour and a biopsy would cause a fierce bleeding.

- Inspect the tympanic membrane. Localise first the handle of the malleus. Then you are sure you are looking at the tympanic membrane. Be aware that the otoscope gives you only a partial view of the tympanic membrane. Move the otoscope a little to make sure you build up a complete picture of the whole tympanic membrane. If pus or wax is blocking the view remove this.

CHECKLIST FOR AN OTOSCOPY:

- First identify the tympanic membrane and check for its position (retraction, bulging), translucency, colour, redness, granulations, perforation.
- If the tympanic membrane is intact, then try to look through it to assess the aeration of the middle ear.
- Is the middle ear aerated or is there pus or fluid?
- Take note of the size and the localisation of a perforation.
- Is the perforation central, marginal or epitympanal(above the malleus handle)?
- Is the middle ear dry with normal mucosa?
- Is the mucosa swollen and injected?
- Are there polyps or granulations?
- Is there cholesteatoma?
- Look for cholesteatoma especially at supero-posterior, marginal and epitympanal perforations and retraction pockets.
- Most difficult to see and very often overlooked are fluid in the middle ear (otitis media with effusion) and cholesteatoma.
- Make a schematic drawing of the otoscopic findings on the patient card.

HOW TO MAINTAIN THE OTOSCOPE:

- Do not forget to switch off the otoscope after each examination to save battery power. If you are not using the otoscope daily, remove the batteries in between. Clean each speculum with a disinfectant solution. The re-usable ones can be autoclaved. Have spare batteries and bulbs in stock, as well as enough speculae of different sizes.

Describe where these conditions are found in the patient to a partner:

- wax, foreign bodies, growths, otitis externa, fungus, acute otitis media, otitis media with effusion, chronic suppurative otitis media, otitis media with cholesteatoma, dry perforations and also rhinitis, tonsillitis, enlarged tonsils and adenoids and enlarged neck glands

PATIENT RECORDS – CLINICAL NOTES.

Make short and relevant notes on the patient record:

1. History with the complaints expressed by the patient, previous illnesses and operations, present medication, allergies
2. Examination findings and test results
3. Diagnosis
4. Plan: treatment and prescription, further tests, referral, follow-up date

Example (4 years old child):

H/ earache and fever for 2 days. Previous illnesses: AOM 3x last 3 yrs.

Medication: none. Allergies: none known.

E/ Right ear: injected, bulging TM; Left ear: NAD. Nose: purulent discharge. Throat: NAD.

D/ AOM Rt ear; purulent rhinitis

P/ Rx amoxicillin syrup tid 250 ml 7/7 and Paracetamol syrup qid 5 ml PRN

COMMONLY USED ACRONYMS:

TM: tympanic membrane

FB: foreign body

AOM or OMA: acute otitis media or otitis media acuta

CSOM: chronic suppurative otitis media

OME: otitis media with effusion, glue ear

OE: otitis externa or external otitis

NAD: no abnormality discovered
 Rx: prescription
 OD: once daily
 BID: twice daily
 TID: three times daily
 QID: four times daily
 PRN: as needed
 AC: before meals
 PC: after meals
 IM: intramuscular
 IV: intravenous
 Tbsp: table spoon
 Tabs: tablets
 Stat: immediately
 FBC: full blood count
 ESR: erythrocytes sedimentation rate
 BP: blood pressure
 T: temperature

Work with a partner:

Describe the symptoms you would find in a 6year old child with chronic suppurative otitis media.

Prepare a health card for this child

Include:

Symptoms

Previous illnesses

Medication

Allergies

Record state of:

Ear _____ Nose _____ Throat _____

Diagnosis:

Treatment:

2.4 EAR EXAMINATION

GENERAL:

- Get a general impression of the patient's condition. Does he/she look healthy? Is the child growing well? Check the weight curve of under-fives when available. What is the hygienic condition of the child? Are there generalised glands or sores? Is the patient breathing through the nose or through an open mouth? Is there a stridor? Are speech and hearing normal?

PINNA:

- Is the pinna normal? Check for infection, abnormal shape, tumours, fistulas and scars. Do not forget to check behind the ear and under the ear lobe.

NOSE, THROAT AND NECK EXAMINATION

NOSE/THROAT/NECK:

- Is the nose blocked or is there normal nasal breathing? Is there a nasal discharge?
- Look into the mouth. Are there infections/sores of the tongue and mucosa? How are the gums? How are the tonsils, enlarged, inflamed? How is the condition of the teeth? Are there adenoids?
- Palpate the areas of the neck: retromandibular, submandibular, submental, pre-jugular and posterior. Are there enlarged glands?



Normal eardrum



Tympanosclerosis

NOTE: Multiple enlarged glands, especially submental are suspicious of HIV.

EXAMINATION OF THE HEARING WITH TUNING FORK AND BARANY NOISE BOX:

The tuning fork is an indispensable tool to differentiate between conductive and sensorineural hearing impairment and to check the audiogram that may be mistaken in this respect. The Barany noise box is used to establish hearing loss.

A 512 Hz tuning fork is used for the Rinne and the Weber test.

Rinne test:

- Each ear is tested separately.
- Make the tuning fork vibrate by tapping it on the elbow. Don't tap it on hard surfaces as this will produce 'clang' tones that have a much higher frequency and make the test useless.
- Place the base of the vibrating tuning fork on the mastoid and ask: "Do you hear sound?". If yes, then immediately place the tuning fork just in front of the entrance to ear canal.
- Ask the patient: "Is the sound is now louder or softer?" Repeat the test if the patient is not sure and ask again which sound is loudest: with the tuning fork on the bone or in front of the ear canal.
- In normal hearing or in a sensorineural hearing impairment the sound in front of the ear canal is the louder. The Rinne is called positive. In a conductive hearing impairment it is the reverse: the sound on the bone is louder. In this case the Rinne is called negative. One can do the test on oneself by simulating a conductive hearing impairment by plugging the ear canal with a finger. In a small conductive hearing impairment the Rinne is still positive. The Rinne reverses to negative if the air-bone gap is more then about 20 dB.



Rinne test. Tuning fork on mastoid



Rinne test. Tuning fork in front of the ear canal

Weber test:

- Both ears are tested simultaneously. This test is only useful in asymmetrical hearing impairment.
- Make the tuning fork vibrate by tapping it on the elbow.
- Place the base of the vibrating tuning fork on the middle of the patient's forehead and ask the patient: "Where do you hear the sound loudest: on the left, on the right or in the middle?" Repeat the test if the patient is not sure. If the patient doesn't hear the sound, put the tuning fork on the front teeth.
- In normal hearing or in a symmetrical hearing impairment the sound is heard in the middle. In a sensorineural hearing loss the sound is heard in the better ear. This is called lateralisation. In a conductive hearing impairment the sound is lateralised to the worse ear.



Weber test. Tuning fork on the forehead

Barany test:

This test is used to ascertain if a patient is completely deaf in one ear or still has some hearing of speech remaining. The test is particularly useful in one-sided deafness. Sometimes there seems to be a hearing threshold of 70 dB or higher on the audiogram of a deaf ear, but this is because sound is overheard by the hearing ear. The Barany box is a clockwork noise maker that is used to mask the hearing ear.

- Explain to the patient: "The machine will make a loud noise in the 'good' ear, please try and repeat what I shout into your bad ear". Place the tip of the noise box on the ear canal entrance of the hearing ear, turn the box on and shout something simple like "hello" into the bad ear. If the patient doesn't hear this then ear is 'barany deaf'. This means there is no perception of speech at all and this will have consequences when advising about a hearing aid.



Barany test. Masking the better ear



Barany noise maker and 512 Hz tuning fork

Choose a partner:

1. Explain the use of a tuning fork
2. Demonstrate the use of the tuning fork

Explain to the group the main purpose of a Barany test

3 DETECTION, SCREENING AND TESTING OF HEARING IMPAIRMENT

3.1 DETECTION OF A HEARING LOSS

Early detection and rehabilitation of a hearing loss is important for infants and young children. There is evidence to show that if an infant has a congenital sensorineural hearing impairment detected and rehabilitated in the first six months of life, speech and language development is much better than for those identified and rehabilitated later.

Detection of a hearing loss early is also important for the older child who might otherwise become isolated and misunderstood. Frequently, he or she is suspected of having a behavioural problem and may not receive the type of help needed.

3.2 METHODS OF SCREENING

Hearing loss in infants and very young children may be suspected by parents and any parent voicing a suspicion of hearing loss in their child has considered it carefully first. Others in contact with hearing impaired children may be able to compare their responses to sound with those of other children they are in contact with and mention their suspicions. All such suspicions should be taken seriously and the infant/child's hearing tested.

Detection methods have also been devised for use in this age group. These methods include:

- attention to “at risk” factors
- check lists
- questionnaires
- screening tests

3.2.1 RISK FACTORS for hearing impairment are found in Module 1. Using risk factors to identify hearing impairment in infants and young children has been only partially successful. Around 50% of hearing loss is undetected. Some types of inherited hearing loss may not be obvious from the history and infections during pregnancy do not always give clear symptoms.

3.2.2 CHECK LISTS. A list can be made and given to new mothers, indicating the signs to be expected in a normal hearing infant and young child. Such a list can assist in the identification of some of those having a moderate or more severe hearing loss. The typical checklist would include responses to sound and milestones for developing speech and language (Table 1).

Table 1: Check List for parents or carers

Newborn	Startles to a loud sound
0–3 months	Soothed by moderately loud voice or music
3–4 months	Turns towards the source of a sound
6–8 months	Turns and locates the source of a quiet sound Babble sounds appear eg. Dada
12 months	Increased babble and the first word is heard Understands one or two simple instructions eg. “clap hands”
18 months	Says at least six words
2 years	Joins two words together
3 years	Talking in sentences. Speech mainly clear.

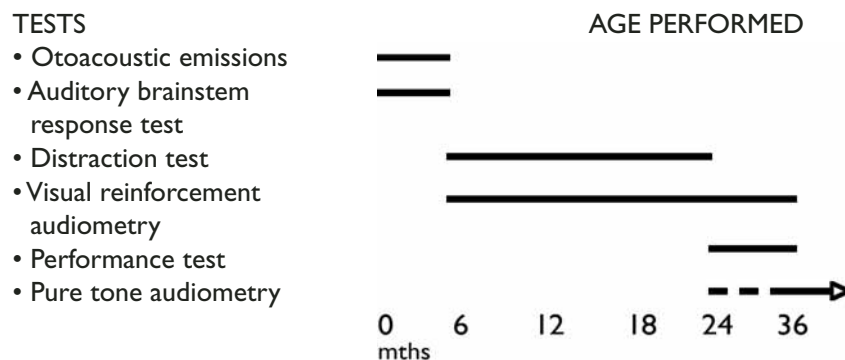
3.2.3 QUESTIONNAIRES have been employed with babies and older children with varying success. Questionnaires depend upon observation, and so a slight hearing impairment or a unilateral hearing loss may be missed using this method. They have the advantage, however, of being an inexpensive method of detecting more severe hearing loss in children with both ears affected (eg. See Table 2).

Table 2 Questions for infants 6–8 months

• Do you think your baby has normal hearing?
• Does your baby startle to loud noises?
• Does your baby notice the sound of a car horn or bicycle bell?
• If you speak normally to your baby, does he/she turn to look at you?
• If you speak very quietly to your baby does he/she turn to look at you?

3.3.3 SCREENING TESTS can be used at various ages based upon the level of development that the infant/child has reached (Fig. 1). All such tests require the tester to first acquire training. A loud sound is required to elicit a behavioural change in an infant, so specialised tests are needed at this age. As the infant matures responses can be obtained to quieter sounds until at around six months when an infant can turn and locate the source of a sound made at ear level. This ability to turn towards a sound is the basis of the Distraction Test (described later). Other tests can also be used with older children until they are capable of co-operating in pure tone audiometry, which is the test that provides the most information.

Fig. 1 Screening tests of hearing



3.3.4 NEWBORN HEARING SCREENING

Tests have been developed to detect a hearing impairment in newborns. These do not depend upon a behavioural change in response to sound and so all degrees of hearing loss can now be determined. The tests use otoacoustic emissions and/or auditory brainstem responses.

Otoacoustic emissions:

- are sounds made by outer hair cells in the cochlea in response to a sound signal.
- are not usually recorded if there is too much debris in the outer ear or if there is middle ear fluid.
- are of two main types used in testing hearing in infants:– transient evoked otoacoustic emissions (TEOAEs) and distortion product otoacoustic emissions (DPs).
- TEOAEs are elicited using a click sound and are absent if there is a hearing loss >25–30dB.
- DPs are the result of the interaction between two tones close in frequency

and introduced simultaneously. They can be recorded in ears with up to 45dB HL hearing loss.

NOTE: There are hand held instruments available for testing with OAEs or it is possible to use automated equipment.

The auditory brainstem response test (ABR)

In this test responses to a sound are recorded at three electrode positions on the surface of the skull. The responses are seen as a waveform and one wave, wave V, is the wave which needs to be identified. A click sound is usually used to obtain the response. The click contains frequencies across a wide range, and stimulates the cochlea along its length, but the responses are in the frequency region 1–4kHz, mainly around 3kHz. The test, therefore, only gives information relating to high frequency hearing. Newborns can be tested whilst asleep.

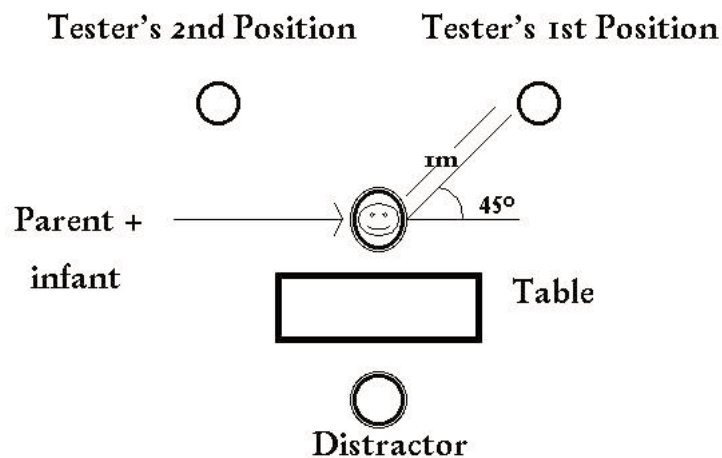
Newborn screening programmes

Otoacoustic emissions are often used initially for screening hearing of newborns. In some screening programmes those who have no emissions are re-tested a month later. If again there are no emissions the newborns are referred for the ABR test. Those babies who have “at risk factors” may be tested by ABR without first being screened using otoacoustic emissions.

3.3.5 SCREENING THE HEARING OF OLDER INFANTS AND CHILDREN. Behavioural tests of hearing may be used when an infant reaches the developmental age (as opposed to the chronological age) of six months. Infants not at this level of development and some of those with more than one disability will need to be tested by the methods already described.

The rooms used for testing need to be very quiet.

3.3.6 DISTRACTION TEST. A distraction test may be performed if an infant is sitting and able to turn and locate the source of a sound. It is carried out with the infant sat upon an adult’s knee facing forwards where a distractor controls the infant’s attention using toys. The tester introduces the sound signals from 45degrees behind, on a level with the ear and about one metre behind (Fig. 2a).

Fig. 2a Positions for distraction testing

High, mid and low frequencies (i.e. high, mid and low pitched sounds) are tested separately in order to detect hearing loss restricted to one part of the frequency range. The sound stimuli used may be :-

High frequencies	high frequency rattle, “ss” sound or *warble tones at 4kHz
Middle frequencies	warble tones at 1kHz
Low frequencies	voiced hum or warble tones at 500Hz

(*warble tones are tones which vary slightly around a central tone. Hand held instruments are available for performing the test)

The sounds are introduced at very quiet levels (35dBA). Care has to be taken not to give clues as to the tester’s position other than the test signal.

3.3.7 VISUAL REINFORCEMENT AUDIOMETRY

Equipment is needed for this test – a sound source and a lit up toy or flashing light. The sound source is an audiometer and the sounds can be introduced via loudspeakers or headphones (or small earphones). If loudspeakers are used then warble tones of 500Hz, 1, 2 and 4kHz are used; if headphones are used then pure tones can be employed. The two loudspeakers are placed at an angle of about 60 degrees to the side of the infant/child being tested so that there is the need to turn and look at the light source that is usually placed on top. This helps the tester to recognise a response during the test.

At first, an infant is shown a light whenever a sound is heard. Once the infant has learned to look for the light whenever a sound is made the test itself can start i.e. once the infant has been conditioned.

In the test the sound is made first and the light is only introduced after the infant has turned to look for it. In this way sounds of different frequency can be introduced at the screening level chosen, usually 30/35 db at the ear, when using loudspeakers.

Discuss why the Distraction test is used as a method for screening infants.

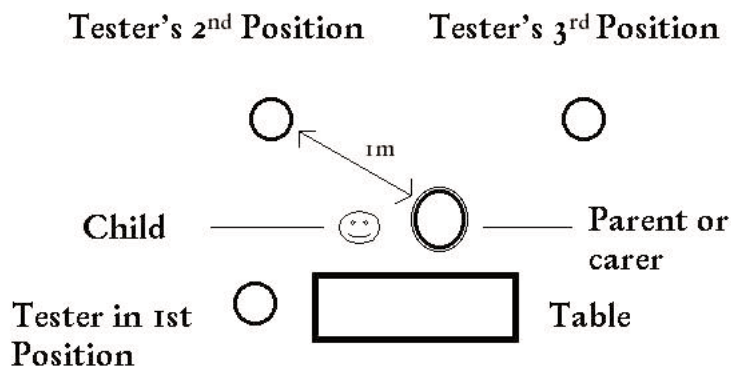
3.3.8 PERFORMANCE TESTS

A child is shown how to wait until a sound is heard before carrying out an action. Once this can be done the test is performed at a metre distance and from behind (Fig. 2b). The test may be performed using

- 1 “Go” for low frequencies, “S” for high frequencies , introduced at the quietest voice levels
OR
- 2 Warble tones at 500Hz, 1or 2kHz and 4kHz introduced at a very quiet level corresponding to normal hearing.

The child is said to have “passed” the screen if there are two responses at the quietest level.

Fig. 2b Positions for performance testing



Explain the difference between Distraction tests and Performance tests and when they could be used to test hearing.

3.3.9 PURE TONE AUDIOMETRY Screening of hearing may be performed using pure tone audiometry. Pure tones are introduced using headphones and testing carried out by air conduction at 500Hz, 1, 2 and 4kHz. The sounds are often introduced at a level of 20dB HL.

3.4 MEASUREMENT OF HEARING

All the tests described in Figure 1, with the exception of otoacoustic emissions, may be used to quantify the degree of hearing loss in children as well as screen. This is done by starting at the level of loudness used for screening and then, if there is no response, raising the level of the sound until a response is obtained, and measuring that level with an instrument called a sound level meter. Some infants and young children have so severe a hearing loss that they do not hear any sound but respond very quickly if touched or if an object is seen. Others may not seem to respond due to additional disabilities. These two groups can be difficult to test so those infants and children who fail a screening test of hearing should always then be tested by experienced trained testers.

The auditory brainstem response test is limited in only testing to brainstem level and not giving information about low frequency hearing. The behavioural tests, with the exception of pure tone audiometry, provide information about the hearing levels of the better ear only. They may indicate a difference between the two ears, by showing difficulties in locating the source of a sound, without indicating the size of the difference. Information about the hearing level of both ears separately may be obtained using visual reinforcement audiometry.

Pure tone audiometry is the gold standard. This test can be used with most children from the age of three years and in some several months earlier. Adults are usually tested using pure tone audiometry.

Where there is an asymmetrical hearing loss, a procedure known as “masking” is necessary if the hearing level of both ears is to be determined. Masking puts a noise into the better ear whilst the hearing threshold in the poorer ear is measured. See section 2.4, page 31 for masking using the Barany noise box. Masking could also be used with visual reinforcement audiometry if needed.

3.5 TYMPANOMETRY

This is a test of the middle ear and is not a test of hearing. It is often used in addition to hearing tests, for adults and children, to help determine the type of hearing loss found. Tympanometry can indicate whether the middle ear is normal or has fluid in it, whether a perforation is present, if grommet tubes are working or are blocked. It involves a soft plastic tip being placed in the outer part of the external auditory canal and a tone being introduced into the ear. The amount of sound reflected back is measured and indicates whether fluid is present or not. The size of the space beyond the plastic tip indicates if the tympanic membrane (eardrum) is perforated or not. A test can also be performed to see if the contraction of the stapedius muscle can be detected. A contraction is not detectable if there is fluid in the middle ear.

SUMMARY

It is essential to detect hearing impairment and to rehabilitate those affected as early as possible. Tests are available for screening and measuring hearing loss in newborns, older infants, children and adults and for identifying the type of hearing loss. Not all such tests require expensive equipment but all need some measure of training before they are carried out.

4 EAR CONDITIONS – DIAGNOSIS AND TREATMENT

4.1 EAR INFECTIONS AND OTHER CONDITIONS

OTITIS EXTERNA (OE)

OE can be:

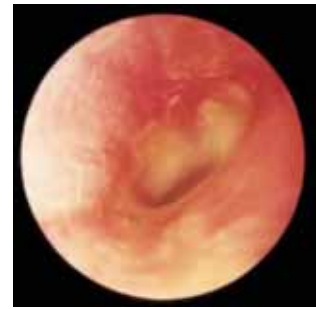
- bacterial, fungal (otomycosis) or eczematous
- diffuse or localised
- acute or recurrent/chronic.



Chronic otitis externa with fungus (otomycosis)



Acute, diffuse external otitis with oedema



Chronic otitis externa

DIFFUSE OTITIS EXTERNA:

Main causes:

- poking with cotton wool tips and other objects
- humidity and contaminated water
- ear discharge from otitis media
- contact allergy
- pre-existing skin diseases (psoriasis, eczema)

Signs and symptoms:

- itching
- in acute case: severe pain
- scaling skin (dry otitis externa) or scanty discharge (wet otitis externa)
- in acute cases redness of the skin and in severe cases oedema

- typical appearance of fungus in case of otomycosis
- conductive hearing impairment, when the ear canal gets blocked with debris and secretion

Treatment:

- clean out the ear canal with syringing, mopping or suction
- in case of bacterial OE antibiotic or antibiotic/steroid ear drops, qid 3 drops for a week.
- cases with otomycosis and severe cases of oedematous OE can be treated effectively with a single instillation of 1% silver nitrate gel, repeated after a couple of days PRN
- in case of pre-auricular cellulitis and /or lymphadenitis: Penicillin V for 5 days

LOCALISED OTITIS EXTERNA, BOIL, FURUNCLE, ABSCESS:

Causes:

Infection of a hair follicle, gland or sebaceous cyst, most often from *Staphylococcus Aureus*.

Signs and symptoms:

painful, localised swelling at the ear canal entrance



Localised otitis externa

Treatment:

- apply antiseptic ointment daily, eg silversulfadiazine or povidon-iodine
- Cloxacillin for 5 days and Paracetamol or ibuprofen PRN
- open the abscess, when ripe

Advise the patients not to pick their ears with pins, tooth picks etc., to avoid dirty water entering the ear and to use clean towels.

Sometimes it is difficult to clean out the ear canal, especially in case of fungus.

Refer these patients to the ear nurse or ENT-specialist.

External otitis can be secondary to a suppurative otitis media with a perforation. Check the state of the ear drum with the otoscope.

Describe the signs and symptoms of OE



Hyperkeratosis obturans

HYPERKERATOSIS OBTURANS

Hyperkeratosis obturans is an abnormal desquamation of the skin of the ear canal with accumulation of keratin/cholesteatoma, usually one-sided.

Signs and symptoms:

- a ring of granulations at the outer part of the ear canal. Behind these granulations the ear canal is filled with whitish debris, which is keratin or cholesteatoma. The ear canal might be distended
- feeling of blockage of the ear with a conductive hearing impairment.

Treatment:

- refer for cauterisation of the granulations and removal of the keratin with a 2 mm suction tip. More than one session might be needed. Regular follow-up every 3 or 4 months is advisable.

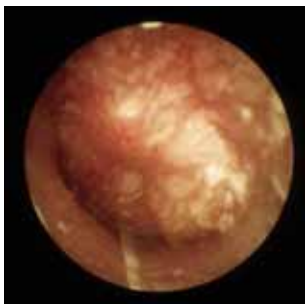


Acute otitis media. Early stage

ACUTE OTITIS MEDIA (AOM)

Causes:

- upper respiratory tract infection (rhinitis, sinusitis, adenoiditis), pathogens are mostly *Streptococcus pneumoniae*, *Moraxella catarrhalis* and *Haemophilus influenzae* and less frequently *Staphylococcus aureus* and others
- infection may occur through a pre-existent perforation (contaminated water), mostly Gram-negative pathogens such as *E. coli*, *Proteus*, and *Pseudomonas aeruginosa*
- haematogenous infection from measles and scarlet fever, causing necrosis with large tympanic membrane perforations, destruction of hearing ossicles and chronic suppurative otitis media



Acute otitis media, bulging. Suppurative stage

Predisposing factors:

- age, the majority is below 5 years of age
- family history of otitis
- winter season
- bottle feeding
- day-care centres
- passive smoking

Signs and symptoms

- earache
- fever
- irritability
- hearing impairment
- redness of the ear drum, later bulging, because of accumulation of pus in the middle ear
- discharge occurs after rupture of the ear drum, after which the fever and pain go down. The perforation is mostly small and may be not easily visible in the presence of pus



Perforated acute otitis media

Treatment:

Many cases heal spontaneously, but in order to prevent chronic otitis media and complications occurring, antibiotic treatment is recommended.

Infants and children:

- oral amoxicillin (15 mg/kg, tid) or co-trimoxazole (trimethoprim 4 mg/kg; sulfamethoxazole 20 mg/kg bid) for 5 days
- Paracetamol syrup in case of high fever and pain
- ear drops are not indicated; decongestive nose drops are not of benefit

If there is no clinical improvement after 5 days of treatment then treat for 5 more days with the same antibiotic. If still no improvement (still pain, fever or discharge) refer to the hospital.

Frequent dry-mopping or wicking at home in case of purulent discharge is advisable. This may also help to prevent otitis externa and impetigo.

Check the eardrum and the hearing after treatment.

In some cases the infection can break through to the surrounding structures such as mastoid, brain, inner ear and facial nerve. In case of **mastoiditis** or other signs and symptoms of **complications** like dizziness, vomiting, hearing loss, headache, stiffness of the neck, drowsiness, convulsions, facial palsy, give an injection of Benzylpenicillin and Chloramphenicol and refer to the hospital immediately.

ACUTE MASTOIDITIS

Causes:

An acute mastoiditis can develop some weeks after inadequate treatment of acute otitis media, when the pathogens are very virulent or when the patient has low resistance. It can also occur after an acute exacerbation of an otitis media with cholesteatoma. The suppurative process spreads from the middle ear to the mastoid and with faulty drainage causes bone necrosis of the mastoid cells. The pus can break through outwards through the mastoid surface behind the pinna or inwards to the inner ear, dura or facial canal.



Acute mastoiditis with subperiosteal abscess

Signs and symptoms:

- increasing fever and illness
- increasing pain, especially over the mastoid area
- tender, fluctuating swelling and redness over the mastoid area causing the pinna to protrude
- profuse discharge from a perforation of the ear drum or a bulging ear drum without discharge
- often swelling or sagging of the posterior-superior part of the ear canal near the ear drum
- neurological symptoms as mentioned under complications of AOM point to an intra-cranial breakthrough of the abscess

Treatment:

Start with Benzylpenicillin (50,000 units/kg every 6 hours IV) and Chloramphenicol (25 mg/kg every 6 hours IV or IM) and refer to hospital. If there is no ENT-surgeon available to perform a mastoidectomy or when the referral is delayed, then aspiration with thick needle or an incision and drainage of the abscess should be done in the hospital and administration of IV antibiotics according to the culture and sensitivity test result.

OTITIS MEDIA WITH EFFUSION (OME)

Causes:

OME results from blockage of the Eustachian tube by an upper respiratory tract infection (rhinitis, sinusitis), allergic rhinitis, adenoid hypertrophy, epipharyngeal tumour. OME mostly occurs in children below seven, but also in HIV-positive adults with lymphadenopathy and re-growth of the adenoid.



Otitis media with effusion



Resolving OME with air-fluid hairline



OME with posterior retraction

Signs and symptoms:

- conductive hearing impairment
- feeling of ear pressure, blocked ear
- sometimes ear-ache
- tinnitus
- retracted ear drum with middle ear effusion, sometimes with air bubbles and a visible fluid level (hair line)

Treatment:

Treat upper respiratory tract infections. Do not overlook sinusitis. Most cases in children resolve spontaneously after some months. Refer the patient, if the middle ears don't clear up and the hearing impairment persists after 3 months. In chronic otitis media with effusion, adenoidectomy with myringotomy is effective in children. Insertion of grommets may be recommended. In HIV-positive adults grommets may be recommended, depending on the degree of hearing impairment.



Myringostapediopexy



Severely retracted eardrum

Discuss the predisposing factors of OME
Suggest some preventive measures for OME



Chronic suppurative otitis media



CSOM



Dry, medium size, perforation



Dry total perforation

CHRONIC SUPPURATIVE OTITIS MEDIA (CSOM)

Causes:

- a non-healed acute otitis media with an ear drum perforation
- necrotising otitis from measles, scarlet fever or tuberculosis
- traumatic ear drum perforation with secondary infection

Most cases start in the first two years of life. Untreated, the ear drum perforation will become larger and the hearing impairment worse.

Signs and symptoms:

- mucopurulent, sometimes malodorous ear discharge, lasting continuously for two weeks or longer
- absence of ear ache, unless there is an acute exacerbation with deep ear ache (danger sign of intra-cranial complication !)
- eardrum perforation
- the ossicular chain may be disrupted
- thickened middle ear mucosa, often with granulations
- conductive or mixed hearing impairment

Treatment:

The aim of treatment is to get the chronically discharging ears dry, to stop further deterioration of the hearing and to prevent complications. In selected cases repair of the ear drum and ossicles can be done. Give a *single course* of oral antibiotic treatment as for acute otitis media if not already given. *Note:* oral antibiotic treatment may not be effective against chronic ear infections. Do not give repeated courses of oral antibiotics for a draining ear.

- Teach the patient how to dry mop ears. Patient should dry mop 3 times a day.
- Follow up in 5 days. If the ear discharge still persists, continue dry mopping and start with antiseptic eardrops.
- Refer, if possible, to a specialist for ear suction and antibiotic eardrops. Refer to the ear specialist in case of pain (a danger sign of intracranial complications).
- See patient as often as possible to repeat dry mopping or syringing and putting in eardrops-daily or weekly- and repeat examination of the ear and behind the ear each time.
- Test the hearing in both ears when the infection has cleared.
- Advise the patient to avoid water entering into the ear.

CHRONIC OTITIS MEDIA WITH CHOLESTEATOMA

Causes:

The underlying cause is a dysfunction of the Eustachian tube. Cholesteatoma (epidermis and keratin debris) accumulates in a retraction pocket or behind a perforation of the ear drum, mostly epitympanally or superoposteriorly near the annulus. This cholesteatoma further accumulates in the epitympanum and mastoid. Eventually the cholesteatoma destroys the hearing ossicles and the surrounding bone of the middle ear and mastoid and sometimes creates a fistula behind the ear.

Over the years the bone erosion increases, which can lead to complications such as hearing impairment and dizziness (labyrinthitis), facial palsy, lateral sinus thrombosis and intracranial complications like meningitis, epi- and subdural abscess, and brain abscess.

Signs and symptoms:

- a gradually increasing conductive or mixed hearing impairment
- if there is discharge, then this has an offensive smell. The ear may however also be dry. This is actually more tricky, because the patient has less complaints and may only visit the doctor, when the hearing impairment is advanced and the possibilities for surgical repair and restoration of the hearing are very much reduced
- an epitympanal or superoposterior pocket or perforation with whitish material, which is the cholesteatoma. Granulation may be present. Sometimes there is only a small, dry epitympanal crust. A crust at this location should always be removed.

Underneath this crust there may be a perforation or retraction pocket with cholesteatoma. A small pocket or perforation can hide a big cholesteatoma behind it. One can only see the tip of the iceberg. A polyp protruding from a perforation is suspicious of cholesteatoma behind it

Treatment:

All patients with cholesteatoma need referral to an ENT-surgeon, while without treatment, serious, even fatal complications may occur. In principle the treatment is surgical in order to eradicate the disease and to save what is left of the hearing. In selected cases restoration or improvement of the hearing is possible.



Cholesteatoma



Epitympanal defect with cholesteatoma



Epitympanal polyp, hiding cholesteatoma

Identify the causes of **CHRONIC OTITIS MEDIA WITH CHOLESTEATOMA** and recommend treatment

RETRO-AURICULAR FISTULA

Signs and symptoms:

- a tiny opening in the skin overlying the mastoid bone behind the pinna
- chronic purulent discharge from the fistula
- a small polyp may be protruding from the opening



Retro-auricular fistula and abscess from cholesteatoma



Retro-auricular fistula and polyp from cholesteatoma

Causes:

- cholesteatoma that has destroyed the mastoid cortical bone
- tuberculosis

Treatment:

Refer for further assessment and surgery. The operation will most often result in a (modified) radical mastoid cavity.

FACIAL PALSY

Anatomy and function:

The facial nerve is the 7th of 12 pairs of cranial nerves and runs in a bony canal in the skull base near the ear (the temporal bone), exits the skull just beneath the ear canal entrance and then spreads out to the facial or mimic muscles. Without proper functioning we cannot frown, raise the eyebrows, blink, close

the eyes, smile and protrude the lips. Additionally the facial nerve runs to the tear glands, the salivary glands, the side of the tongue for sensation of taste, and to the stapedius muscles to dampen excessively loud sounds. In Ramsay-Hunt syndrome (Herpes Zoster oticus) the hearing nerve is also affected.



Facial palsy from cholesteatoma

Signs and symptoms:

Facial palsy is usually unilateral, although in 10% it is bilateral. The palsy develops suddenly and can get worse over the following few days to two weeks. The severity can vary from mild weakness of the facial muscles to complete paralysis of side of the face. Accompanying features are dryness of the eye and mouth, excessive tearing of one eye, impairment of taste. Other symptoms include earache, hypersensitivity to sound and difficulty drinking without spilling.

Causes:

In unilateral palsy the cause is located along the pathway of the facial nerve through the temporal bone. In bilateral cases there is a neurological disease, which will not be discussed in this teaching resource.

- In most instances no specific cause can be found. Re-activation of dormant Herpes simplex virus is suspected to play a role.
- Herpes Zoster
- Otitis media, especially cholesteatoma
- Lyme disease
- Sarcoidosis
- Skull base fractures (temporal bone fractures)
- Tumours of the temporal bone

Prognosis:

The prognosis is generally good. Complete recovery may take up to 6 months. The prognosis is better in younger patients, incomplete paralysis and when recovery begins in the first few weeks.

Treatment:




- Patients need to be referred to the hospital for further examination and treatment. Steroids alone or combined with acyclovir may give good results. Prednisone dosage: oral 1 mg/kg in 3 portions daily for 15 days, tapering down to 0 during the next 5 days.
- It is extremely important to protect the open eye from drying out when it



may become blind due to scarring of the cornea. Give artificial tears (methylcellulose eye drops) and tape the eye closed during sleep.

- Mimic exercises speed up recovery. Advise the patient to do exercises with trying to close the eyes, raise and frown the brows and lip exercises by showing the teeth and protruding the lips.
- Difficulty with drinking can be solved by raising the paralysed mouth corner with a finger or tape.

Discuss the treatment and prognosis of
Facial Palsy

4.2 MANAGEMENT OF EAR INFECTIONS

Disease	What is it?	Symptoms	Treatment
Otitis Externa(OE) 	Infection of the outer ear canal and/or pinna	<ul style="list-style-type: none"> • Itching • Pain • Scaling skin or scanty discharge • Redness of the skin • Oedema in severe cases 	<ul style="list-style-type: none"> • Clean the canal with suction, syringing or mopping • Topical treatment – no oral antibiotics (unless cellulitis or swollen glands) • Silversulphadiazine cream for the pinna • 1% Silvernitrate Gel in the ear canal
Acute Otitis Media (AOM) 	Acute infection of the middle ear	<ul style="list-style-type: none"> • Fever • Irritability • Earache • Hearing impairment • Redness of the ear drum • Later bulging of the eardrum 	<ul style="list-style-type: none"> • Oral Antibiotics (Amoxicillin or Co-trimoxazole) for 5–7 days • Paracetamol as long there is fever and pain • No ear drops, no nose drops
Acute Otitis Media with perforation 	Acute infection with a small perforation	<ul style="list-style-type: none"> • Discharge of the ear • Fever and pain subside • Perforation of the eardrum 	<ul style="list-style-type: none"> • Oral Antibiotics (Amoxicillin or Co-trimoxazole) for 5–7 days • No ear drops

Disease	What is it?	Symptoms	Treatment
Chronic Suppurative Otitis Media (CSOM)	Infection of the middle ear for more than 2 weeks with a perforation of the ear drum	<ul style="list-style-type: none"> • Ear discharge • Perforation of the ear drum • Hearing impairment 	<ul style="list-style-type: none"> • Suction cleaning • Wicking or mopping at home • Ciprofloxacin ear drops. Not longer than 2 weeks • No oral Antibiotics • No water should enter
	Accumulation of fluid or mucus in the middle ear	<ul style="list-style-type: none"> • Blocked ear • Hearing impairment • Tinnitus 	<ul style="list-style-type: none"> • < 3 months: expectant ('wait and see') • > 3 months: refer to ENT
			

4.3 CLEANING THE EAR AND INSTILLING EARDROPS

EAR WAX:

- Ear wax needs to be removed, when it occludes the ear canal and causes hearing impairment or when it hinders otoscopy. Otherwise, a little wax does not need to be removed.
- Advise your patients not to clean their ears with cotton buds. This is ineffective and actually pushes the wax deeper into the ear canal. The bud may accidentally remain behind in the ear canal as a foreign body.



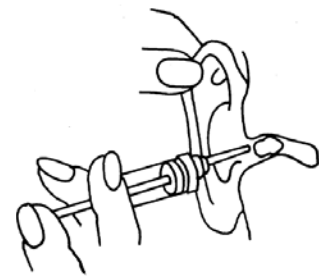
Impacted ear wax



Cotton wool in ear canal

Syringing:

- The gentlest way of removing wax is by syringing with water. However, syringing wax in patients with a known or possible tympanic membrane perforation should not be done, because this action will push the wax into the middle ear and cause infection. In these patients the wax has to be removed by hooks or suction under good vision with a head-light or microscope.
- The water should be clean (best is freshly boiled water that has cooled down) and be at body temperature (37° C). Too hot or too cold water may cause a severe vertigo attack. Direct the tip of the syringe to the posterior wall of the ear canal and empty the syringe with some force. However, keep in control of your movements and avoid touching the ear canal skin with the tip. Be sure, that the tip is tightly fixed to the syringe or the tip can become a dangerous projectile.
- If a few attempts are unsuccessful, then it will be better to soften the wax.



Softening ear wax:

- Wax is soluble in water. Water with a detergent, e.g. soapy water is a very effective wax softener. Also a 5% sodium bicarbonate solution in distilled water is also recommended. Commercial ear wax solvents have no advantage and may cause an allergic skin reaction.
- Fill the ear canal with body-warm soapy water or bicarbonate solution, patient in a lying position or with the head tilted, so the water does not run out. Let the patient press the tragus repeatedly to squeeze the water into the ear canal. After 20 minutes try the syringing again. If still unsuccessful, have the patient repeat the procedure with soapy water at home for a couple of days before syringing again.
- Sometimes the ear canal is not filled with wax, but with whitish debris, keratin. This is very adherent to the skin, is not soluble in water and cannot be syringed out. This material needs instrumental removal under good illumination and vision.

Explain the need for syringing and under what circumstances softening of earwax is necessary



Ear ring in ear canal

FOREIGN BODIES.

- There are two types of foreign bodies (FB), such as vegetable, like seeds or beans and non-vegetable, such as cotton wool buds, sticks of wood, stones, eraser-rubber and insects. Both types can cause an otitis externa, when they remain in the ear canal long enough. Seeds, however, swell in the presence of water, which makes them more difficult to remove. At a later stage they cause a strong inflammatory skin reaction in the form of granulations and polyps.
- Small seeds laying loosely in the ear canal can be syringed out. Impacted seeds should not be syringed, but removed with hooks or with a grasping micro-forceps. Sometimes in children general anaesthesia is necessary. All non-vegetable FB may be syringed out.
- Insects, buzzing in the ear canal, can as a home measure, be silenced with a few drops of clean vegetable oil and syringed out later.
- Do not try to remove round objects, like a bead, with a forceps. It will slip of the forceps and be propelled deeper into the ear canal. Remove this type

of FB by syringing or with a hook. Handle carefully to avoid trauma to the ear canal skin and eardrum.

- Refer to the hospital, if you are unsuccessful after a few attempts, especially if the child does not sit still.

What are the 2 different types of FB?

Explain how you would remove a seed from the ear canal.

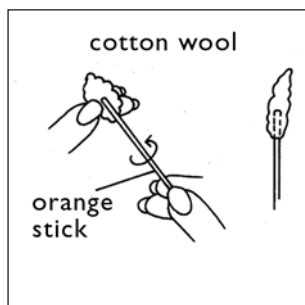
OTITIS EXTERNA / CHRONIC SUPPURATIVE OTITIS MEDIA

Syringing, dry-mopping/wicking, suction cleaning:

- In general otitis externa (OE) and chronic suppurative otitis media (CSOM) are treated with topically applied medicines, such as ear drops. To be effective, debris and pus have to be removed first. This can be done by syringing only if the ear drum is intact. Syringing is generally not recommended in CSOM (perforated ear drum). Mopping, wicking and suctioning is recommended. Dry-mopping can be done with a cotton wool mop on a cotton wool carrier or orange stick. Make sure, that the cotton wool is wrapped beyond the end of the stick. Wicking can be done with a rolled piece of clean cloth.
- In case of a chronically discharging ear (CSOM) instruct the mother or carer to dry-mop or wick the ear several times a day, before instilling the ear drops. This should be repeated until all the pus has been removed. Especially keep the outer ear clean to avoid contamination of the face and impetigo.



Holding child for cleaning of the ear



Dry mop



Wicking

- Where available, suction cleaning with a suction pump (manual or electrical) and fine suction tips is less time consuming and more effective than syringing or dry-mopping/wicking, especially to remove pus from the middle ear. Direct vision with a head-light is essential to avoid trauma.

Explain the difference between Syringing, dry-mopping/wicking, suction cleaning and when it is appropriate to use each method.

Instilling ear drops:

- Ear drops cannot be effective, if the ear canal is full of pus or debris. So clean out the ears first.
- The patient lies down with the ear to be instilled uppermost or tilts his head accordingly. Pull the pinna backwards and outwards as with the otoscopy. Instil the drops into the ear canal, without touching the ear with the dropper in order to avoid contamination of the bottle. Then press the tragus repeatedly to force the drops through the perforation into the middle ear. The patient should keep his head tilted for ten minutes before the other side can be instilled. It is not advisable to have patients themselves instil the drops, because drops will be spilled and also it is difficult to avoid the bottle from getting contaminated.
- If more than one member of a family are treated with ear drops, then each of them need their own bottle. The same applies for nose drops and eye drops.
- There is no need to keep an opened bottle in the fridge, but unfinished bottles have to be discarded after two weeks.

Draw up a flowchart of how to instil eardrops

4.4 EAR TRAUMA

Patients with an injury of the ear will generally need referral to the hospital for treatment.

TEAR OF THE PINNA:

Treatment:

Clean the wound carefully with an antiseptic solution. Refer to the hospital for removal of the defective cartilage and suturing of the wound. Give Amoxicillin to prevent perichondritis. Untreated perichondritis will lead to loss of cartilage and deformity of the pinna.



Human bite

EAR PINNA HAEMATOMA:

Here has been bleeding between the perichondrium and the cartilage. Refer to the hospital for surgical treatment. Non-treatment can result in perichondritis, abscess and deformity.

Treatment:

This consists of aspiration or incision and drainage and antibiotic coverage.



Pinna haematoma, incised and drained

TRAUMATIC EAR DRUM PERFORATION:

This can be caused by a sudden air pressure wave in the ear canal from e.g. a blow on the ear or the shock waves from an explosion. Poking in the ear with pins etc., welding sparks and lightning can cause a perforation. Ear syringing may cause a perforation, especially in thin eardrums and when too much force has been used.

Treatment:

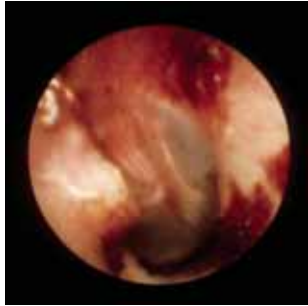
Most, including large, perforations close spontaneously after a couple of weeks or months time. No immediate surgical intervention is necessary. Infection must be prevented. Patients should avoid water entering the ear. If there is a discharge, then the treatment is the same as with CSOM, being dry mopping/suction cleaning and antibiotic ear drops. Refer the patient to an ear specialist if the perforation has not closed after six months.



Small traumatic perforation



Large traumatic perforation with



Temporal bone fracture, protruding into the ear canal

TEMPORAL BONE FRACTURE

(latero-basal skull-base fracture):

This is caused by a blow to back or the side of the head (road traffic accident, assault).

Signs and symptoms:

- earache and tenderness behind the ear
- post-auricular haematoma
- bleeding from the ear; this is mixed with liquor (cerebro-spinal fluid) when the dura has been torn
- conductive hearing impairment and tinnitus, caused by the blood in the middle ear, whereby the ossicular chain may be disrupted; in some cases hearing impairment and dizziness with nystagmus occurs; liquor may also escape from the nose
- protruding bone in the ear canal
- haemato-tympanum; the ear drum may be intact or perforated
- facial nerve paralysis may occur; this can be immediate, caused by a tear or compression of the nerve or with a delay of some days caused by oedema

Treatment:

- refer to the hospital
- when a blood clot in the ear canal is blocking the view, leave it untouched
- cover the ear with a sterile gauze
- forbid the patient to blow his nose to prevent bacteria being blown through the cracks of the skull which might cause meningitis
- the haematotympanum will be resolved in 3-4 weeks; if there is still a conductive hearing impairment remaining, then there is probably an ossicular chain disruption, mostly with dislocation of the incus; the ossicular chain can be repaired later; complete deafness however is permanent and irreversible
- an immediate facial nerve paralysis needs immediate surgical exploration; a delayed paralysis is treated with Prednisone tablets, 4 days tid 20 mg, then tapered down to 5 mg per day

Describe the different types of ear trauma and their causes

Describe the treatment of temporal bone fracture

5 EAR OPERATIONS

Ear operations should be performed by an ENT-surgeon, who is specialised in micro-surgery of the middle ear. Operations are done with help of an operating microscope under local or general anaesthesia.

AIMS OF EAR SURGERY IN OTITIS MEDIA:

- stopping the ear disease and prevention of further deterioration of the hearing
- prevention and treatment of disabling and fatal complications
- restoring the hearing

5.1 MINOR OPERATIONS:

5.1.1 MYRINGOTOMY:

Definition: A small tympanic membrane incision and evacuation of middle ear fluid.

Indications:

- (sub)acute otitis media, not responding to medical treatment
- acute otitis media with complications
- otitis media with effusion

The myringotomy opening heals usually in a couple of days.



Myringotomy

5.1.2 GROMMETS

Definition: Myringotomy and insertion of a grommet in the tympanic membrane.

Indications:

- chronic otitis media with effusion, longer than 3 months duration, 25 dB or more hearing impairment in the better hearing ear
- recurrent acute otitis media.

Myringotomy and grommet insertion can be combined with an ADENOIDECTOMY.



Grommet in situ

PATIENT INFORMATION

GROMMETS (ALSO CALLED TYMPANSTOMY TUBES):

Hearing loss lasting for some time could be caused by fluid behind the eardrum. In order to improve hearing, the fluid must be removed from the middle ear. To drain the fluid from the middle ear a small ventilation tube or grommet is inserted through the eardrum. The fluid is then able to flow out of the middle ear through the grommet and then out of the ear. Once the middle ear is ventilated, the accumulation of fluid usually stops.

Grommets are also called 'PE (pressure equalising) tubes' or 'ventilation tubes'.

The procedure takes a few minutes and will be done under general or local anaesthesia.

After insertion of the grommets your hearing will be better straight away, unless there is an infection. Once the grommets are in place a person cannot feel them. They usually stay in the eardrum for 6–12 months, sometimes shorter, sometimes longer, depending on their size and shape and will be ejected by themselves into the ear canal.

A worsening of hearing means that the grommets have come out or are blocked and the glue in the middle ear has build up again. It may be necessary to replace the grommet.

The ear may become runny, especially if dirty water has gone into the ear. This infection is treated with cleaning and instillation of antibiotic drops. Always avoid getting water in the ear whilst washing. Swimming, but not diving, is allowed using earplugs made of cotton wool with Vaseline or silicon custom-made earplugs.

Sometimes a small eardrum perforation may be left after extrusion of the grommet.

Some patients need grommets several times.

5.2 MAJOR OPERATIONS:

5.2.1 SIMPLE MASTOIDECTOMY:

Definition: A complete mastoidectomy with dissection of all accessible cells. An incision is made behind the ear and the mastoid bone is opened with a micro-drill. The bony wall of the ear canal is kept intact.

Indications:

acute mastoiditis with impending or existing complications which do not resolve after appropriate antibiotic therapy and myringotomy.

CSOM, not responding to intensive, conservative treatment

PATIENT INFORMATION

MASTOIDECTOMY

The doctor has diagnosed an infection in the bone behind the ear. The infection has not healed using medicines alone and needs to be cleared with an operation.

An incision is made behind the ear and all the infected bone is cleaned out. The operation is done under general anaesthesia and may take an hour.

Once the source of infection has been removed, the ear has a better chance of being dry and trouble-free.

5.2.2 MODIFIED RADICAL MASTOIDECTOMY:

Definition: An operation to eradicate disease of the middle ear and mastoid in which the mastoid and epitympanic spaces are converted into an easily accessible common cavity by removal of the posterior and superior external canal walls. In this operation the tympanic membrane (remnant) and functioning ossicles are left intact. This operation is combined with a TYMPANOPLASTY and with a MEATOPLASTY.

Indications:

- chronic otitis media with cholesteatoma
- chronic mastoiditis with destruction of the posterior bony ear canal wall

PATIENT INFORMATION

MODIFIED RADICAL MASTOIDECTOMY:

The surgeon has diagnosed a longstanding ear disease that cannot be treated with medicines, but only with an operation. A pocket of skin with dirt is growing deep in the ear and may damage the hearing.

Without treatment there is a great risk of complications such as hearing loss, dizziness, facial palsy and brain infections. The operation is not completely without any risk. However, if the ear is not operated on, there is a greater risk of developing severe complications.

The goal of the operation is to make the ear safe and to preserve the hearing.

The ear is opened from behind or just in front and the bone behind the ear (the mastoid bone) is opened and all disease is removed. The eardrum will be closed and when possible the small hearing bones (ossicles) will be repaired. The operation results in a common cavity of the drilled-out mastoid and the ear canal. Hearing improvement cannot be expected if there is too much destruction of the ear by the disease. In order to help aeration, inspection and cleaning, the surgeon will widen the opening of the ear canal. The operation is done under general anaesthesia and may take a couple of hours.

Life-long, regular check-ups are necessary for cleaning the ear and to see if the disease has come back. Sometimes a second operation may be necessary. Earwax doesn't come out by itself from the cavity and needs to be removed at follow-up visits.

Always avoid getting water in the ear. Water in the cavity can cause infection and an attack of dizziness. Some of the cavities discharge constantly and are difficult to keep dry. The doctor may propose an operation to deal with this.

5.2.5 TYMPANOPLASTY

(MYRINGOPLASTY AND OSSICULOPLASTY):

Definition: Repair of the tympanic membrane (myringoplasty or tympanoplasty type I) and/or repair of the ossicular chain (ossiculoplasty) utilising tissue graft in order to close the middle ear and improve the hearing.

The operation can be combined with a mastoidectomy.

Indications:

- dry perforations and/or ossicular chain disruptions/fixations (inactive CSOM or post- traumatic)
- in combination with modified radical mastoidectomy.

PATIENT INFO

TYMPANOPLASTY (MYRINGOPLASTY AND OSSICULOPLASTY)

Hearing loss lasting for some time could be caused by a hole in the eardrum that doesn't heal. There is also a chance of ear infections, especially when water or dirt gets into the ear, and these will make the hearing worse.

The hole in the eardrum will be closed with an operation under general anaesthesia, using the patient's own tissue, which is taken from a cut in the skin near the ear. It looks a bit like patching a tyre. During the operation the doctor will also look at the hearing bones (ossicles) in the middle ear and check if they are intact and move well. When possible these little bones (ossicles) will be repaired. The operation will take 30 to 60 minutes. The patch or 'graft' will grow together with the remaining eardrum over a couple of weeks.

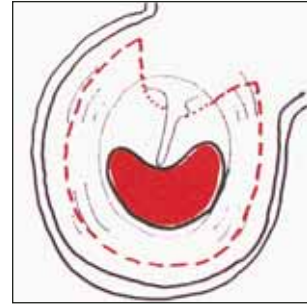
In over 80% of the cases eardrum repair is successful. In less than 20% the eardrum doesn't heal and the hole will remain as it was or be smaller. The result of repair of the small hearing bones is less predictable. The operation can be done again if necessary.

To ensure good healing it is important to keep the ear dry for the first month at least and to take the medicines and eardrops as prescribed by the doctor. The hearing will improve over a couple of months.

It is important to keep the follow-up appointments.



Graft (fascia of the temporal muscle)



Graft in place (underlay)

List the minor ear operations and describe the need for each one.

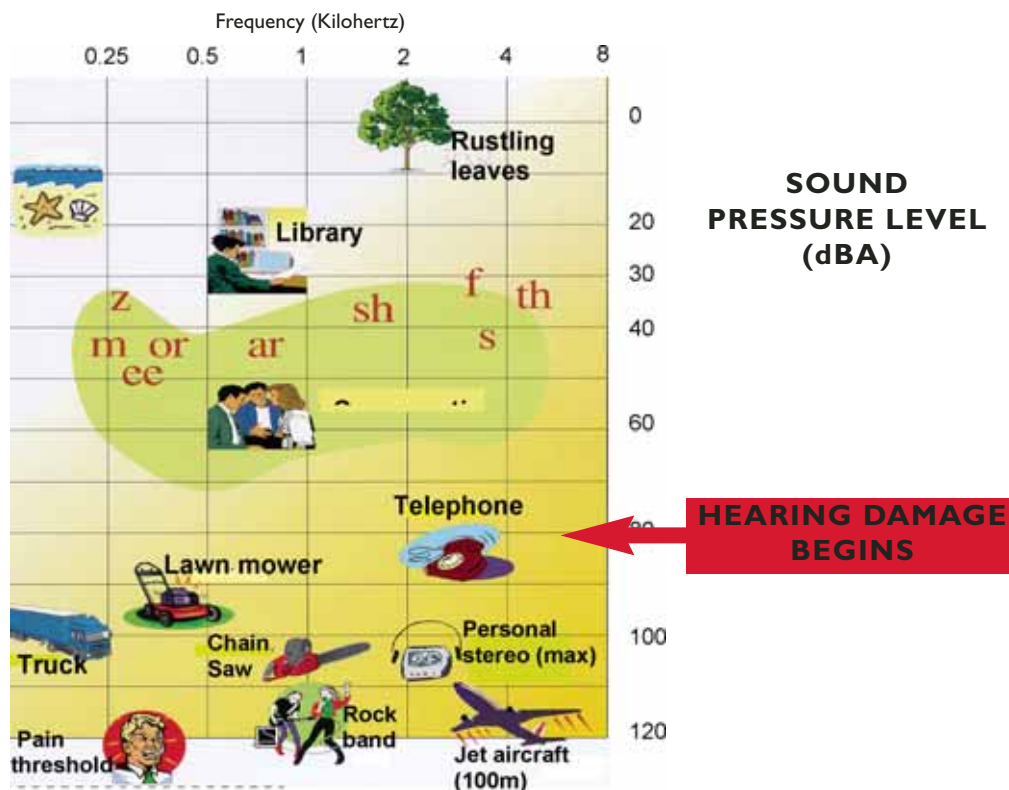
Explain the need for a MODIFIED RADICAL MASTOIDECTOMY. Describe how you would explain this operation to the patient.

6 NOISE-INDUCED HEARING IMPAIRMENT

6.1 WHAT IS NOISE INDUCED HEARING IMPAIRMENT?

Excessive noise such as produced by drilling, sawing and hammering machines and engines is the most common occupational hazard. Hazardous noise is also found outside the workplace, e.g. from loud music due to loudspeakers or headphones. Immediate loss of hearing can be caused by exposure to sudden intense forms of acoustic energy such as explosions and blasts or changes in barometric pressure. Excessive noise over a prolonged period of time gradually worsens the hearing by damaging the outer hair cells in the inner ear. Once the damage is done, it is irreversible. A rough estimate that noise is at a hazardous level is when one cannot have conversation with someone at a distance of 2 meters. The first signs are difficulty in hearing a conversation against a noisy background and often there is ringing in the ear – a condition called tinnitus.

FREQUENCY AND INTENSITY OF FAMILIAR SOUNDS



Courtesy: Australian Hearing

6.2 PREVENTION

- Employees should not be required or permitted by their employers to work in an environment in which they are exposed to noise equal to or exceeding a sound pressure level of 85 dBA without appropriate hearing protection. There should also be a system of regular hearing screening. Without regular hearing screening the hearing impairment will only be noticed when it is too late.
- Machines and equipment should be designed and insulated to emit less noise.
- Hearing protectors exist in different forms, such as ear muffs, ear plugs and custom-made ear moulds. Some ear moulds contain a filter that allows speech to pass through. Hearing protectors should fit well and be worn consistently.
- Countries should enact and enforce legislation to make these provisions mandatory in the workplace, and for the setting up of compensation schemes. Awareness of the bad effects of social as well as occupational noise should be raised amongst the public and those with a higher risk of exposure.



Man at work wearing hearing and vision protectors

How would you explain the need for ear and hearing protectors to workers in a factory?

7 AURAL HABILITATION, REHABILITATION AND EDUCATION

7.1 AURAL HABILITATION AND EDUCATION:

INTRODUCTION:

Deaf students are typically visual learners. Most, but not all, deaf learners have some capacity to learn to speak and read speech (Lip-read). Proficiency in speech for someone who has never heard clear speech requires intensive training. Language, a set of codes for vocabulary and grammatical rules, can be learned independently from speech. Sign language is a legitimate language. Its grammar structure, however, is different from spoken languages. Therefore, reading and writing in the dominant spoken language is difficult and often delayed for the Deaf. As with spoken languages, sign languages vary across cultures. There is no universal sign language.

7.3.1 COMMUNICATION METHODS USED IN DEAF EDUCATION

Speech Training, Sign Language, Total Communication and Education: There is no singularly successful method in teaching the deaf.

The following approaches to teaching deaf learners are listed according to their proximity to the spoken dominant language.

Oral/Aural Methods: Learners are taught almost exclusively through speech and speech is expected from the learners. Signs and gestures are discouraged in the classroom. Aural habilitation is stressed to develop listening and speech and speech reading skills. **Suitability:** Used primarily for learners who are hard of hearing and deaf students with useful hearing and capacity to speak well.

Total Communication Method: Learners are taught through a combination of communication methods to



Mixing oral and manual deaf learners Holy Cross Services, Trichy, India

suit individual needs (see Fig. 1). Includes simultaneous communication method wherein the teacher speaks and concurrently signs the words she speaks. The grammar of this approach is the same as the spoken language (manually coded language). Modern TC methods allow the teacher to individualize using the local sign language (e.g. FSL - Filipino Sign Language) grammar with some learners and spoken language e.g. (English or Tagalog) with others in the course of a lesson. Suitability: Can be used in an inclusive classroom with hearing, hard of hearing and deaf learners or in a classroom for deaf learners.

Bilingual-Bicultural Method: Classroom instruction and discussions are conducted in the learners' first language, the local sign language. The national and other languages are taught through reading and writing. Deaf history, Deaf culture and advanced sign language are included in the curriculum and often taught or transmitted through Deaf teachers. Suitability: This is the preferred method of instruction for culturally Deaf learners who depend on sign language.

Figure 1: Total Communication



How could the teacher and parents/families work together to encourage skills in listening, speech and speech reading (lip-reading) of a hearing impaired child?

AURAL HABILITATION FOR THE HEARING IMPAIRED

Aural or auditory Habilitation is the training given to learners who have not yet developed listening, speech, and language skills. The interventions are tailored to meet each learner's individual needs and include assessment, sound and speech perception training, speech and language therapy, sign language, and dominant language literacy. Interventions provided in the early years have the greatest effect.

To be effective, these interventions require the following hardware supports:

- Hearing aids
- Group / individual speech trainers
- Mirrors, sound producing toys, etc.
- Visual aids and learning materials
- Noise reduced, well-lighted classrooms

7.3.2 TEACHING STRATEGIES IN DEAF EDUCATION

Effective teaching strategies in classrooms for deaf learners are visual and gestural and can be simultaneously verbal. The use of group and individual hearing aids for amplified speech assist in perfecting skills in listening, speech and speech reading, especially for those who have enough hearing to benefit from speech and for very young hearing impaired children. This combined use of five communication modes in the education of the deaf is Total Communication, previously mentioned and illustrated in Figure 1. Educators of the Deaf are skilled in using multi-media approaches in the classroom.

The Visual – Gestural Communication approach capitalizes on the visual learning styles of the Deaf. The strategy goes far beyond the traditional talk and chalk methods common to hearing classrooms. The emphasis is on language learning which leads to improved cognitive development. Academic subjects taught through visual and experiential teaching strategies can result in boosting confidence in learning and personal self-image.

Language and thinking skills are taught through communication (oral and/or signed) interactions including strategies such as question and answer cycles, problem solving as well as through visualizations of concepts categorized in logical sets to facilitate long-term visual memory and structured language.

7.2 COCHLEAR IMPLANTS

7.2.1 WHAT IS A COCHLEAR IMPLANT?

A cochlear implant is different from a hearing aid.

Hearing aids amplify sounds. Cochlear implants compensate for damaged or non-working parts of the inner ear. The device receives and transmits sound waves but bypasses the outer and middle ear and directly stimulates the hearing nerve through fine wires, allowing the person to perceive the sounds. An operation under anaesthetic is needed to insert the wires through the skull into the cochlea of the inner ear.

Discuss the differences between a hearing aid and a cochlear implant. Explain how a cochlear implant would help a 3 year old acquire speech and language.



7.2.2 WHO COULD BENEFIT FROM A COCHLEAR IMPLANT?

Cochlear implantation improves communication ability in most late deafened adults with severe to profound hearing impairment and often produces social benefits as well. Children (over 2 years) and adults with profound hearing impairment are the most appropriate candidates for implantation.

A cochlear implant could also benefit adults with severe to profound hearing impairment as it helps them understand speech without needing visual cues such as lip-reading or sign language. Usually anyone who could benefit well from a hearing aid is not a candidate for a cochlear Implant.

7.2.3 REHABILITATION:

Recipients of cochlear implants need to be taught how to interpret sounds into meaningful speech. Once the implant is switched on the recipient must attend intensive speech and language therapy as well as counselling and educational, medical and technical supports. Implantation should not be done unless the necessary medical, educational, technical, psychological and hearing therapist resources and services are available. Without these support structures in place the patient will obtain almost no benefit from the cochlear Implant.

7.2.4 COSTS AND AVAILABILITY:

The financial cost of a cochlear Implant is extremely high, over \$10,000–\$25,000, hence especially expensive for most people in developing countries. In addition, most cochlear Implants run on six or more hearing aid batteries that need to be replaced every week or so. Where there are limited resources for a hearing health programme, it will be more effective to use these resources to prevent a larger burden of hearing loss in a greater number of people by using less expensive interventions.

Cochlear Implants (the device), and the medical expertise and rehabilitative services are not yet available in many of the developing countries.

7.3 DEAFBLINDNESS

7.3.1 WHAT IS DEAFBLINDNESS?

Deafblindness is a distinct disability. It involves the dual sensory loss of sight and hearing. We understand 90% of the world around us through our senses of sight and hearing, our two major distance senses. Deafblindness leaves the person isolated, unaware of his surroundings, with difficulties in communicating with the world around him, and hinders moving around the environment.

The deafblind have to rely on spatial memory, touch, smell, and kinesthetic sense to better understand the world around them.

There is no single medical condition that causes deafblindness. There are several disorders, syndromes, infectious diseases and other adventitious conditions (acquired) that may result in an individual being deafblind.

The deafblind person may show a wide range of visual and hearing losses.

7.3.2 VISUAL & HEARING IMPAIRMENTS COMBINED

Individuals may have:

- hearing impairment and visual impairment with vision loss being the primary disability
- hearing impairment and visual impairment with hearing impairment as the primary disability
- hearing impairment and blindness
- hearing and visual impairment
- deafness (profound hearing impairment) and visual impairment
- deafblindness

The majority of those who are classified as having concomitant visual and hearing impairment have some useful residual vision or hearing. Total absence of vision or hearing is rare.

Often individuals who are deafblind may have other impairments like mental retardation, epilepsy, physical disabilities, or other types of disabilities.

Individuals with Dual Sensory Impairments:

<u>Onset</u>	<u>Degrees</u>	<u>Conditions</u>
Congenitally deaf/ adventitiously blind	Hard of hearing/blind	Stable
Congenitally deafblind	Hard of hearing/ visually impaired	Progressive
Adventitiously deafblind	Deaf/visually impaired	Temporary
Adventitiously deaf/ congenitally blind	Deafblind	

There are several common disorders of eye and the ear found in the deafblind children:

The eye

- Glaucoma - an abnormal increase in intraocular pressure
- Cataract - any opacity of the lens of the eye.
- Retinal dystrophies (retinitis pigmentosa) when retinal degeneration occurs
- Microphthalmos - being born with small eyeballs
- Coloboma - a lesion or defect of the eye

The ear

- Otitis media inflammation of the middle ear that is caused by bacterial or viral infection.
- Cholesteatoma is a congenital or acquired benign skin-like mass which develops as a complication of chronic or recurrent otitis media.
- Conditions affecting the ossicular chain – middle ear bones (incus, malleus & stapes)

The eyes and ears develop during the first 12 weeks of pregnancy. Various diseases and conditions can be directly related to the development of vision and hearing during this time. Congenital Rubella Syndrome remains the greatest cause of deafblindness in developing countries, because of the lack of immunisation. Children born deafblind from Congenital Rubella Syndrome may later

develop additional health problems like glaucoma, heart problems, epilepsy, and premature ageing. The earlier the mother suffers from Rubella during the first trimester the greater is the damage to the developing eyes and ears.

7.3.3 SYNDROMES:

- Down's Syndrome Trisomy 21
- Patau's Syndrome Trisomy 13
- Usher's Syndrome congenital hearing loss combined with progressive retinitis pigmentosa
 - type 1 causes profound deafness and poor balance
 - retinitis pigmentosa may be noticed before the age of 10
 - people usually communicate using sign language
 - type 2 causes partial to severe hearing loss
 - balance is not affected
 - retinitis pigmentosa may not become apparent until adolescence
 - speech assisted by the use of lip-reading and the use of hearing aids, will be the first method of communication
 - type 3 is the rarer form of Usher's Syndrome
 - people are usually born with normal sight and hearing
 - they later develop a hearing loss and retinitis pigmentosa in adolescence or later
- Alstrom Syndrome
- Waardenburg Syndrome
- Goldenhaar Syndrome = Oculo-ArticuloVertebral Syndrome
- CHARGE Association = may have a genetic link
 - Coloboma of the eye
 - Hearing loss
 - Choanal Atresia
 - Renal complications
 - Genital malformations

7.3.4 OTHER CAUSES:**Congenital infections (infection transmitted from mother to foetus)**

Syphilis

Toxoplasmosis

Rubella

Cytomegalovirus – infection

Neonatal herpes simplex virus

Congenital birth trauma

Prematurity

Low birth weight

Hypoxia = low oxygen

Other trauma

Accidents**Ageing****Medications/drugs abuse****Fetal Alcohol Syndrome****Other infections:**

HIV (AIDS virus)

Meningitis

7.3.5 DEAFBLIND PROGRAMMES

Deafblind programmes have usually been started in existing schools and programmes for the blind or deaf.

Deafblind need their own individual learning programmes to better understand the world around them. Communication remains the critical factor in empowering the deafblind.

7.3.6 WAYS OF COMMUNICATING WITH THE DEAFBLIND:

- Interpreter
- Expressive Speech = voice
- Receptive speech = lip-reading & hearing
- Spelling Out Words
- Writing and Reading print on paper
- Finger Braille
- Writing words in palm
- Tadoma = a deafblind person using Tadoma places his thumb lightly on the lips of the speaker to feel breath sounds (s,sh,ch, & f) and lip movements (to tell vowels from consonants & diphthongs)the index finger is placed along the side of the nose to detect nasal sounds (m,n,ng)

- Sign Language
- Hand over Hand communication



Deaf teacher using Hand over Hand communication with Deafblind pupil

Describe what Deafblindness is and the impact it has on the individual's ability to communicate.

8 HEARING AIDS

8.1 WHAT ARE HEARING AIDS?

A hearing aid is an electrical device worn on the ear. They enable hearing impaired people to hear sounds better and louder.

8.2. WHO CAN USE HEARING AIDS?

Almost everyone, young and old, who has a hearing impairment can be helped with hearing aids.

How successful is the use of hearing aids depends on many things:

- at what age the hearing impairment occurred
- whether the hearing impaired person has already developed spoken language
- how soon hearing aids are fitted after a hearing impairment is discovered
- the degree of hearing impairment - slight, moderate, severe, profound
- the type of hearing impairment - conductive, sensorineural
- how motivated the hearing aid wearer is towards using hearing aids
- how well hearing aids are fitted and maintained
- the quality of the hearing aid and ear mould
- the help and support available to learn to use hearing aids – especially for young children
- where hearing aids are used - quiet or noisy surroundings
- if the wearer has been given instructions on how to listen/use the hearing aid

In general, people with a hearing impairment in only one ear do not need to use a hearing aid, because they receive enough information in their good ear.

8.3 WHY ARE HEARING AIDS NEEDED?

Hearing impaired people need hearing aids to help them communicate. Hearing aids can help people hear and understand speech and other sounds around them. The ability to hear all these sounds not only improves the quality of life of hearing impaired people, but can also significantly improve their

ability to learn at home, at school or in the workplace. Hearing aids can help hearing impaired people become active members of their families and community instead of being isolated and alone.

8.4 WHEN SHOULD HEARING AIDS BE FITTED?

Hearing aids should be fitted as soon as a hearing impairment has been discovered. This is especially true for babies and young children. It is important that young children can hear well in order to develop speech and language. Important language learning can be missed when young hearing impaired children are not fitted with hearing aids.

8.5 WHERE CAN HEARING AIDS BE OBTAINED FROM?

Hearing aids are not ornaments or pieces of jewelry that can be bought “off the shelf” in a shop. Hearing aids need to be fitted following an accurate hearing test.

Hearing aids (including the ear moulds) then need to be properly fitted into the ear. At the same time new wearers must be given instructions and help on how to use hearing aids and look after them. Follow up visits are needed to give further assistance to the wearers and their carers. Therefore, hearing aids should only be obtained from a person who has received appropriate training and is experienced enough to carry out all these tasks.

Why is a hearing aid called an “aid”?

In what way does it help the person hear sounds more clearly?

Early identification of hearing impairment in babies and children is very important for successful use of hearing aids

Remember – hearing aids are not a miracle cure for hearing impairment, they are an “aid” that helps hearing impaired people to hear sounds better.

8.6 TYPES OF HEARING AIDS AND HOW THEY WORK

8.6.1 HOW DO HEARING AIDS WORK?

Microphone – the sound is picked up through the microphone and changed from a sound signal to an electronic signal.

Amplifier – The electronic signal from the microphone is made stronger by the amplifier.

Receiver – The receiver works like a loud-speaker and changes the amplified electronic signal back to a sound signal. It transmits the amplified sounds to the ear.

On-off switch on a hearing aid is usually labelled 'O T M'

O = Off position

T = Telecoil used with specially adapted equipment to cut out background noise

M = On position (M stands for microphone)

Sometimes the on-off switch is part of the battery drawer. In this case the hearing aid is switched off by slightly opening the battery drawer.

Volume control alters the loudness of the sound going into the ear from the receiver. The volume can be adjusted by the hearing aid wearer.

Battery drawer is where the battery is kept and is usually positioned at the bottom of the hearing aid

Battery is the power supply for the hearing aid.

Ear hook (BTE hearing aids only) – this rigid plastic hook fits over the top of the ear to hold the hearing aid in position. It is also connected to the plastic tubing of the earmould.

Cord – (BW hearing aids only) – the receiver is attached to the main part of the hearing aid by a cord. This cord can be single (for one receiver), or double (for two receivers).

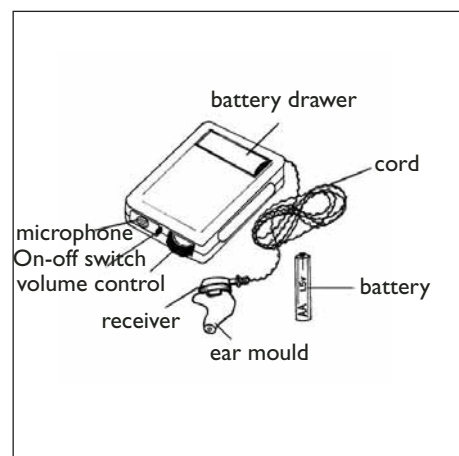


Diagram of BW hearing aid

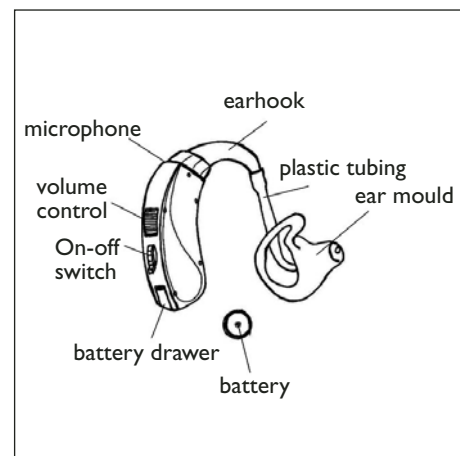


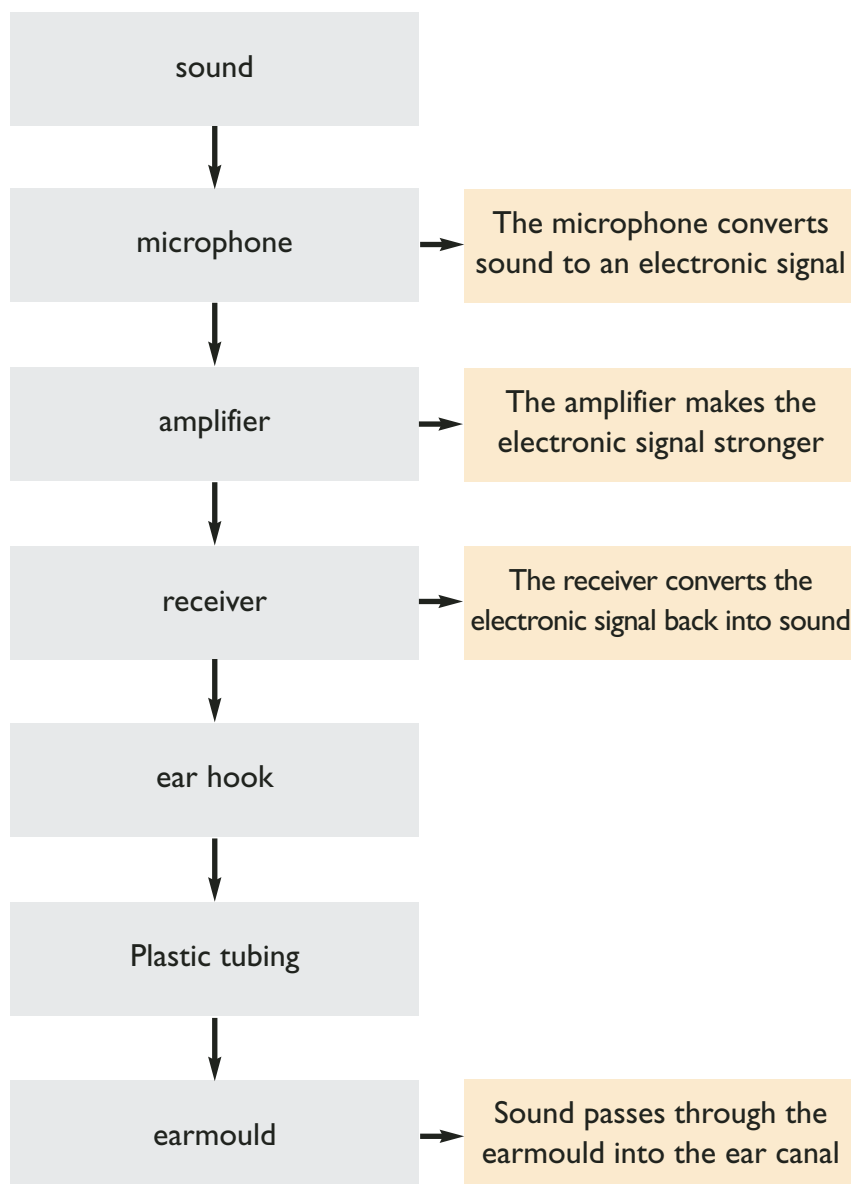
Diagram of BTE hearing aid

8.6.2 HOW DOES SOUND TRAVEL THROUGH HEARING AIDS?

The hearing aid picks up sound through the microphone on the top of the hearing aid. The microphone converts the sound to an electronic signal that is then made stronger by the amplifier.

This is then passed on to the receiver where it is converted back to sound again. In a BW hearing aid the receiver is outside the main part of the hearing aid and is connected by a cord. The sound enters the ear through the ear mould that is clipped onto the receiver. In a BTE hearing aid the sound travels down the ear hook from the receiver and then through the plastic tubing in the ear mould into the ear canal.

Flow diagram of how sound travels through a BTE hearing aid



8.6.3 TYPES OF HEARING AIDS

Body-worn (BW) hearing aids

A BW hearing aid consist of a small box worn on the front of the body with a cord leading to the receiver that is clipped into an ear mould in the ear. They are usually used for severe and profound hearing impairment.

Behind-the-ear (BTE) hearing aids

BTE hearing aids are worn behind the ear and are connected by a short length of plastic tubing to an ear mould in the ear. They can be used for all levels of hearing impairment.

Solar rechargeable hearing aids

A few solar rechargeable BW hearing aids have been designed specifically for people in developing countries. They include a solar panel built into the housing which, when exposed to direct sunlight, charges a rechargeable battery. Solar rechargeable BTE hearing aids are also currently being developed.

How does sound travel through the ear to the brain?

8.7 TYPES OF BATTERY

The correct batteries must be used or the hearing aid will not work properly. For BW hearing aids any standard AA size 1.5 V battery can be used, but long life alkaline batteries are advised (these are more expensive but will last much longer). For BTE hearing aids special hearing aid batteries must be used. The battery life depends on how often the hearing aid is used, at what volume and the power of the hearing aid itself. Batteries may last from just a few days to almost a month.

Solar rechareable batteries and chargers are available.

Remember – the circular LR44 watch/camera batteries should not be used as they will damage a BTE hearing aid.

8.7.1 FITTING A NEW BATTERY INTO A HEARING AID

For BW hearing aids place the battery in the battery drawer matching the positive signs together

For BTE hearing aids remove the paper from the battery and place the battery in the battery drawer (not inside the hearing aid) matching the positive signs together. Gently close the battery drawer – do not force it shut. Do not touch the face of the battery as it can clog the aircells that are used in a zinc battery.

Note: the paper cannot be replaced and the battery cannot be put back in the packet to be used later.

8.7.2 CHECKING THE BATTERY

- Remove the hearing aid from the ear and take off the ear mould.
- Switch the hearing aid on and turn the volume control to the highest setting
- Place the hearing aid in the palm of your hand. For a BW hearing aid place the receiver next to the microphone.
- If there is a continuous whistling sound the battery is working
- If there is no whistling sound the battery is used. Replace the battery
- If there is still no whistling sound with a new battery then there is a problem with the hearing aid

8.8 EAR MOULDS

8.8.1 WHAT ARE EARMOULDS AND WHY ARE THEY NEEDED?

Ear moulds connect the hearing aid itself to the ear. They are made individually for each person so that they fit exactly into the ear. If an ear mould is the wrong size or has been put in the ear incorrectly there may be a loud whistling sound. An ear mould that does not fit properly will be uncomfortable and may even be painful. Ear moulds need to be replaced every one to two years. Children, whose ears grow very quickly, will need new ear moulds every few months.

The ear mould is an essential part of any BTE or BW hearing aid.

Solid Ear moulds are used with BW hearing aids and are connected to the receiver by a small plastic or metal ring. Shell Ear moulds are used with BTE hearing aids and are connected to the hearing aid by a short length of flexible

plastic tubing The left ear mould is a mirror image of the right ear mould. Hold the ear mould with the canal part at the bottom and the helix at the top. With the concha (crescent shape) at the back, the direction of the ear canal indicates the ear into which the ear mould is to be fitted.

8.8.2 FITTING THE EAR MOULD ONTO THE HEARING AID

For a BW hearing aid the ear mould simply clips on to the receiver and can then be fitted into the ear.

For a BTE hearing aid the plastic tubing needs to be cut to the right length. If it is too long the hearing aid will not stay behind the ear properly. If it is too short then the ear hook of the hearing aid will be pulled down on the top of the ear and be uncomfortable.

Remember – the tubing on a BTE hearing aid must not get twisted as this will block the pathway of the Sound

8.8.3 FITTING THE EAR MOULD INTO THE EAR

Fitting an ear mould into the ear correctly is not easy and can take some practice:

- Hold the ear mould between the thumb and middle finger. Your first finger helps support the hearing aid.
- Fit the canal part of the mould into the ear canal first.
- Now press the mould into the ear so that it fits into the shape of your ear.

8.9 HEARING AID CARE AND MAINTENANCE

8.9.1 LOOKING AFTER HEARING AIDS

- Do not to drop them – hearing aids are delicate.
- Do not leave hearing aids in direct sunlight or on top of a heater.
- Do not wear hearing aids without medical advice if you have any ear discharge from an infection.
- Do not use a pin, paper-clip or any sharp object to remove dirt from hearing aids or ear moulds.
- Store hearing aids in their box, in a cool, dry place out of the reach of other children and animals. Don't just put them in a pocket.

- Only use the on-off switch and the volume control – all other controls should only be changed by a trained person.
- Remove hearing aids before putting on perfume or hair spray
- Never try to repair hearing aids yourself – if they break return them to the place where they were fitted.
- Keep cords of BW hearing aids free of knots and do not wind them tightly around the hearing aids.
- Do not get hearing aids wet – remove them for washing and swimming. If hearing aids do get wet, do not put them in the oven or the sun to dry out. Remove the batteries, leave the battery drawers open and put them somewhere safe for a day or two and they may dry out.
- Keep hearing aids in a “stay dry” or plastic bag/box with rice or silica gel crystals to absorb moisture.

8.9.2 LOOKING AFTER BATTERIES

- Batteries should be stored in a cool, dry place, away from small children and animals that may swallow them. If a battery is accidentally swallowed seek medical help immediately. In very hot, humid climates batteries can be stored in a refrigerator. Used batteries must be disposed of carefully and not thrown in the fire or left where small children or animals can reach them.
- When the hearing aid is not being used it should be switched off to save the batteries. In hot, humid climates or if the hearing aid is not going to be worn for a long time the battery should be removed from the hearing aid altogether.
- Batteries for BW hearing aids can be bought at local shops. Batteries for BTE hearing aids can usually be bought at hearing centers. Batteries should always be bought well within their expiry date.
- For zinc air batteries do not remove the tab on the top of the battery until it is going to be inserted into the battery drawer. Removing the tab causes the battery to discharge.

8.9.3 LOOKING AFTER EAR MOULDS

It is very important to keep ear moulds clean, so they need to be washed every two or three days:

- Detach the ear moulds from the hearing aids
- Wash the ear moulds in warm soapy water. Do not use strong detergent or spirit.
- Any wax still stuck in the hole through the ear moulds can be carefully removed using a toothpick / thin stick. Be careful not to push the wax further down the tube.

- Rinse the ear moulds in clean water and blow through the tubing to remove any drops of water.
- Dry the ear moulds with a soft cloth or tissue and replace them the correct way around on the hearing aids.

Condensation (small drops of water) sometimes forms in the plastic tubing and can block the ear mould. If this happens, remove the ear mould and tubing from the hearing aid and blow through the tubing.

NOTE: Do not blow into the hearing aid itself

8.10 HEARING AID FAULT-FINDING

Problem	Problem identified	Solution
Weak or no sound	Hearing aid switched off	Switch hearing aid on
	Volume too low	Increase volume
	Battery running down or used up	Replace battery
	Battery not inserted correctly	Insert battery correctly
	Battery drawer not closed properly	Close battery drawer
	Ear mould tubing blocked with wax or moisture	Clean ear mould and tubing
	Ear mould tubing twisted	Replace ear mould tubing
	Cord broken	Replace cord
Sound comes and goes	Other	Send hearing aid for repair
	Dirty battery contacts	Send hearing aid for repair
	On–off switch or volume control faulty	Send hearing aid for repair
	Cord not plugged in correctly	Push in cord plugs
Distorted sound	Cord faulty	Replace cord
	Volume too high	Decrease volume
	Battery running down	Replace battery
	Clothing noise	Wear hearing aid outside clothing
	Cord faulty	Replace cord
	Other	Send hearing aid for repair

NOTE: Hearing aids are expensive and delicate so all wearers must be shown how to look after the hearing aid. Lost or broken hearing aids are no help for anyone.

Explain why users have to take care of the batteries and the ear moulds.
Why should they keep the ear mould free from dirt and wax?

ANNEX. Development of a National Programme for Prevention of Deafness and Hearing Impairment

A National Programme For The Prevention And Rehabilitation Of Hearing Impairment would usually be developed and implemented by the National Government, often assisted by local or international NGOs. This might be part of a National Plan on Disability. The model could also be adapted for local or district programmes.

The process of development of the programme should include the relevant policy decisions, appointment of national and district coordinators, creation of a national committee for coordinating all stakeholders, and preparation of the national programme.

The detailed programme should include general aims and objectives, intended outputs, outcomes and specific targets. It should identify the main causes of hearing impairment to be tackled with the specific strategies and technical procedures to be applied. Selected populations at risk may need to be targeted. Primary ear and hearing care (PEHC) as a component of primary health care (PHC) should be set up, together with provision or strengthening of ear care and audiological and rehabilitative services at secondary and tertiary levels. The training and supervision of staff involved in new activities should be addressed; reporting requirements should be laid out and the monitoring and evaluation criteria for the plan defined. A time frame should be constructed and the programme should be devised so as to integrate with existing or future community-based rehabilitation programmes. The detailed programming should also clearly define the role and input from other government ministries or departments, collaborating agencies and nongovernmental organizations, i.e., in terms of specific technical activities, coverage of populations/areas, and resource mobilization.

The programme would consist of the following elements:–

A. PRIMARY PREVENTION

A programme for primary prevention of ear diseases and hearing impairment should be devised and implemented, and focused particularly at the primary level of health care. The main elements would consist of:–

- (1) Primary ear and hearing care (PEHC), – the subject of this training resource – to prevent and treat common ear conditions such as wax, foreign bodies, and acute and chronic otitis media, carry out simple tests for deaf-

ness and hearing impairment, and make appropriate referrals and follow-up. A programme for primary ear and hearing care should be devised which would integrate into primary health care. This would include training for the most basic level (eg village health workers) and for staff at the larger centres (eg specialised nurses, midwives, primary care doctors), and would also include or at least link to the following elements (2) to (6).

(2) Health education programme to address the problems and prevention of inherited, pre-natal and peri-natal causes of ear disease, chronic otitis media, ototoxic drugs, infectious causes, and, for adolescents and young adults, noise-induced hearing loss. It should also address presbycusis in older persons. The importance of screening should be covered. This programme would be targeted at parents, teachers, schools, community leaders, health professionals, and the general public. A strategy would need to be developed using different messages and various media according to the group being targeted and resources available.

(3) Surveillance and early treatment for infectious diseases such as cytomegalovirus, Herpes simplex, HIV/AIDS, Lassa Fever, Lyme Disease, malaria, measles, meningitis, mumps, rubella, syphilis, toxoplasmosis, and typhoid fever that may cause hearing loss.

(4) Monitoring of the coverage of the immunisation programme for vaccine-preventable diseases, such as measles, mumps, rubella, and meningitis (if implemented) that may lead to hearing loss.

(5) Improvement of the maternal health programme in order to minimise hearing loss related to inadequate ante-natal and perinatal care.

(6) Consideration of the creation of a genetic counselling service, (including pre-marriage counselling) for parents with a positive family history of hearing impairment or where there are siblings with inherited causes of hearing loss. This could be based at the main PHC centres or MCH centres.

(7) Where adults are also targeted there should also be development and enforcement of a hearing conservation programme against noise-induced hearing loss in the work-place, especially for adults in high-risk occupations. This should include regular inspection and monitoring of noise levels, advising on noise reduction, ear protection, regular screening of employees for hearing impairment, health education for the work-force, counselling and compensation schemes for those affected, and legislation to enable enforcement.

B. SCREENING AND DETECTION

A screening programme for early detection of hearing impairment in infants and young children should be set up. The main points of this should be as follows.

(1) It could be a component of a comprehensive screening programme for all disabilities and may be implemented through community-based rehabilitation (CBR).

(2) The first screen should be during the first year of life, generally from 6 months of age (universal neonatal hearing screening is being implemented in some developed countries using the techniques of oto-acoustic emissions (OAE), and automated auditory brain-stem response, (ABR) audiometry, but such screening may not be affordable at present by many developing countries). Screening should be focused at the PHC level. The screen could be conducted by village health workers (VHWs) or at maternal and child health (MCH) centres when infants are taken for immunisation. The mid-wife, nurse and/or doctor in charge would need special training. Programmes to raise awareness about the availability and importance of screening should be conducted for parents and health professionals, as part of the health education programme.

(3) The second screen should be about age 4 or 5 years on school entry and could be incorporated into a school health screening programme. Screening tests should include otoscopy, screening audiometry and tympanometry. The tests and equipment to be used, training required for school health teams, procedures and capacities for referral and follow-up will need to be determined.

Even if screen-positive children with mild to moderate levels of hearing impairment are not referred, they can at least be targeted for simple classroom measures to improve school progress, so that the level of awareness generally in the school and community will also be raised. The decision whether to implement a school-wide screen of hearing impairment could await the findings of a population-based survey so the costs and benefits of implementation can be determined, especially where resources are limited.

(4) Where there is or is planned to be a CBR programme, the screening programme could be integrated with this. This integration should preferably be at all levels, but even when national policy on CBR has not been formulated, possibilities for integration could be addressed locally.

(5) The details of the screening programme could be determined by a technical advisory committee or working party set up by the Ministry of Health. The terms of reference of this committee would include the particular screening methods to be used, training required, potential impact on

referral services and consequent increased capacity needed, and integration with other programmes. If sufficient expertise is not available locally, it may be necessary to appoint a consultant to advise such a committee.

(6) The screening programme should not be implemented in an area until it is clear that the available services can accommodate the estimated additional numbers of cases discovered by the screening.

C. SERVICES

Expansion of services may be required and this will depend on the numbers of persons in the population estimated and found to have remediable or avoidable ear disease and/or deafness and hearing impairment. This information will ideally be obtained from a population-based prevalence and causes survey.

The primary level services would include components on prevention, basic management and referral of ear diseases and hearing impairment.

Secondary level services may need to be expanded to include or increase (1) Basic ENT services, including management and basic surgery, or a decision to refer to the tertiary level; (2) Capability to make an audiological assessment for basic diagnosis and management of deafness and hearing impairment, including provision of hearing aids and services to fit them and follow up, or referral to the tertiary level for more detailed assessment and management or rehabilitation.

Tertiary level services would include (1) Comprehensive ENT services including more complex surgery including microsurgery, (2) Audiological diagnostic services with close links to rehabilitation services.

Rehabilitation or tertiary prevention would cover (1) Hearing Aid Services which would include the establishment of adequate numbers of focal points to make and fit ear moulds and procure, fit and repair hearing aids and provide counselling and follow-up in their use. Issues related to procurement of hearing aids, spare parts and components, reconditioned aids, funds for new aids, and procurement of earmould materials would need to be addressed, possibly through the setting up of public- private partnerships. (2) Speech/language pathologists may need to be appointed and based at tertiary referral centres, and able to provide a static and an outreach service, and also training for CBR workers and for teachers of children with hearing impairment. All these services should be linked or integrated with school health services, educational provision and other rehabilitation or tertiary prevention services;

D. TRAINING

The needs for more, trained professionals in this field at primary, secondary and tertiary levels should be determined in the light of the survey results. The personnel who would carry out primary ear and hearing care services, screening, higher level otological and audiological diagnosis and management, and hearing aid and earmould services should be identified, or new positions created at all levels.

Opportunities for basic and refresher training should be set up nationally or sought regionally. This would include training in primary ear and hearing care for community and primary health care workers, training in hearing screening for health staff at PHC and MCH (maternal and child health) centres and in school health teams, training in oto-rhino-laryngology for higher-level health professionals, and training in audiology and audiometry, and ear mould technology and hearing aid fitting and repair. These could be short courses or modules within other courses. Training for speech pathologists will also be required. There should be an expansion of training for teachers in schools for children with hearing impairment and for teachers in normal schools who teach classes in which children with hearing impairment are integrated.

E. MONITORING AND EVALUATION.

A system for monitoring and evaluating the programme to determine and measure its fulfilment of the objectives and outcomes should be devised at the planning stage and put in place from the beginning.