ABC of ENT

HAROLD LUDMAN

ASSESSING DEAFNESS

Full assessment of a deaf patient demands specifying, for each ear, the site of the defect, the cause, and the severity of disability. When these can be stated, which is not always possible, an attempt can then be made to determine (a) whether the defect is treatable, with a possibility of improving hearing; (b) the overall disability, considering hearing in both ears, and (c) whether the deafness is a symptom of another disease—for example, syphilis or acoustic neuroma.

Important aspects of the history include the rate of onset and progression, family history, any information about noise exposure or unusual medication and associated aural symptoms (pain, discharge, vertigo, and tinnitus). Examination will show whether the external ear canal is obstructed and, if not, the state of the ear drum. Obstructing wax or debris must be removed. The otologist generally removes it manually under the illumination of a headlight using wax hooks and rings, or cotton wool on wire carriers, but the GP may prefer to syringe wax from the ear. For safety there should be no previous history of middle ear disease or suspicion of perforation. A story of previous uneventful syringing is always comforting. If the wax is hard it may be softened by instilling olive oil or 5% sodium bicarbonate drops twice a day for a few days beforehand. Proprietary ceruminolytic drops should be used with great care since they may cause otitis externa with swelling of the meatal skin and severe pain if the canal is already filled with hard wax.

When the canal is clear the drum can be examined—preferably with a Siegle's speculum to assess mobility. Without this manoeuvre a middle ear effusion may be overlooked because the drum may look surprisingly normal when the whole middle ear is filled with mucoid material. At this stage the otologist will usually examine the ear under a binocular operating microscope.

Conductive and sensorineural hearing loss can be distinguished by the use of two tuning fork tests—the Rinne and the Weber. For each the ideal fork has a frequency of 512 Hz (cycles per second).

Rinne test

The examiner first establishes that the vibrating fork is audible at the meatus and on the mastoid process. Then he presses the foot of the vibrating fork on the mastoid bone of the ear under test. He then moves it to the external meatus and asks the patient whether he can still hear it. The fork is returned to the mastoid and the question repeated. By repeating this manoeuvre the examiner can establish reliably where the fork is heard longest. When conductive mechanisms are normal (giving a positive response, recorded as AC > BC) the test shows better (more prolonged) hearing by air conduction—at the meatus. Positive responses are found in normal ears and those with sensorineural hearing loss.

Weber test

Audiometric tests

When the deafness is conductive, bone conduction, where sound is transmitted direct to the cochlea through the skull, remains unimpaired, while the response to air-conducted sound is diminished. As the hearing loss increases the sound is heard for longer by bone conduction than by air conduction. This is a negative response ($BC > AC$). If, however, one ear is totally deaf while the other retains good hearing bone conducted sound from the deaf side will be heard by the intact cochlea on the other side, giving a false-negative Rinne response. To expose this false-negative the test should be conducted with a loud sound introduced into the normal ear—for example, with a Barany noise box.

The foot of the vibrating fork is placed on the forehead and the patient asked in which ear the sound is heard. This test is particularly useful when hearing is very different in the two ears. When the hearing defect is sensorineural the fork will be lateralised to the better side. The reverse obtains when the deafness is conductive.

If there is a combination of conductive and sensorineural loss the normally reliable results of the tuning fork tests may be misleading.

Quantitative measures of the loss, and accurate determination of its site and cause, depend on audiometric tests.

The most familiar test is pure-tone threshold audiometry. This test, performed with electronic equipment and standardised techniques in a soundproofed room establishes the severity of the hearing loss throughout a range of frequencies from 250 to 8000 Hz. At each frequency the hearing loss is measured and plotted on a logarithmic decibel scale with reference to normal hearing at that frequency, to produce an air-conduction audiogram. A bone conduction threshold audiogram can be produced by a transducer on the mastoid. By comparing the air and bone conduction thresholds a quantified Rinne test at different frequencies is available, allowing conductive and sensorineural hearing losses to be distinguished. Bone conduction thresholds must be regarded with caution. They are less accurate and reliable than air conduction thresholds.

A pure-tone audiogram provides evidence of the type of hearing loss and indicates its severity. In some cases the pattern of the curve suggests the cause—for example, in hearing loss induced by noise, early Menière's disease, and presbycusis. More specialised tests in the outpatient clinic are needed to assess further the severity of the disability (though pure-tone audiograms are surprisingly useful for this) but mainly to identify the site of the lesion.

Acoustic impedance measurements allow middle ear pressure to be assessed and middle ear effusions to be recognised. This technique records contraction of the stapedius muscle in response to auditory stimuli and is useful for recognising conductive defects and in sensorineural diagnosis.

Speech audiometry examines discrimination ability above threshold. It measures the proportion of spoken words recognisable at different intensities and, by comparison with the pure-tone audiogram, indicates whether a sensorineural defect lies in the cochlea or auditory nerve. Tests for so-called "loudness recruitment" and adaptation are also necessary for distinguishing between sensory and neural defects.

Management

Surgery

Apart from treating underlying disease, management must take account of the patient's social disability (see later article). What can be done to help one ear depends on the state of the other. Theoretically most conductive defects can be remedied, while (with few exceptions) no correction is available for a sensorineural one. Apart from removing wax from the external meatus, conductive defects can be corrected by operation using the binocular microscope.

Stapedectomy—to correct otosclerosis—has led the development of microsurgery of the ear. The disability caused by the immobile stapes footplate is relieved by replacing the stapes with a plastic (or metal) prosthesis attached laterally to the long process of the incus and transmitting pressure medially to the perilymph of the inner ear within the vestibule.

Perforated ear drums are repaired by myringoplasty. A graft, usually of connective tissue (such as temporalis fascia), is placed on the outer surface of the drum after it has been prepared by removing the outer layer of skin. Alternatively the graft may be laid inside the middle ear, in contact with the medial surface of the ear drum.

Breaks in the ossicular chain are mended by various reconstructions (ossiculoplasties) to attach the ossicles to each other, using artificial materials or ossicular bone. Rebuilding of both the ossicular chain and the defective drum is a tympanoplasty. (This term also describes reconstructive procedures in which diseased tissue is excised.)

Secretory otitis media, particularly glue ear, is relieved by a myringotomy incision in the anterior ear drum, aspiration of the effusion (which is often difficult because of its tenacity), and insertion of a ventilation tube or grommet to ventilate the middle ear cleft.

All operations on the ear carry a risk of cochlear damage, particularly when the inner ear has to be opened as in stapedectomy. This risk determines the principle of operating on a patient's worse ear and never operating if a patient can hear with only one ear.

If neither surgery nor medical treatment can improve hearing, as in sensorineural deafness, the patient may need sound amplification with a hearing aid (see next article).

Sudden sensorineural deafness

Sudden sensorineural deafness, which usually affects only one ear, constitutes a medical emergency. In most cases no cause is found. Fortunately the patient usually recovers or improves spontaneously after a few weeks. Nevertheless, all patients presenting with this syndrome should undergo full otological assessment. Some acoustic neuromas present in this way, as may syphilis. Traumatic tears of the intralabyrinthine membranes, with perilymph leakage from the oval or round window, may be preceded by the trauma of such slight exertion that it may escape the history. When this is possible the patient should rest sitting up in bed, and operative exploration of the middle ear may be considered to seal any perilymph leak.

If no cause is found and no perilymph fistula suspected treatment with systemic steroids and vasodilator drugs may be considered.

The photograph of an operating microscope was reproduced by permission of Carl Zeiss (Oberkochen) Ltd and that of the audiometer by permission of Amplivox.

Mr Harold Ludman, MA, FRCS, is consultant otolaryngologist, King's College Hospital, and neuro-otological surgeon, the National Hospital for Nervous Diseases, London. This is the fifth of 16 articles.