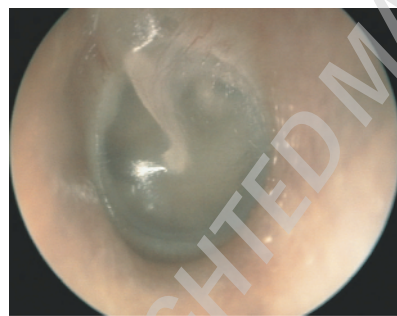
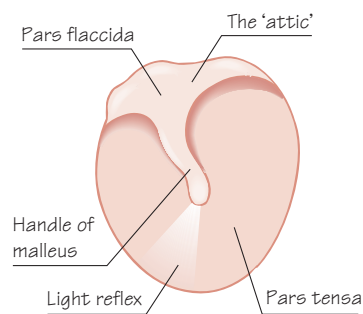


Figure 1.1
Cross-section through the ear and Eustachian tube



(a)
Figure 1.2
The eardrum as seen with an otoscope (auriscope)
(a) – Schematic diagram
(b) – photograph

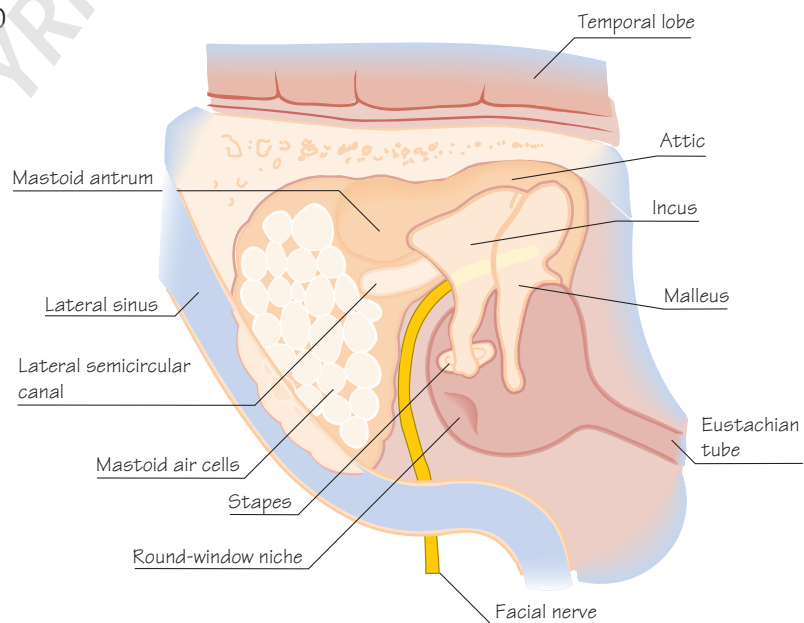


Figure 1.3
The middle ear and mastoid air cell system

The ear

The ear has three divisions:

- 1 The outer (external) ear
- 2 The middle ear
- 3 The inner ear

External ear

The external ear is made up of (Figure 1.1):

- The pinna
- The external auditory meatus (ear canal)
- Lateral portion of tympanic membrane (ear drum)

The outer (lateral) part of the external ear has a cartilaginous skeleton and the deep (medial) part has a bony skeleton: both are lined by skin. Skin overlying the lateral portion contains hair follicles and sebaceous and wax glands, which are all absent in the medial portion.

The tympanic membrane forms a boundary between the external and middle ears and is divided into the stiffer pars tensa below and the less rigid pars flaccida above (Figure 1.2).

Middle ear

The middle ear is an air-filled space behind the tympanic membrane that contains the ossicles (bones of hearing): malleus, incus and stapes (Figures 1.1 and 1.3). The ossicles form the ossicular chain, which amplifies and transmits sound vibrations to the inner ear.

The Eustachian tube forms a link between the middle ear and nasopharynx. The facial nerve (cranial nerve VII) also runs through the middle ear. Posteriorly, the mastoid air cell system also opens directly into the middle ear (Figures 1.1 and 1.3).

Inner ear

The inner ear comprises (Figure 1.1):

- The part of the middle ear behind the pars flaccida is called the 'attic'.
- The cochlea – this part of the inner ear creates electrical impulses in the cochlear nerve (cranial nerve VIII). These impulses are relayed to the brain to be perceived as sound.
- The vestibule and labyrinth (semicircular canals) – these are involved in balance control.

Anatomical relations of the ear

The ear is close to some important structures which can be involved if infection or disease spread:

- *Eustachian tube* (Figures 1.1 and 1.3) This is a part bony and part cartilaginous tube lined with ciliated epithelium that connects the middle ear space with the **nasopharynx**. Infection in

the nose and pharynx can easily track up this tube to the middle ear, which is really a part of the upper respiratory tract. The Eustachian tube is especially important in children – it is wider, shorter and more upright than in adults. Gently hold your nose, close your mouth and try to exhale – you will feel air entering your middle ear via the Eustachian tube.

- *Mastoid air cell system* The mastoid process is a bony lump behind the pinna that contains a honeycomb network of epithelium-lined air cells (mastoid air cells). The mastoid air cell system opens directly into the middle ear cleft (Figure 1.3). Infection can track in here to cause 'mastoiditis' (see Figure 8.3).

- *Middle cranial fossa* This contains the temporal lobe of the brain and sits just above the middle ear so meningitis and brain abscess are possible complications of ear infection.

- *Venous sinuses* These surround the brain and carry blood to the neck veins and are also closely related to the middle ear and mastoid. Infection can propagate and result in potentially fatal cavernous sinus thrombosis.

- *Facial nerve* The seventh cranial nerve runs through the mastoid and the middle ear. It supplies the muscles of facial expression and is at risk in ear infections and in some types of ear surgery.

TIPS FOR EAR EXAMINATION

- Look at the pinna and the mastoid and check for swellings, scars and colour change.
- Use a good quality otoscope (auriscope) to obtain a view of the eardrum. Use the biggest speculum that will comfortably fit and do not put it in too far.
- You may need to straighten the ear canal by pulling the pinna upwards and backwards to help fit the speculum in.
- Note the condition of the skin of the external ear and try to get a good look at the eardrum in a systematic manner.
- Complete examination includes tuning fork tests, hearing assessment, assessment of facial nerve function and post-nasal space examination to look at the Eustachian tube opening.

Clinical practice point

If you cannot obtain a good view of the eardrum using an otoscope, gently manipulate the pinna. Do not put the speculum in too far.