

## ACUTE OTITIS MEDIA.

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### Ætiological Factors.

Acute suppurative otitis media is a disease of all ages and all climes, and as it is almost invariably an extension of acute infection of the upper respiratory passages, is naturally prevalent under similar conditions.

While the importance of the infecting agent is obvious it is always in suitable environments that such infections flourish. General debility, induced by living in overcrowded conditions, by lack of sunshine and of food, and of the essential vitamins, accounts for the fact that the incidence of the disease is far higher among the poorer classes of the community than among those who are better housed, better fed and better clothed.

As the infection reaches the middle ear in the vast majority of cases via the Eustachian tube, it is obvious that an important predisposing factor will be any condition of the nose or nasopharynx associated with infection, acute or chronic. It is therefore very common in infants and children suffering from infected tonsils and adenoids, and in patients of all ages suffering from acute or chronic nasal sinusitis. It also commonly accompanies an acute coryza, and the exanthemata, particularly scarlet fever and measles. It frequently occurs in influenza, the incidence varying very considerably in different epidemics. In infants it may result from the irritation of the mucous membranes due to teething.

More rarely it may be due to the entry of infected fluid into the Eustachian tube following too forcible nasal douching or swimming. Incidentally, the usual modern swimming stroke, the trudgeon-crawl, is more likely to cause water to enter the nose than the old fashioned breast stroke. Infection is more liable to occur where pools are inefficiently sterilised, or grossly overcrowded, or in the sea where the water is contaminated by sewage from large towns.

Furthermore, in cold summers infection seems to be commoner and this is presumably due to lowered bodily resistance from over chilling. Very occasionally infection occurs from the outer ear via traumatic rupture of the tympanic membrane, as in fractures of the base of the skull, or in perforations caused by some sharp body as a hairpin during sleep. But in these cases infection usually results from injudicious attempts to sterilise the external meatus after the damage has occurred. Therefore it is a rule never to introduce any fluids into the ear in such cases unless infection has already occurred. Very rarely indeed infection may pass outwards to the tympanum from the internal ear, as may occur in cerebro-spinal meningitis.

Hitherto we have assumed the presence of an intact tympanic membrane. If, however, a perforation of the membrane is present, as a legacy of old middle ear suppuration, the introduction of fluid into the outer ear will often rekindle the infection. Thus it sometimes happens that a patient complains of pain and later of otorrhœa, following the removal of wax by syringing, and he may then accuse his practitioner of rupturing the drum by clumsiness or force.

A little consideration will show that excessive force applied to the outer surface of the drum, except by a sharp instrument, cannot stretch the drum to the point of rupture, as the bony inner tympanic wall acts as a buffer stop. Thus, in rupture of

the drum membrane from gunfire, the drum membrane is not ruptured inwards by the wave of compression, but outwards by the succeeding wave of rarefaction. The true explanation of these cases of otitis media following syringing is, of course, that infection is carried in through a pre-existing perforation. If such a perforation is known to exist in an otherwise normal tympanum, the entry of fluids of any kind must be strictly avoided. These patients must be cautioned against swimming, as no ear plugs are completely efficacious, and cerumen should be removed when necessary by means of a suitable hook.

If the perforation is discovered only after syringing, careful drying of the meatus with alcohol may prevent infection.

### Bacteriology.

Almost any pyogenic organism may be found in acute otitis media, but the commonest are the streptococcus hæmolyticus, pneumococcus, and staphylococcus.

It is, indeed, fortunate that the streptococcus hæmolyticus is the predominant infective organism, now that potent chemotherapeutic agents are available. There is every reason to expect that with these and allied substances in the future the whole outlook in otitis media will be completely changed.

### Symptomatology.

Whether the infection reaches the tympanum from the pharynx via the lumen of the Eustachian tube or via the subepithelial lymphatics has been a matter of some controversy, but has no practical application. At all events infection seems more prone to ascend the relatively short wide tube of infants. The important fact is that in very many cases the infection involves the whole middle ear tract, including the extensions into the mastoid process, almost simultaneously. This is shown by the frequency with which mastoid tenderness appears in the very earliest stages of otitis media. The first reaction to infection is an intense hyperæmia and swelling of the lining membrane, the effect of which is to cause complete obstruction of the Eustachian tube. Exudate is then poured out into the middle ear and extensions, at first serum, mixed with mucus from goblet cells in the Eustachian tube and tympanum, soon becoming turbid from migration of leucocytes and erythrocytes, and shedding of epithelial cells, until finally it is frankly purulent.

The effect of this increased secretion poured out into a cavity already almost obliterated by enormous swelling of its lining membrane, and with its normal outlet to the pharynx occluded, is to cause extreme tension. This tension, and the forcible stretching of the tympanic membrane which results, are the cause of the agonising earache. Earache therefore is much more severe in the acute fulminating cases associated so often with influenza, than in subacute infections, where indeed pain may be quite insignificant.

Areas of pressure necrosis are liable to develop in the mucosa, and the underlying bone, and it is a process of this nature which causes the ultimate spontaneous rupture of the drum head.

In infants the drum head is, compared with that of adults, relatively thick and strong, and therefore much more resistant to perforation. In infants therefore, perforation of the mastoid cortex occurs frequently, with the formation of a subperiosteal abscess, before any discharge appears in the meatus.

Earache, in the vast majority of cases, is the most prominent symptom, and, like most pains is more unbearable at night. It is throbbing or boring in nature, with acute exacerbations, and radiates over the side of the head forwards to the temple and backwards to the occiput and even, very occasionally, to the teeth and gums. It is not influenced by manipulation of the outer ear, but is intensified by such actions as sneezing or yawning, which raise the intratympanic pressure. In young infants the site of pain may be indicated by the patient putting his hand to the affected ear as he cries, or attempting to bury it in the pillow.

Fever is present in greater or lesser degree. In children a temperature of 100° F. to 104° F. is common, in adults little rise may occur.

Deafness is also present in greater or lesser degree, associated with tinnitus, and is especially marked when there is co-existent infection of the mastoid process.

More rarely there may be vertigo, and meningism, the latter more especially in infants.

In the early stages otoscopic examination shows increased vascularity of the drum membrane, a prominent vessel appearing along the malleus handle and smaller vessels radiating from this at right angles towards the periphery. Soon the whole membrane loses its gloss and appears dull red, this redness extending to the adjacent deeper part of the meatus. The drum is then seen to bulge outwards, at first in its postero-superior part, soon involving the whole drum so that no landmarks are visible. At the same time the normal process of desquamation of the outer epithelial covering of the drum is enormously accelerated, and this may form a greyish-white film which is sometimes mistaken for the colour of the normal drum. It is, however, quite simple to wipe this deposit away with a cotton wool covered probe, to reveal the intensely red drum beneath. Sometimes a small yellow nipple-like projection is seen in the centre of the red bulge, indicating the site of impending perforation.

Sometimes perforation has already occurred, in such cases discharge, blood-stained serum, pus, or mucopus fills the meatus and not until this has been removed by syringing or mopping can the drum and perforation be seen. The latter usually shows itself as a pulsating spot of light. In some cases it may be obscured by the swollen drum and can only be inferred from the welling up of pulsating discharge.

### Differential Diagnosis.

Several conditions may cause difficulty in diagnosis.

The pain of *furunculosis* may be very acute, but here the swelling is in the cartilaginous meatus and there is extreme tenderness on pressing the tragus. Pain is also elicited by manipulation of the pinna, or by movement of the tempero-mandibular joint, both causing deformity of the cartilaginous meatus. If pus is present it contains no mucus, and if the pus is cleared away and a speculum passed beyond the furuncle the drum is seen to be intact and the hearing unaffected. Catheterisation of the Eustachian tube may also assist by confirming the absence of fluid in the tympanum.

In *myringitis* the drum is red but not bulging, the constitutional disturbance is trifling and the hearing is almost unaffected.

*Bullous otitis* may be more difficult to diagnose, unless seen early. Purple bullæ form on the outer surface of the drum and on the adjacent deep meatal walls, pain is severe and constitutional disturbances marked. A large bulla may well be mistaken for a bulging drum.

A *sessile polypus* is sometimes mistaken for the drum, but the former is pinker, moister and more fleshy in appearance, and touching with a probe soon settles the diagnosis.

Occasionally, in *sub-total loss* of the drum, the convex outer surface of the inner ear is mistaken for a bulging drum. Here again, the colour and moist appearance of the mucosa should be sufficient guide; further there is usually some marginal remnant of drum and the whole structure is much deeper than a bulging drum. A fine probe immediately clinches the diagnosis.

In *herpes of the facial nerve* pain is severe, and is accompanied by deafness. Soon after the onset, however, a typical herpetic eruption is seen on the drum and deep meatal walls, the deafness is of the inner ear type, and facial palsy develops.

The importance of making a correct diagnosis of this condition is of course due to the fact that any operative interference may be deemed by the patient to be responsible for the deafness and palsy. Finally, in the various *reflex otalgias*, the drum membrane is normal in appearance and a search of the common sites will reveal the cause.

### Diagnosis.

It is obvious that no diagnosis of acute otitis media can confidently be made without inspection of the tympanum. To this end all foreign matter must be carefully removed from the meatus by gently syringing, by the use of a wax hook or by mopping with a cotton wool covered probe. In cases where this removal causes excessive pain it may be justifiable to give a short general anæsthetic for the purpose.

For work in clinics a forehead mirror and standard lamp are best, but for examining small children and patients in bed one of the modern electric auroscopes is invaluable. It is impossible to make a confident diagnosis in a difficult case with poor illumination.

Having inspected the drum one should note the signs of constitutional disturbance, whether any mastoid tenderness or oedema is present, whether there is any alteration of hearing, and whether there is any sign of intracranial infection. Also one should look for the primary focus of infection, such as an acute sinusitis or acute tonsillitis.

### Treatment.

In regard to treatment it is interesting to read what Celsus (*circa* 50 B.C.) has to say on the subject. He was, of course, well aware of the serious results which could follow inflammation and pain in the ears. He says, "This makes it the more necessary to administer speedy relief in their beginnings, to prevent any greater danger." He advocates fasting, purging and bleeding, hot fomentations applied outwardly, and also tepid infusions into the ear, these comprising such strange medicaments as the juice of roses and roots of reeds, and oil in which worms have been boiled. What advance have we made in treatment in the course of nearly 2,000 years?

The general principles remain very much as they were in ancient days. Rest, light diet, increased fluid intake, aperients, and the application of heat to promote hyperæmia and relieve pain. There is still a tendency to endow drops inserted into the ear with magical properties. Certainly some drops have a soothing effect, either by covering the inflamed surface of the drum with a protective film or by softening it so that it stretches more easily. But that drops can penetrate the unbroken epithelial covering of the drum in quantity sufficient to exert any curative action on the lining of the middle ear seems more than doubtful. The ordinary glycerine and phenol drops of the B.P. are probably as good as any; glycerine softening the drum and phenol not only partially anæsthetising but also sterilising the outer surface of drum and deep meatus.

Heat applied to the outer surface of the ear and mastoid process is the most soothing therapeutic measure; either by means of boric lint fomentations changed every two hours during the day, or kaolin fomentation, or the application of an electrically heated pad, or even the radiation from a gas-filled electric light. Incidentally, infra-red radiation is readily obtained, if desired, from an ordinary electric bowl fire.

Sedatives are given internally to relieve pain, such as aspirin or Dover's powder, due regard being paid to their deceptive effect on the temperature.

As, in the majority of cases the infecting organism is the streptococcus hæmolyticus, type A, we have in prontosil and sulphanilamide powerful adjuvants to treatment. It is probably wise not to resort to these drugs indiscriminately but to reserve them for the more severe cases.

**Myringotomy.** If pain persists, fever is present, and the tympanic membrane is seen to bulge, the operation of myringotomy, sometimes called paracentesis, will be indicated.

Except in tiny infants a short general anæsthetic is required, e.g. in adults gas and oxygen, or evipan, in children open ethyl chloride. If for any reason, a general anæsthetic is contra-indicated the local application to the drum of 20 minutes of phenol, cocaine and menthol, in equal parts by weight, produces fairly efficient anæsthesia.

An attempt is made to sterilise the skin covering the drum by means of ether applied on a wool-covered probe. The myringotome used must have a sharp pointed, sharp edged, blade. Most people will find that the electric auroscope gives the best view of the field of operation, and great care is necessary to avoid touching unsterile parts while introducing the blade of the knife. The incision is made vertically through the centre of the bulging part, the knife entering at the lower margin and being carried up to the upper before withdrawal. A common error with beginners is to incise the skin over the adjacent posterior meatal wall, or to make only a minute puncture in the drum; usually because of inadequate illumination and bad anæsthesia. As the drum is incised blood stained serum or pus gushes out, accompanied sometimes by the escape of pent-up air. Some of the fluid should in every case be examined for organisms. The theoretical dangers attending the operation, damage to the internal ear or to an abnormally high jugular bulb, are so extremely rare in practice that they may be disregarded. It is frequently possible, under the same anæsthetic, to deal with the primary focus, as for example to puncture and wash out an infected maxillary antrum.

The advantages of an early myringotomy are, first, that pain is almost always relieved, and second, that the danger of mastoid infection is reduced. Although it is impossible to give accurate scientific proof of the latter statement, clinical

experience tends to bear out its truth. Certainly, in relieving the tension, the natural processes of repair are far more favourably placed for resolution.

After-treatment should consist in the application of heat, as described above, usually in the form of hot boric fomentations. There is no point in placing a wick of gauze in the meatus, this will merely tend to block what is in itself a natural drainage tube. Nor is there much point in prolonging indefinitely the hot fomentations. Usually three or four days will suffice. After that time it is best to begin gently syringing two or three times daily with warm boric lotion. It has been suggested that syringing might carry pus into the mastoid and spread infection there. This is due to a misconception of the physical conditions present. The whole cavity of the middle ear is potential only, being occupied by excessively swollen mucosa and pus, the exit to the inner side is closed, and the incision in the drum is valvular from herniation of the swollen mucosa outwards through it. Consequently it is impossible to force fluid or drops through into the middle ear. This is borne out by practical experience.

It is hardly necessary to point out that here, as elsewhere in the body, the application of antiseptics to the infected mucosa would not kill off the organisms in the deeper parts. So that even if antiseptic drops could be induced to enter the tympanum, resolution of infection is dependent on the natural defensive mechanism of the body.

The utmost we can do is to relieve tension by an early myringotomy, to keep the skin of the meatus in as clean a condition as possible by frequent syringing rather than by the blind insertion of drops, and to help the natural defensive mechanisms of the body. In this latter connection it is impossible to overestimate the value of the sulphanilamide group of drugs.

At the same time the primary focus in the nasopharynx is treated as far as possible, so as to reduce congestion of the Eustachian tube and allow some drainage from tympanum to pharynx. Frequently this will consist in giving inhalations of menthol in steam, or in an ephedrine spray, or benzedrine inhalant.

### **The Development of Mastoiditis.**

Careful watch must now be kept for signs of spread of infection in the mastoid air cells. Here, the general condition of the patient provides a most valuable indication.

The usual signs indicating a spreading infection in the mastoid are:—

1. Pain and tenderness persisting for two or three days in spite of myringotomy, especially if the tenderness first appears after the myringotomy.
2. Fever, over 100° F., and rapid pulse in an adult, especially if these tend to rise on successive days.
3. Copious pulsating discharge filling the meatus within a few minutes of mopping out, and therefore too copious to be secreted by the tympanum alone; the so-called reservoir sign.
4. (Edema of the postero-superior deep meatal wall. (Heine's sign). (Edema or subperiosteal abscess over the mastoid process or zygoma or below the tip.
5. Signs and symptoms of labyrinthine or intracranial complications.
6. Persistence of acute suppuration for more than six weeks in spite of efficient treatment.

In many cases exhibiting the signs of mastoid involvement, apart from external abscess formation or intracranial complications, careful treatment with complete rest for the patient will avert further operation. But if in spite of efficient treatment, the general condition of the patient is deteriorating, it is necessary to open the mastoid in order to drain the antrum and exenterate the air cells.

Specially to be deprecated is the very prevalent idea that because the ear is "running very freely" all is well. A profuse discharge merely indicates an extensive pyogenic area, that is the whole lining membrane of the mastoid antrum and cells is infected.

One particular type of infection calls for special care, viz, the so-called streptococcus mucosus or pneumococcus type III.

This is particularly apt to cause a latent type of mastoiditis, in which infection persists in the mastoid after the disease in the middle ear has apparently quite resolved. The onset is usually relatively painless and afebrile, and after a variable period up to three months from the onset, symptoms of mastoiditis or of intracranial complications develop. In known or suspected cases of this infection a series of skiagrams of the mastoid region is invaluable.

Persistent deafness after apparent resolution is a usual feature.

During resolution in the ordinary type of case the changes occur in reverse order to those described in the onset of infection. To hasten the process it is often advisable in children to remove infected tonsils and adenoids, or in adults to drain an infected nasal sinus.

The aim should be, in every case, to restore the tympanic membrane and the hearing to normal. And this will be accomplished, not by the random instillation of drops into the ear, but by the application of the ordinary surgical principles of cleanliness and free early drainage.