ACUTE OTITIS MEDIA IN INFANCY

BY

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Anatomy.—The tympanic membrane is the same size in the new-born as in the adult. It lies almost horizontal in the plane of the base of the skull, so that its lateral border is almost in the same plane as the superior wall of the meatus. Thus the postero-superior quadrant, the region in which bulging is usually detected, is very near the surface and next the inner limit of the superior wall of the meatus.

The meatus is cartilaginous, and runs upwards from its attachments to the tympanic ring, so that to straighten the meatus and enable a view of the tympanic membrane to be obtained, the lobule must be pulled downwards.

For examining the membrane and deep reaches of the meatus, the use of an electric otoscope¹, with a small speculum, is essential.

The mastoid process develops only towards the end of infancy. The aditus and antrum are present at birth. The latter lies above and somewhat behind the tympanic ring.

I have frequently operated upon infants of six months of age for mastoiditis, and found an extensively pneumatized mastoid process.

Classification.—Acute otitis media in infancy may be described under various headings:—

1. Otitis media neonatorum.
2. Agonal otitis of infancy.
3. Otitis media of infancy.

Of these groups the first two are latent or clinically obscure in type.

(1) Otitis media neonatorum.

This is not an uncommon disease of the new-born. I have operated on a mastoid abscess in an infant of 5 weeks of age, in which the ear disease must have been present for at least three weeks. Deaths in infants soon after birth from meningitis are commonly due to an acute otitis media that has escaped detection during life (cf. Dodds²).

In the new-born, the tympanum is filled with gelatinous material. This acts as a good culture medium for the bacteria introduced soon after respiration and deglutition occur, by a retrograde extension along the Eustachian tube. This latter first functions after birth. The ear may become infected during labour. The initial deglutition and aspiration inoculates the gelatinous material in the tympanum. The embryonic connective tissue in the middle ear cleft, usually disappears some time after birth, but may do so before birth. Not only bacteria, but liquor amnii, vernix caseosa, fluid, meconium or pus have been found in the tympanum of the new-born. The ear is situated at some depth from the surface, so that inflammation may proceed in it for some time without becoming manifest. Hence any low grade or sub-acute infection will certainly escape detection, in the absence of otorrhœa.

Otitis media may be present within the first hours of birth. The lesion may be suspected and detected solely by the fact that the infant has a very high temperature, the origin of which is obscure. In the routine examination for the cause, the tympanic membrane is examined. It is found to be bulging, though the infection may be slight, and most of the tympanic and meatal landmarks are plainly identifiable.

In an infant only 24 hours old, admitted under the care of Dr. Sidney Owen, with a temperature of 103°, the tympanic membrane was bulging, but pale, with some injection. Myringotomy revealed pus, and the temperature subsided. This was an example of pyrexia neonatorum.

Another common way for the otitis to become overt in the new-born is the detection of a blood-stained discharge from the meatus, followed later by pus. On the other hand, nothing may be noticed until a lump forms behind the ear, i.e., a mastoiditis has occurred. Any of the syndromes of otitis media as it occurs in infants may occur in the new-born.

In 800 consecutive post-mortem examinations on infants up to 28 days old, no case of ear disease was recorded (Cruickshank⁴), but the examination of the ear must have been omitted. According to Malherbe⁵, in infants, pus will frequently be found in the tympanum and antrum. The suggestion has been made that some prophylactic measures be instituted against the onset of these suppurative aural lesions in the new-born. Such a measure is the routine instillation of two to five drops of argyrol (1 per cent.) into the nose of the infant night and morning for a few days after birth, the head being dependent, so that the drops gravitate to the post-nasal region.

(2) Agonal otitis in infants.

Rizzi⁶ states that in all autopsies on infants up to two years of age one-quarter showed the presence of otitis media, and of these, two-thirds showed a bilateral otitis media. In most cases a mixed infection was found, and in only a few instances was a pure culture (pneumococcal) obtained. The ear lesion was frequently found in cases succumbing to acute pulmonary conditions. The otitis was latent, symptomless, and usually only detected

at autopsy. In some cases gastro-enteritis was present, but out of 200 cases on which these figures were based, in no instance was death ascribed as due to it. The tissues of the middle ear cleft undergo rapid post-mortem changes, with the result that the cavities become filled with purulent fluid (Alexander⁷). Hence the purulent collections in the middle ear found at autopsy, may be post-mortem in origin.

Changes in the tympanic membrane, as Maybaum⁹ has emphasized, are frequently observed in the terminal stages of many fatal diseases.

Otitis media, gastro-enteritis and respiratory disease.—This association is observed in children's hospitals usually by the physician, as the gastro-enteritis or the respiratory disease is the condition which brings the case under observation. These patients never appear before the otologist initially as ear cases, and there is room for close collaboration between the physician and the otologist, in the elucidation of the problems in connexion with these conditions, whose association is proved by autopsy records.

In 300 post-mortem examinations, in cases dying of malnutrition, Odenael⁹ found that 80 per cent. had pus in the mastoid antrum, and 50 per cent. had pus in the maxillary antrum. The mastoid condition was considered to be primary, and not secondary to the malnutrition. According to this author, if vitamin A is withheld from an animal's diet, pus is found in the nasal sinuses, and although there can be little doubt that the purulent aural lesion may be an agonal infection, it may in some cases be the cause of the gastro-enteritis. With the predominance of this latter disease, the ear condition may be overlooked, as it is usually latent, that is to say, the ear is not discharging, and the tympanic membrane is apparently but little different from normal on inspection; yet exploration of the tympanum or mastoid antrum may reveal purulent lesions.

The relation of the ear condition to the gastro-intestinal disturbance is one on which many diverse views are expressed. The acute suppurative aural condition may affect the gastro-intestinal track with bad effect on both the ear and the intestinal condition (Bottacin¹⁰), so that a fatal termination is frequent. On the other hand, it is stated by Matison¹¹, and Girard¹², that the ear is the primary condition. The gastro-enteritis may take a favourable turn after antral drainage has been established. In my opinion, myringotomy is not sufficient.

In 70 consecutive post-mortem examinations on infants dying of diarrhoea and vomiting, Alden and Lyman¹³ found that all had suppuration in the middle ear.

Otologist and paediatrist working together observed 39 cases of gastro-enteritis (Maybaum⁸). In the majority of cases, the ears were normal. Of these cases, 22 died, and in 16 the tympanic membrane was normal; in three cases the membrane showed marked changes with pus in the tympanum and antrum, in three other cases the membrane showed slight changes. No

bone necrosis was observed in any of the autopsy cases. Of the 17 cases that recovered, the normal membrane was found in five, minor changes in five, and marked changes in five. It was confirmed that the accumulation or infection in the mastoid is an ante-mortem process. The conclusion arrived at was that the intestinal toxæmia was not of otitic origin. (Maybaum⁸, Wishart¹⁴, Druss¹⁵).

The lesion found in these cases differs from the ordinary suppurative otitis by being completely devoid of all those signs usually associated with a suppurative lesion. The picture is a pale one. The lesion appears indolent. There are no inflammatory signs present, nor is there any inflammatory reaction in the surrounding parts. The condition simulates a cold abscess. There is no injection, no pain, and there is no swelling if we except a slight bulge in the membrane. Similarly there is no temperature or local heat, and no apparent loss of function: yet the lesion is suppurative.

The indolence of the lesion lends much support to the hypothesis that the whole condition is a terminal or agonal one occurring in a moribund patient, whose power of resistance is so enfeebled as to prevent any reaction occurring. The pus may result from purulent agonal or post-mortem decomposition (see agonal otitis). The patient is so debilitated that no inflammatory reaction occurs. Whether the ear lesion is post or propter hoc in relation to the intestinal condition, is still undecided.

The fact that pus has also been found in the nasal sinuses, is in support of the hypothesis that the disease is an agonal one. Moreover, in cases of frank mastoiditis or otitis, while occasional vomiting may occur, persistent vomiting does not occur, unless meningitis or some other intra-cranial complication is present. Diarrhoea never occurs even when a fatal issue results.

It seems, therefore, much against the hypothesis that the gastro-enteritis is secondary to the otitis or mastoiditis, that the aural conditions, when primary, should be conspicuously free from diarrhoea and recurrent vomiting, and also show all the criteria of inflammation, pain, pyrexia, swelling and injection, which are absent in the otitis associated with gastro-enteritis.

In view of these difficulties it seems to be a good rule in practice that in a case of gastro-enteritis in an infant, the ears should receive expert examination with a view to detecting an infective focus in the tympanum or antrum.

In a recent case of diarrhoea and vomiting in an infant the tympanic membrane could only be described as not normal. It was incised, and under local anæsthesia, the mastoid antrum rapidly opened. Pus was found therein. The gastro-intestinal symptoms rapidly abated, but recurred with drainage of the other antrum, convalescence was uninterrupted.

In the case of a weakly infant with diarrhoea and vomiting for nine days, under the care of Dr. D. Winnicott, the infant was noticed to be constantly putting his hand up to the right ear. The tympanic membrane was white, devoid of any signs of inflammation, but somewhat bulging. Myringotomy revealed pure pus. The tympanum and its inner wall were pale, and shewed no signs of inflammation, giving

the impression of pure pus having been poured into a normal tympanic cavity. The vomiting thereupon ceased and the child took the first feed for days. The symptoms then recurred and the other ear was incised. The case, however, terminated fatally. At autopsy the mastoid antrum on each side was full of pus. There was no bony involvement. Mere myringotomy will not drain the condition, as there is a narrow isthmus formed by the aditus which separates off the antrum. The latter must be drained by an antrotomy.

OTOSCOPIC APPEARANCES.—In these cases, these are very little removed from the normal. The expert cannot say more, as a rule, than that the membrane is not absolutely normal. There may be slight bulging in the postero-superior quadrant, or the entire drum may be bulging with the umbo forming a dimple in the centre. As the plane of the membrane is a continuation of the superior wall of the meatus, the superior bulge is very near the advancing edge of the speculum. It is far more superficial than is at first realized. The membrane shows no injection.

TREATMENT.—Prophylaxis should be enjoined in all cases of gastro-enteritis. Argyrol should be instilled into the nostrils daily as described above. In frank cases of gastro-enteritis, the ears should be closely inspected and if myringotomy reveals pus, the antrum drained. This may be done under a local anæsthetic, such as 1 per cent. novocain, and should not take long to perform, as the antrum is separated from the surface by a thin plate of cartilage. As the facial nerve is emerging from the stylo-mastoid foramen in infants, it lies very superficially just lateral to the postero-inferior angle of the tympanic membrane. It is thus in grave danger of injury if the incision behind the ear extends down too low or too far forward.

Some advise myringotomy alone, and Alden and Lyman¹³ have recorded cessation of symptoms following this procedure.

(3) Otitis media purulenta of infancy.

In frank otitis media, the presenting symptom is usually one of the following:—(a) Pyrexia of unknown origin; (b) obvious earache; (c) a sanguineous or purulent discharge from the ear; or (d) symptoms suggestive of meningitis (meningism), or convulsions.

(a) **Pyrexia of obscure origin.**—In the new-born, as during infancy, a high temperature may be the sign of an acute otitis media, hence in all cases of 'pyrexia of obscure origin' in the new born or during infancy, it is essential to examine the tympanic membranes thoroughly. With the onset of otorrhœa from rupture of the tympanic membrane or from myringotomy, the temperature falls to normal. The clinical fact must be borne in mind that a high temperature such as 103°, 104° or even 105°, may be produced by an otherwise symptomless acute otitis media.

The changes visible in the tympanic membrane may appear to be slight and out of proportion to the high temperature. The tympanic membrane may be obviously bulging, like a balloon tyre, the umbo being the indrawn central depression. The colour may be pale, or injected, but the normal

membranal landmarks, such as the handle of the malleus are easily visible and there is no injection present to speak of on the membrane, or on the meatal wall adjoining the membrane. Yet the onset of otorrhœa within 24 hours, with a fall of temperature, may settle the origin of the pyrexia.

In infants, it is possible for pus to be present in the tympanum, yet the tympanic membrane remain pale, free from injection, and not necessarily bulging. Hence it is that Alexander¹⁶ advised prompt myringotomy, in all cases of earache with a temperature above 100°, on the ground that such a temperature indicates a suppurative lesion. Often the temperature alone is the guide whether to withhold myringotomy or perform it. Alexander further advises, that if a child has earache, and it can be elicited that at any time subsequent to the onset of the earache, the temperature was over 100°, then myringotomy is indicated, even if the temperature is only 99° when the child first attends.

With this view I am completely in accord, and have practised it at the children's hospital for some time. When it is remembered that acute otitis media in infants is a very common ailment in London hospital practice, the value of this dictum is obvious. The temperature is, as mentioned, the chief guide as to active treatment. Even a bulging tympanic membrane is not necessarily an indication for myringotomy, in spite of the earache being severe.

I have seen an infant with severe earache, which had been present for 48 hours, and had interfered with sleep. The tympanic membrane was bulging considerably, but was pale, and free from vascular injection. There was mastoid tenderness. The temperature was 99°, and had never been above that level. In view of this, myringotomy was withheld, and the ear condition healed up without perforation.

(b) **Earache.**—In infancy, a child may have a frank otitis media, yet be free from any symptoms indicating the presence of earache. It is, however, easy to overlook earache, with the result that the cause of the child's obvious pain is only rendered too apparent by the subsequent detection of bleeding or discharge from the ear. Certain points suggest the presence of earache. The presence of meningism is one, with nuchal rigidity or convulsions. Pulling the ear, and putting the hand constantly to the ears, are often the only symptoms to suggest earache. Constant crying with the above pointers, indicates the presence of earache, whether intrinsic (of true aural origin) or extrinsic (referred) origin. Banging the ear, resisting the attendant's attempt to reach the ear, may indicate which ear is the seat of the trouble. At the same time, the infant may move or roll the head from side to side with a regular pendulum movement, crying and restless all the time, until it falls into a fretful slumber. Attempts to palpate the mastoid, result in the infant throwing the head back towards the tender ear, and even give rise to a rigid neck.

(c) **Otorrhœa.**—The usual sequence in cases of acute otitis media is for the parent to observe a blood-stained ear discharge which soon becomes purulent. This may be the first and only symptom of the otitis.

The tympanic membrane is very resistant to the penetration of pus through it, and purulent secretions may drain down the Eustachian tube into the pharynx. This may only occur, if the infection is a relatively mild one. If, however, it is severe, pus does penetrate the membrane or extend to the antrum. The latter is superficial in infancy, being separated from the surface by a thin plate of cartilage, or patent persisting petrosquamosal suture. Pus may thus easily extend outside the confines of the antrum through the thin plate of cartilage or the suture, and produce an inflammatory swelling behind the ear.

(d) **Meningism.**—This is a syndrome that is peculiarly apt to occur in infants in the initial stages of an acute otitis media. As its name implies the condition simulates meningitis. Earache may be manifest or apparently absent. The infant is feverish, and throws the head back, with the result that nuchal rigidity becomes evident. Vomiting may occur, and restlessness. The child may be ill and have convulsions.

On examination of the tympanic membrane, it is found to be inflamed and/or bulging. With the rupture of the membrane and the discharge of the pus, or as a result of a myringotomy, the cerebral symptoms rapidly abate, following the liberation of the pent-up inflammatory products in the tympanum.

The cerebral symptomatology suggests a meningitis, but in meningism, the child sleeps, there is still pulsation in the fontanelle, and both the temperature and the pulse are raised. The condition only occurs in the commencing stages of an acute otitis.

In an established case of meningitis, the temperature is raised but the pulse is not proportionately so. The child is sleepless, restless, delirious, and may exhibit facial twitchings or grinding of the teeth. There is no pulsation in the anterior fontanelle, which is hard and distended. Kernig's sign and nuchal rigidity may be demonstrated. Lumbar puncture will settle the diagnosis, and should be performed where these symptoms are present. In meningism, if a lumbar puncture is performed, the fluid is normal, but under increased tension.

Cerebral symptoms occurring in a case of acute otitis, of some standing (after the membrane has perforated), are never due to meningism, but always due to meningitis.

Meningism never occurs in a chronic otitis media. Any such symptoms are due to meningitis. Thus mastoidism and meningism have this in common, that both occur only in the initial stage of the acute otitis before the membrane has been perforated by the suppuration, all the symptoms subsiding with this onflow of pus. Any symptoms persisting after this stage are due to mastoiditis or meningitis respectively.

Physical signs.—The physical signs of an otitis, in addition to the anomalous tympanic membranal changes mentioned above, may be an injected inflamed membrane, the redness extending on to the meatal wall

around. The congestion may be such as to obliterate the landmarks and to make it impossible to delimit the margins of the membrane. If the Siegle's attachment to the speculum is used, and aspiration practised, the suction will cause the membrane to move and so define its limits.

In an otitis media, there is never any swelling behind the ear, nor is there any sagging of the posterior superior meatal wall. Both these latter signs, when present in association with acute otitis, indicate the presence of a mastoiditis. As mentioned above, there is no true mastoid developed till after the sixth month, but by mastoiditis, before this age, is meant the extension of suppuration outside the confines of the mastoid antrum.

It must not be forgotten that the tympanic membrane may be white, without any injection, yet pus is deep to it. If there is earache and a temperature above 100°, the lesion is suppurative, even if the tympanic membrane displays this apparent absence of active inflammation. The membrane is never absolutely normal. It may be moist, bulging in one quadrant or the entire part; and the light reflex is always absent, the surface having lost its characteristic normal sheen.

Tenderness may be present in the initial stages of the otitis. This is indicated by the obvious distress produced by palpating behind the mastoid process. If the tympanic membrane is bulging and unruptured, the tenderness must be assumed to be due to the otitis, uncomplicated. If, however, there is no bulging and the membrane is perforated, and the discharge is free, any tenderness means a mastoiditis. This early tenderness, which is always an initial tenderness, disappearing as the discharge appears, is termed by Alexander¹⁶, 'mastoidism.' The aditus, antrum and tympanum all form part and parcel of one cavity, and they may all be involved in the inflammation. Hence tenderness over the mastoid is only to be expected in the early stage of the disease.

Exfoliative otorrhœa.—There is a common fallacy to which attention must be drawn. The fact that the ear is stated to be discharging is no evidence that there is a purulent discharge, or that the membrane has perforated. Cleaning the meatus, by syringing and mopping with cotton wool wipes, will show that in a number of cases the tympanic membrane is still bulging, red and unperforated. What has happened is that the inflammatory products in the tympanum have produced an exfoliation or desquamation of the outer layer of the tympanic membrane, which is cast off into the meatus as a white debris, and appears as a discharge. Such a membrane requires myringotomy.

Cryptic otitis.—Where otitis media occurs in association with another disease, e.g., pneumonia, it not uncommonly happens that the ear inflammation is not revealed until a discharge from the meatus becomes overt. This cryptic otitis is frequent in attacks of the acute specific fevers. Hence in all instances of disease in which ear complications are prone to occur, should have the ears examined regularly.

Treatment.

Myringotomy is indicated in the presence of: (1) mastoidism; (2) meningism; (3) pyrexia above 100° , with earache; (4) a bulging membrane, in the presence of active inflammation of the tympanic membrane, or in the absence of the latter, in the presence of a high temperature.

During the painful period, glycerine and carbolic drops are to be advised, to be replaced as soon as the pain has subsided, by spirit drops. The ear should be regularly syringed with boric lotion, to keep it free of discharge. The infant should wear a cap over both ears, to keep them at an even temperature. Anodynes are to be given by mouth for the relief of pain and to ensure a good sleep. The case should be observed from day to day. Any severe and obvious naso-pharyngeal condition may require attention, e.g., tonsils and adenoids, if the ear condition tends to show no signs of resolution by the end of, say, six weeks. The usual rule is 'two to three days of pain, followed by two to three weeks of discharge.'

In those illnesses in which ear complications are known to occur with frequency, prophylactic measures are to be employed as already described.

Conclusions.

In dealing with the subject of acute otitis media in infancy in the preceding pages certain conclusions have been reached which are of sufficient practical importance to warrant their being summarized here for the sake of emphasis.

1. In an infant the tympanic membrane may remain of apparently normal colour, and yet have pus deep to it.

2. A temperature of over 100° , with an unruptured tympanic membrane, during an attack of acute otitis media, even though such a figure has been reached only once during the illness, indicates the presence of a suppurative lesion, demanding myringotomy without delay. Even if the patient is not seen until a late stage of the attack when only a mild degree of fever (99°) is present, the same conclusions should be drawn if there is a clear history of an earlier temperature of over 100° .

3. The presence of high fever in an infant, even in the newly born, should lead to a suspicion of acute otitis media calling for a careful examination of the ears.

4. In cases of infantile gastro-enteritis the ears should be kept under the observation of the otologist. If myringotomy reveals pus, the antrum should be drained,

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