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The Pathology of Secretory Otitis Media

The study of the histopathology of secretory otitis media has been greatly hampered by the difficulty in obtaining suitable specimens for histopathological investigations. There is, therefore, a good deal of confusion and uncertainty about the ætiology and pathogenesis as well as about the terminology and definition of the disease. Usually, the term is used to draw attention to the presence of a sterile fluid in the tympanic cavity.

It is interesting to note that when the pathology is discussed in the relevant literature it refers to the cytological, bacteriological and possibly biochemical aspects of the fluid aspirated from the tympanic cavity. Not infrequently only the macroscopical appearances and consistency of the fluid are considered under the heading of 'pathology'. On this basis Hoople (1950), Suehs (1952) and Singleton (1956) distinguish two types: the serous or watery or clear type, and the mucoid or gelatinous and turbid type. Others like Senturia (1963) have cast their net more widely and include cases with a certain amount of suppuration.

The serous fluid is probably a transudate; the mucoid fluid has been described as an exudate although it is more likely to be secretory in origin. Serous otitis is a non-inflammatory condition, due to somewhat violent pressure changes in the tympanic cavity, e.g. barotrauma, and offers almost unsurmountable difficulties to systematic histopathological studies.

There seems to be some agreement among recent authors (Stevens 1962) that whilst there are various causes of secretory otitis media, the most important is otitis media in infants and children. Attention should, therefore, be directed not simply at the adenoids and nose, but first of all at the middle ear. This paper will try to elucidate the possible origin of the mucoid component of the fluid present in the middle ear spaces on the basis of microscopical observations on the inflamed middle ear, with particular reference to the occurrence of secretory epithelium in the middle ear cleft.

The Transformation of the Middle Ear Mucosa

The normal mucosa of the middle ear, both in the human and the animal, consists of thin layers of fibrous tissue covered by flattened endothelium-like cells. Under healthy conditions columnar epithelium is limited to the neighbourhood of the tympanic orifice of the eustachian tube. The tube itself is lined by columnar epithelium (Fig 4) containing large numbers of goblet cells which give a brilliant periodic-acid-Schiff (PAS) reaction.

Friedmann (1955) has shown that following infection with low virulent *Streptococcus pyogenes* or with the more virulent *Ps. pyocyanea*, the mucosa of the bulla of the guinea-pig may undergo considerable transformation: the surface of the inflamed mucosa becomes covered by tall ciliated columnar cells and goblet cells (Fig 1).

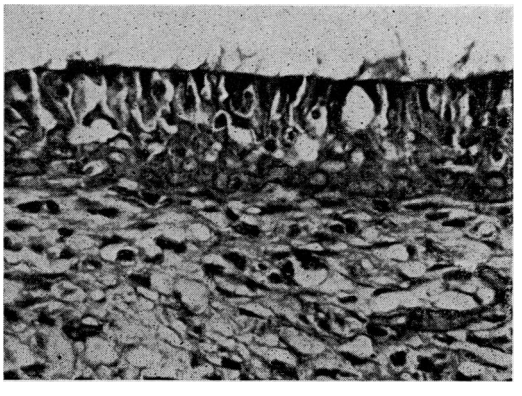

Fig 1 *Infected bulla of the guinea-pig lined by ciliated columnar epithelium.* × *350*

Fig 2A *Cluster of gland-like structures in granulation tissue: chronic mastoiditis.* × *44*

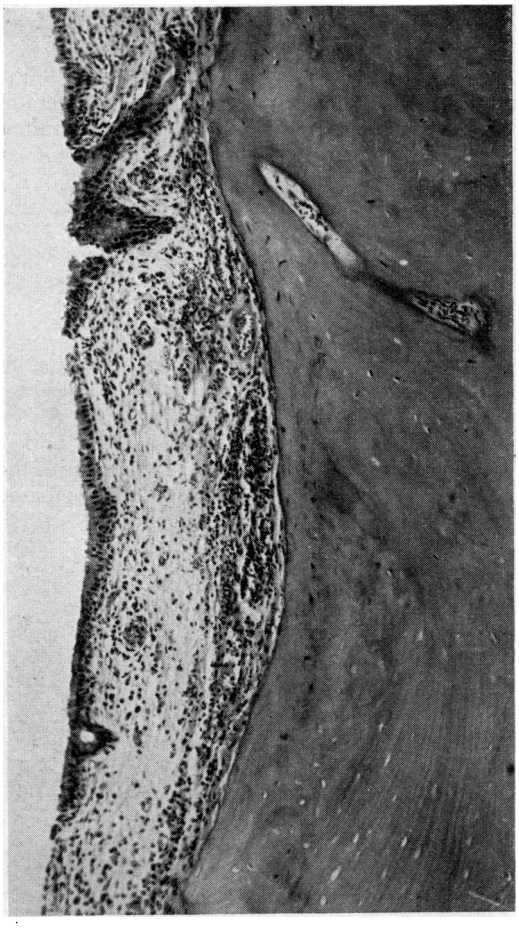

Fig 2B *Malleus covered by inflamed mucosa lined by columnar ciliated epithelium.* × *100*

Fig 2C *Granulation tissue covering malleus. Note surface lined by ciliated columnar epithelium.* × *95*

There are also often gland-like structures, filled with thin or inspissated mucus, present in the stroma or in the granulation tissue: they occur singly or forming clusters of gland-like structures filled with homogeneous mucoid secretion (Fig 2A) which gives a positive PAS reaction (Friedmann 1956).

The incidence of gland-like structures or columnar epithelium was nearly 30% in 1,490 specimens of bone chips and ossicles (Fig 2B, C) removed at operation on the mastoid process and examined microscopically in this department between 1953 and 1959.

The transformation of the middle ear mucosa may be fairly rapid and develop within fourteen days after experimental infection of the guinea-pig (Fig 1). Fig 3 shows the tympanic membrane of a boy of 3½ years who died within twenty-four hours of the onset of acute epiglottitis. Sections of his temporal bones revealed some pus in the tympanic cavity which was lined, up to the posterior surface of the tympanic membrane, by fibrous tissue covered with ciliated columnar epithelium. Whether or not this epithelium had been present before the infection, the finding has demonstrated the occurrence of columnar ciliated epithelium on the tympanic membrane.

Fig 4 shows the temporal bone of an infant of 4 days who died of erythroblastosis fœtalis. The inflamed middle ear cavity contained some pus and columnar ciliated epithelium extending,

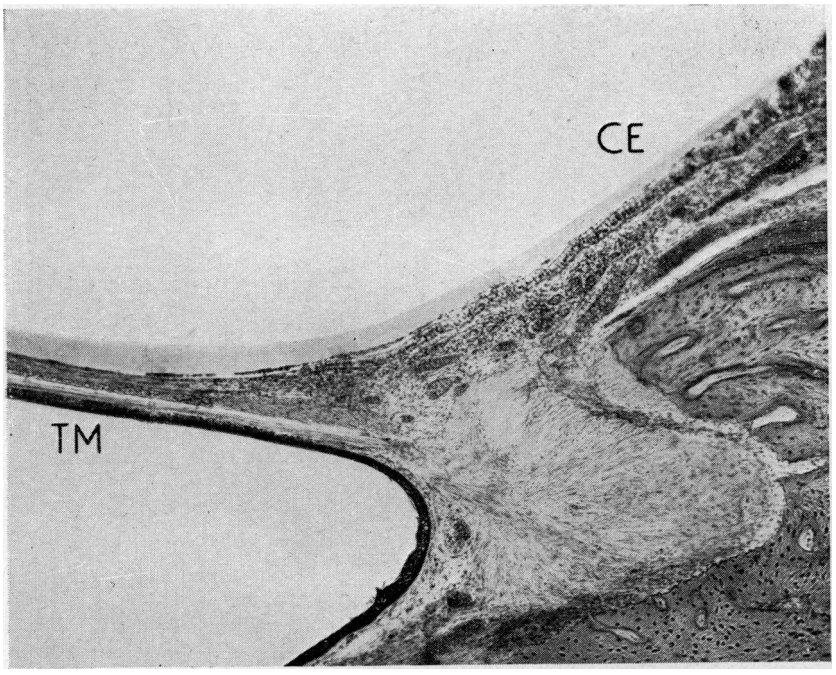

Fig 3 *Incidental finding: ciliated columnar epithelium (CE) in tympanic cavity extending towards tympanic membrane (TM).* × *48*

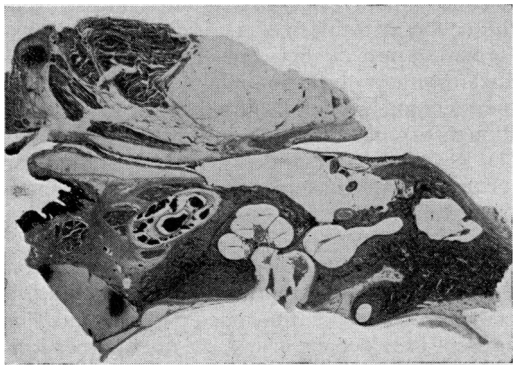

Fig 4 *Section of temporal bone of infant showing entire length of eustachian tube. The infected tympanic cavity is lined by columnar epithelium probably extending from the tube (See* Fig 5). × *1·6*

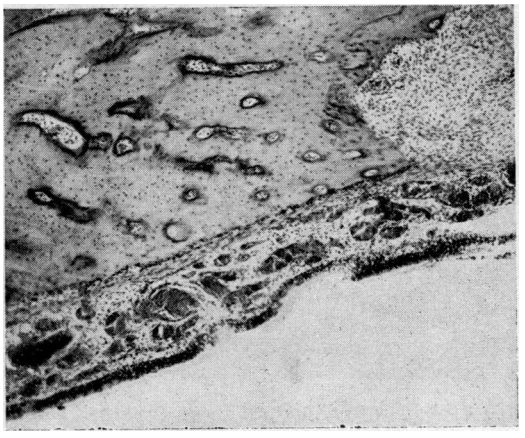

Fig 5 *Detail of* Fig 4 *showing wall of the tympanic cavity lined by columnar epithelium.* × *40*

apparently from the eustachian tube, over a wide surface of the tympanic cavity (Fig 5).

Mastoid Cells – Mucosal Changes

The temporal bones removed at the post-mortem of patients who died of cancer of the upper air and food passages have been sectioned as a routine. Ciliated columnar epithelium was found in occasional mastoid cells in 2–3% of the 214 temporal bones examined in serial sections (Fig 6). In this connexion the following case history, covering many years is of interest:

Case History

Extensive Secretory Transformation of the Mucosa of the Mastoid Air Cell System

(Surgeon: Mr W McKenzie)

A woman of 57 had a polyp removed from the right ear thirty years ago; some intermittent discharge for the last eight years; right ear seldom dry.

1.3.60: Discharge from right ear, yellowish, smelling. Deafness right ear.

On examination: Large polypus filling external auditory meatus. Drum retracted.

2.3.60: Exploration of right mastoid revealed a large antrum 'filled with mucoid fluid'. The middle ear was lined by an intact 'good mucosa' which appeared to be

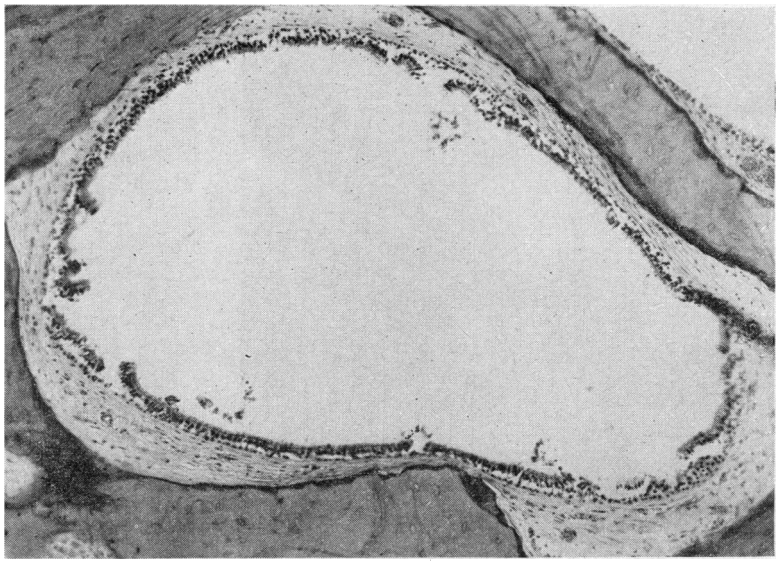

Fig 6 *Mastoid cell lined by ciliated columnar epithelium.* × *95*

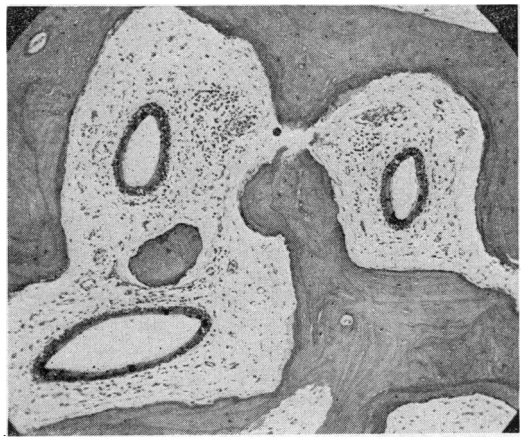

Fig 7 *Confluent mastoid cells with thickened fibrotic mucosa lined by secretory epithelium.* × *54*

œdematous. When last seen on 17.6.62 right cavity 'dry and healthy'.

Histopathology: Bone chips removed at operation were embedded and sectioned. Microscopical examination of the sections showed a cellular mastoid bone. The air cells were lined by thickened fibrotic mucosa covered by tall columnar epithelium (Fig 7). Higher magnification of a cell (Fig 8) shows the lining to consist of ciliated columnar epithelium in which there were large numbers of goblet cells giving a strong positive PAS reaction.

This case shows unusually widespread mucoid transformation of the mucosa of the middle ear cleft, and the microscopical findings help to explain the 'good condition' of the mucosa at operation.

Discussion

The epithelium of the mucosa of the middle ear not uncommonly undergoes certain changes during the course of otitis media, resulting in a transformation into or replacement by columnar ciliated respiratory type epithelium. The origin of the 'new' columnar epithelial lining remains obscure, though two possible explanations are suggested: (1) Reversal to respiratory type or 'columnar metaplasia'. (2) Extension of columnar epithelium from the tympanic orifice of the eustachian tube.

The histopathological findings presented point to the altered mucosa of the middle ear spaces as a principal source of the mucoid secretion. This concept provides the answer to several questions concerning the pathogenesis of secretory otitis media posed by Suehs (1952):

'Why do some cases become chronic with little or no evidence of pathology in the nose, sinuses, nasopharynx or eustachian orifice?
'Why do some continue to have fluid in the tympanum in the presence of an apparently open eustachian tube?
'Why do some individuals with an obstructed eustachian tube and retracted drum develop an accumulation of fluid in the middle ear while others do not?'

Secretory otitis media becomes chronic owing to the more or less profound mucosal changes which, once established, will produce the secretory material accumulating in the tympanic cavity in the presence of either a blocked or patent eustachian tube. The transformed mucosa probably behaves like the mucosa of the nose and sinuses: the ætiological factors causing nasal

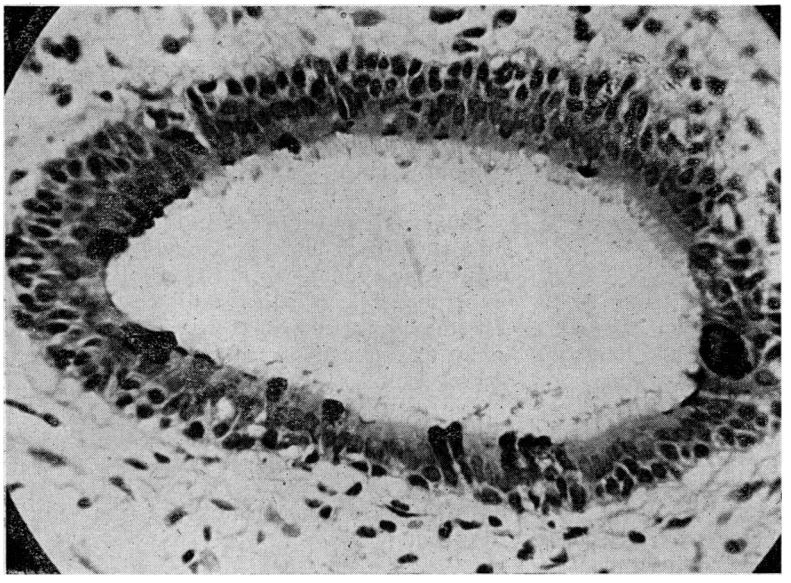

Fig 8 *Lining of mastoid cell at higher magnification showing ciliated columnar epithelium with numerous goblet cells.* ×330

discharge might, therefore, bring about a similar response in the altered mucosa of the middle ear cleft with all its consequences.

There are of course other contributory causes. Chronic otitis media may be incriminated. Moreover, cases of acute suppuratory otitis media, inadequately treated, have been adding to the increasing numbers of 'secretory (mucoid) otitis media'. The role of the secretory epithelium of the eustachian tube must not be underestimated.

Further investigations are required and our own investigations are going to be intensified to answer some of the remaining problems. It seems reasonable to conclude at this stage that the mucosal changes here described form an essential and important histopathological factor in the pathogenesis of mucoid secretory otitis media.

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Secretory Otitis as a Cause of Conduction Deafness in Children

My interest in secretory otitis as a cause of conduction deafness in children dates from a chance finding just two years ago. At that time, secretory otitis was regarded as a condition occurring not very frequently in adults, with a characteristic history and a characteristic appearance of the drum, and often affecting one ear only. Myringotomy and inflation would produce clear yellow fluid with immediate improvement in the hearing, but this treatment often had to be repeated. At the same time, deafness in children, due to eustachian tube dysfunction, was recognized as a common indication for removal of tonsils and adenoids. In some 10% of cases, the deafness was not completely cured by this operation, and these were treated at first by the application of radium to the nasopharynx, and later by careful dissection of adenoids, especially in the lateral recesses of the post-nasal space.

Early in 1961, impacted wax was being removed from the ear canal of a child, under general anæsthesia preparatory to removal of tonsils and adenoids for deafness, and the drum, seen through the operating microscope, appeared opaque and full at the back though with no evidence of