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Chronic otitis media: histopathological changes
A post mortem study on temporal bones

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Abstract. – **The temporal bones of 4 deceased individuals, with concomitant chronic otitis media are studied. The various histopathological changes in the middle ear cleft are examined: suppuration, polyps, granulation tissue. The possibilities of spontaneous healing of a perforated TM and the indications of surgical treatment are discussed.**

Key Words:

Temporal bone, Middle ear, Infection, Chronic inflammation, Metaplasia, Complications.

Introduction

Otitis media (OM) is an infection localized in the middle ear: mastoid, middle ear cavity, eustachian tube. The classification of OM includes:

- OM with effusion[1-3], without perforation of the tympanic membrane (TM)[4-6], due to an increase of fluid in the middle ear cavity, mainly for eustachian tube disfunction .
- OM without effusion, which is the simple inflammation of the TM, that can evolve towards an infection[7,8].

The two conditions may be predisposing agents to a perforation of the TM.

This is a modification of normal anatomy, that let the infectious agents enter into the middle ear cavity. The patient has recurrent or chronic inflammation and infection of the middle ear epithelium and surgical therapy is mandatory.

Materials and Methods

We have studied the histopathological changes in temporal bones of 4 deceased individuals, with concomitant chronic OM.

These patients were donors and agreed during their life to donate *post mortem* their temporal bones to the House Ear Institute as a contribution to a better knowledge of temporal bone diseases.

We have removed the temporal bones in our usual way[9].

Results

Clinical features

The inflammation, while often indolent, may at times give rise to serious complications and even cause death. The hearing loss that is a constant concomitant also contributes to the immense socio-economic problem. Chronic OM sometimes, but not always, follows an attack of the acute disease. The major feature is discharge from the middle ear. Sometimes polyps may occlude the external auditory meatus. The TM is usually perforated in the *pars tensa*.

Gross appearances

There has been little study of the gross appearances of chronic OM, except at surgery when the examination of the middle ear cleft is limited to the operative field. With the use of the microslicing method a more complete gross examination of the whole middle ear may be carried out *post-mortem*. An important feature of chronic OM is the variation in the degree and extent of the inflammation. The tubotympanic region is the most fre-

quently involved and mastoid air cells may also be affected. Mucopurulent material often fills the middle ear space in the tubotympanic region and may also be seen within mastoid air cells. In the inflamed regions the mucosa is thickened and congestion may be severe. Granulation tissue formation may be extensive, showing as red thickened areas particularly on the promontory, in the epitympanum, in the round and oval window niches and in the mastoid. The granulation tissue on the promontory mucosa may be of sufficient thickness to protrude through the perforation in the TM. Such a lesion is the common aural polyp presenting clinically in the ear canal.

A variable degree of loss of ossicular bone may be observed. The most frequently affected ossicle is the incus, particularly in the region of its long process, but dissolution of other ossicles may also occur. In *post-mortem* temporal bones with chronic OM, large surgically produced cavities are sometimes present in the mastoid region. These are the results of operations to remove infected parts of the mastoid to drain the middle ear cleft, and they may or may not be accompanied by evidence of other surgical procedures involving the ossicles, depending on the severity of the "clearance" of the middle ear undertaken by the surgeon. Yellow localized areas seen anywhere in the middle ear cleft are regions of cholesterol granuloma and pearly white patches particularly in the attic are likely to be cholesteatomas, which are frequently present in association with chronic OM.

Microscopic appearances

The most characteristic feature of the pathology of chronic OM is the presence of inflammatory granulation tissue (Figure 1). This cellular reaction has two components. On one hand there is the presence of leucocytes characteristic of chronic inflammation, i.e. lymphocytes, plasma cells and histiocytes. On the other hand there is granulation tissue, constituted by newly formed capillaries and by fibroblasts (Figure 2). Granulation tissue formation takes place in the early stages of healing after the inflammatory destruction of tissue. Chronic inflammatory leucocytes and granulation tissue may be found in the middle ear in chronic OM independently of each other. The two forms of cellular reaction are seen together in aural polyps (Figure 3). This lesion is frequently subjected to biopsy in the investigation of cases of chronic OM. The polyp is usually covered by columnar epithelium, which is often ciliated. Sometimes the epithelium is squamous. This may be produced by metaplasia in the middle ear or by irritation of the polyp when it reaches the ear canal. The core of the polyp is made up of chronic inflammatory granulation tissue. Groups of keratin squames accompanied by foreign body type giant cells may be prominent in aural polyps, particularly in the presence of a cholesteatoma of the middle ear. The middle ear cleft is normally lined by a single layer of cubical or columnar epithelium, which may bear cilia. Tos and Bak-Pedersen[10,11] studied the normal and pathological middle ear epithelia by a whole mount

Figure 1. Perforation of the tympanic membrane. Near the malleus handle the squamous epithelium has migrated around the edge of the tympanic membrane (*arrow*). ×35

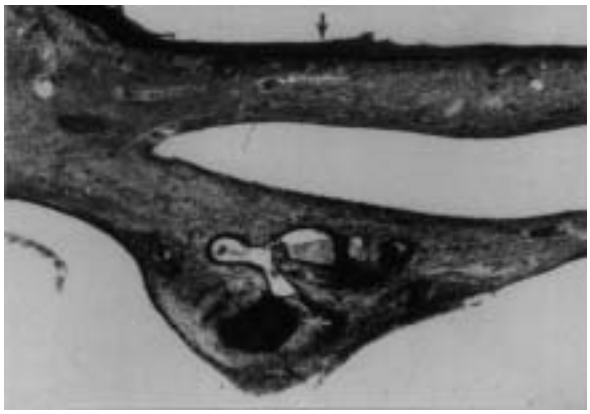

Figure 2. Granulation tissue (*white arrow*) forming in fibrous tissue in the middle ear. Black arrow indicates the tympanic membrane epithelium. ×120

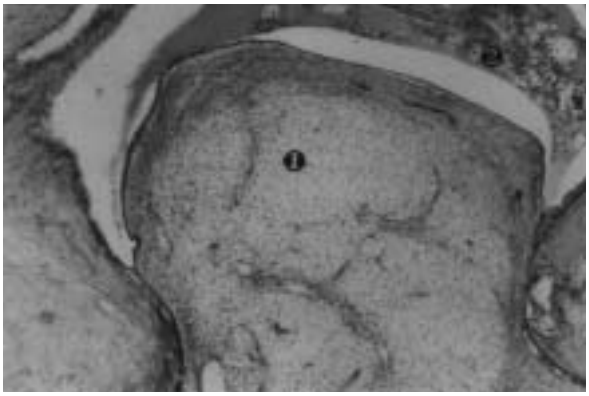

Figure 3. Polyp (1) projecting into middle ear space containing fluid and pus cells (2). ×115

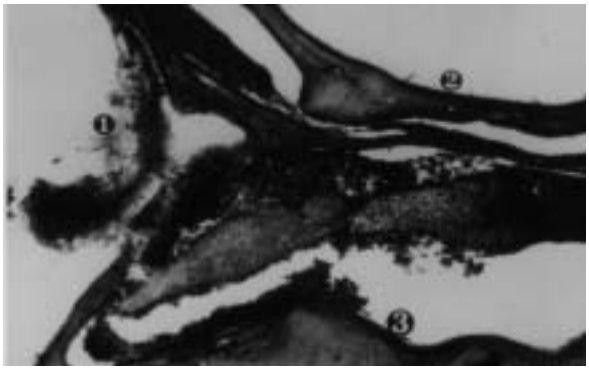

Figure 4. Chronic otitis media with suppuration. Pus (1) fills the middle ear space between the tympanic membrane (2) and the promotory (3). ×120

method, in which the entire mucosa was removed and stained with PAS-Alcian blue. By this method goblet cells appear as oval to round, sharply demarcated blue structures on a pale background. Few goblet cells were found in the normal middle ear, but in chronic otitis the numbers were greatly increased to a level similar to those in other parts of the respiratory tract. Unlike other parts of the respiratory tract, including the cartilaginous portion of the eustachian tube, where tubuloalveolar glands containing mucous and serous elements are present, the middle ear is normally devoid of glands. Under conditions of chronic inflammation, however, the middle ear epithelium comes to resemble the rest of the respiratory tract by the formation of glands. They consist usually of a simple tubule of mucus-producing cells. Gland formation is particularly active in children with secretory OM[12]. Glandular transformation may take place in the mastoid air cells as well as the main middle ear cavity. The secretion derived from the glands is an important component of the aural discharge in chronic OM (Figure 4). The mastoid air cells show fibrosis and their bony walls are markedly thickened. Cement lines in the lamellar bone are numerous and irregular, often forming a mosaic pattern. This indicates the recent active deposition and resorption of bone as a result of the inflammatory process. The product of these preparative processes in the mastoid is a patchy sclerosis with some cystic cavities representing distended air cells. The obliteration of mastoid air cells as a result of chronic otitis is referred to as secondary sclerosis. In some ears the mastoid air cells lack pneumatization from an early age. This has been ascribed to inflammatory change, but such an interpretation has been doubted by others who have regarded the sclerosis as primary, perhaps due to genetic factors[13]. The appearance of the mastoid in primary arrest of pneumatization is said to be unlike that following OM, in that in the former the mastoid air cell system is small and the bone is diffusely sclerotic.

Discussion

The chronic modifications of the middle ear cleft, visible in our histological slides, show the presence of inflammatory granulation tissue (Figure 2) with newly formed capillaries and fibroblasts, sometime with active suppuration (Figure 4) sometimes with polyps (Figure 3), but always with variable degree of metaplasia in the middle ear. In our opinion, the perforation of the TM must be closed as soon as possible. In traumatic perforations, the earlier the closure, the better the possibilities of success. The delay in operation leads to penetration of antigens and bacteria, that provoke infection and modifications of the middle ear cleft, with mastoid involvement. The *wait and see* policy is justified in perforation of TM smaller then 2 mm diameter, not in bigger perforations. As visible in Figure 1, in a big perforation, the squamous epitelium migrates around the edge of the TM[14]. The fibroblast try to spontaneously close the perforation, but in big perforations can not do anything but migrate around the edge of the TM, thus forming a

concentric fibrous layer that impede the normal healing of the TM. Further more, the penetration of epitelium in the middle ear cleft is a great favoring conditions for the developing of a cholesteatomatous OM, with possible severe complications, like labirinthitis, sensorineural hearing loss, facial nerve palsy, meningitis.

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