

constantly present in man than any other virus. It produces lesions most often in mucocutaneous regions and in many cases these are bilateral; in persons liable to repeated attacks the eruption tends to appear in the same area of skin or mucous membrane. The lesions are superficial and usually heal without scarring in a week or ten days. Sixty per cent of the population are infected with the virus and remain carriers through life, while primary infection usually occurs in early childhood. Histologically a vesicle in the skin shows great thickening in the epidermal layer; the affected cells show ballooning and reticular degeneration; multinucleated cells arise from the amitotic nuclear division in epithelial cells. A serous exudate separates the damaged cells, forming the vesicle beneath the stratum corneum which contains fibrin and leucocytes. The dermis shows vascular engorgement and leucocyte infiltration. In a mucosal lesion the mucous membrane over a vesicle tends to be shed and fine granular tissue is formed, the structure of which is a delicate fibrous stroma with collections of polymorphs and lymphocytes in varying proportions. When recovery occurs, the mucosa reforms, cutting off the granuloma and releasing debris consisting of fibrin and white and red blood corpuscles. In the middle ear it is the hæmosiderin so released that gives the clinical picture of the 'blue' drum, described by so many authors. The nuclei of the white cells degenerate with the release of cholesterol, which crystallizes out and behaves as a foreign body, initiating the giant cell response which gives rise to the formation of cholesterol granulomata.

If the condition is mild and resolution is early, the cholesterol crystals are walled off by fibrocellular scar tissue and little harm is done; on the other hand, repeated deposits of cholesterol will lead to massive adhesions forming and the development of adhesive otitis media (MacNaughtan 1956).

Clinical Features

The patient usually presents with deafness and a history of recurring, mild attacks of otitis media, with or without discharge, often associated with upper respiratory infections. The condition may be bilateral or unilateral; usually the deafness is progressive. The drum membrane is typically intact but may be a little dull or may show any gradation of blue up to an inky black. In the acute phase there may be a serosanguineous discharge, with a plum-coloured tympanic membrane showing superficial desquamation or, earlier still, a bullous myringitis. The eustachian tube may or may not be patent but inflation of an obstructed tube rarely brings improvement. In some cases there is evidence of instability of the squamous

epithelium of the drum head, with keratosis obturans or actual invasive cholesteatoma. X-ray of the mastoids is helpful, as there will be clouding of the air cells. Culture of the middle ear exudate will be sterile and the fluid cannot be dispersed by suction and inflation. In the final event the diagnosis will be made by exploration of the mastoid.

Treatment

The purpose of treatment is first to remove any invasive cholesteatoma, if this is encountered, then to clear all cells that are involved in the granulomatous process. The middle ear also has to be inspected, using the microscope after reflection forward of the drum head; we find that an endaural approach is convenient and normally dissect out the cells using the dental drill and binocular microscope. Any gross sepsis in the nose and nasopharynx is dealt with at another time. It may be impossible to prevent further attacks of myringitis or otitis media but at least the drainage of the middle ear may be improved by this method and fewer adhesions formed.

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The Treatment of Cholesteatoma in Children

In this paper I shall discuss only intratympanic cholesteatomata in the child whose meatal skin is not constitutionally abnormal.

The term cholesteatoma is traditional and sonorous but I prefer the term intratympanic epidermoid because I believe the condition is essentially a skin-lined cyst within the tympanum.

The cholesterol granuloma is often not present at all and when present is usually the result of the escape of keratin through a breach in the wall of the cyst, just as a cholesterol granuloma is produced by the rupture of a so-called sebaceous cyst beneath the skin.

The treatment of intratympanic epidermoids in the child by modifications of a radical mastoid operation nearly always leads to a wet ear; while it is not difficult to get a dry safe ear in the adult by conventional surgery, those same procedures in the child fail because any island of mucosa – even a few cells – which may escape removal from the mastoid cavity, will proliferate and secrete mucus. Mucus not only inhibits the growth of squamous skin but encourages the growth of mucous membrane which soon lines the whole cavity; I find it impossible to remove every bit of mucosa from a mastoid cavity.

The moisture in the radical mastoid cavity of a child is not the result of suppuration – it is mucus. Saprophytic infection may lead to granulations and exudate, but mucus is still the main constituent of the discharge; were there none the ear would become dry.

In the adult one can leave the adherent part of the epidermal sac to line the radical cavity, with good results – this seldom succeeds in the child. A Thiersch graft will often succeed in the adult but never in the child – nor will a whole skin graft – they float off on the mucus. The reason for this difference is that in a child the condition is in an early stage of development so that much of the mastoid air cell system has not been invaded by the epidermoid and is still lined by mucous membrane.

In my experience the majority of intratympanic epidermoids begin above the chorda tympani, either by an indrawing of some part of the membrana flaccida or as implantation dermoids deep to its surface in the manner described by Professor Rüedi. Others begin below the chorda by a drawing inwards and upwards of a weakened posterior superior quadrant of the membrana tensa. A character common to all is that they affect the hearing only a little in the early stages and are not associated with pain or discharge, so they may have done a lot of damage before they are discovered.

They are being discovered much earlier these days because of the more careful routine testing of children's hearing by schools and so one must face this challenge to correct the fault straight away. We should not have to wait till some set procedure suitable for grossly damaged ears can be used nor until there is so little hearing left that it cannot be made worse.

If there is a collection of keratin in a pocket in a child's middle ear it will get larger. We may

clean it out repeatedly but in the intervals the pocket is being enlarged by more keratin and the ossicular chain damaged. At any time the pocket may become impacted in the aditus and away it goes into the mastoid out of our reach.

The condition we have to treat is basically skin in the wrong place. Surely if we remove the skin the mucous membrane should soon take its place and the progress of the disease be stopped. Some of my experiments in closed fenestration had shown that mucous membrane grew readily over any denuded bone and that the meatal skin which was not supported by bone did not as a rule fall in but that its inner surface was soon lined by mucosa. So it seemed that if an epidermoid sac were to be dissected free from its bed and everted through its own neck it might shrink till it became just part of the membrane; meanwhile its raw surface and the bed from which it had been raised would be lined by mucosa. This we did to a number of epidermoids arising above the chorda tympani – to do it was not as difficult as expected but in most cases it was steadily drawn back to form a sac again in the original position. It did this in spite of inflation of the middle ear. Sometimes it would be delayed for months by frequent inflation, but it was not prevented. This suggested that the negative pressure in the middle ear was something to be taken seriously and that the sac must be removed completely. These same cases were reopened, mucous membrane had grown over the naked bone areas and the sacs were very easily freed again. This time they were cut off – so leaving a hole in the membrane.

Surprisingly, in most cases the holes healed quickly; thereafter the entire membrana flaccida and the meatal skin not supported by bone slowly stretched and sank inwards to come in contact with the ossicles and even to envelop them and make contact with the inner wall; the final result looked like a dry, well-epithelialized epitympano-mastoid cavity; but one thing became very clear – if there were any sharp ridges, such as an overhanging margin of the bony cavity, squames would begin to collect on the far side of the ridge because, as we have found, migration of squames cannot proceed over a crest. So such ridges must be removed or the skin must be supported by applying a piece of fascia as a free graft to its deep surface – even if the fascia is drawn in, it serves to soften the contours of the cavity so giving a smoother bed for the skin.

Some holes did not heal: the skin did not fall in and, providing there was a way from the epitympanum to the tympanum, there was no discharge: the whole cavity became lined with healthy mucosa; in fact the ear became normal except for the presence of a dry attic hole and varying degrees of ossicular damage.

We believe that the hole prevents any pressure difference between the meatus and the tympanum so that there is no force available to stretch the skin inwards. Moreover, we found that those cases which had originated as implantation dermoids deep to the membrana flaccida and so not necessarily associated with a low intra-tympanic pressure did not show the same tendency to indrawing of the skin – some of such cases were restored to complete normality.

Sometimes there was continued discharge from the perforation or the middle ear collected turbid or brown-coloured fluid; exploration always revealed some island of squamous skin which had escaped removal – it was usually easily removed for it had become thicker and less firmly attached to bone; its removal always stopped the abnormal secretion.

Further action may be necessary to make good any defect in the ossicular chain but one should wait until the ear has become stable and all risk of recurrence has passed, a minimum of about a year; it is better still to wait until the child has become adult. I prefer if possible to do it by placing a chip of bone between the remnant of the stapes and the membrana – gluing it there with blood clot: but there can be no set procedure.

This treatment of epidermoids beginning above the chorda tympani, i.e. by removal of the sac, seems promising – the results are either (1) a dry, well-epithelialized epitympano-mastoid-like cavity or (2) a dry perforation in the membrana flaccida or (3) a normal ear.

Those beginning below the chorda as the result of a falling in of the membrana tensa are a much more difficult problem. In the very early case the incus may still be intact so there seems an obvious course to take, i.e. to remove the sac together with the collapsed atrophic portion of the membrane and replace it with a fascial graft. However, we have found that the graft usually falls in and adheres over a larger area and the hearing is usually poor. To remove the sac and leave a hole in the atrophic portion of the membrana tensa seems to give the best result; although the ear tends to discharge mucus whenever there is a respiratory infection, usually no harm comes of it – the hearing remains good and the sac does not form again.

However, it is not often that one sees the very early case – as a rule the long process of the incus and the greater part of the stapes crura have disappeared and the posterior superior quadrant of the membrane is adherent to the promontory and oval window; however, the hearing remains good as a result of the baffle effect.

To remove the sac leaves a hole into the epitympanum between the chorda tympani and the facial ridge. The epitympanum and mastoid

cavity become lined with mucosa but secretions from them cannot reach the tympanum because the membrane, adherent to the oval window region, acts as a chute carrying the secretions into the meatus. The ear tends to be wet but the hearing remains reasonably good. The gap between the chorda tympani and the facial ridge can be closed off by a sheet of fascia applied from inside; this may result in the membrana flaccida and the unsupported meatal skin being drawn in but the hearing remains good. Although this may achieve a dry, stable and useful ear it is far from the ideal but it is the best we have achieved so far.

There is, of course, nothing new in the basic idea of removing the epidermoid and nothing else; the antauricular extrameatal approach to the tympanum and the binocular microscope have made it easier to achieve. Certainly the results make the effort worth while and I would urge that it be done. The condition is just skin in the wrong place. It is skin that does the damage not infection and its removal is a matter of some urgency.

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Thirty-five Years of Struggle

The struggle to cope intelligently and successfully with the chronic ear is passing quickly from my generation to the next. Each generation outstrips the one before and the present-day crusade to clarify the issue is bound in part to succeed. A final solution is still out of sight.

There is no doubt that in the late 1920s the chronic ear was more common than it is today. Otolologists were 'alerted men' in the same sense that a sentry in wartime is alerted. Dangerous and often life-threatening complications were comparatively common, and for these we were always on the look-out. The phrase 'safety first' seemed to be the watchword; too often hurried decisions were made to operate for safety's sake. I can recollect operations done for intermittent discharge from nonmarginal perforations; some of these patients, now old, still attend for supervision – fortunately they are content in the certainty that deafness was a small price to pay for survival.

The classical radical mastoid operation was an accepted procedure though some surgeons were experimenting with modifications which might combine safety with preservation or even improvement of function. Some attempts were made to preserve the membrana tensa when dealing