SURGICAL MANAGEMENT OF TYMPANOSCLEROSIS- OUR EXPERIENCE

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ABSTRACT

Through the year 1993 to 1996 a total of 132 cases of chronic otitis media were taken up for tympanoplasty with or without mastoidectomy, out of which 30 cases were found to have tympanosclerosis; 11 cases (37%) out of this were found to be significant and were subjected to tympanosclerotic plaque extraction. Clinically significant tympanosclerosis has been defined as that affecting the surgical procedure by requiring removal to effect a hearing improvement. Success in hearing restoration so achieved in such ears is approximately as good as in non-tympanosclerotic ears.

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KEY WORDS: Tympanoplasty; Tympanosclerosis.

Introduction

Tympanosclerosis is irreversible pathological sequelae of chronic inflammation of middle ear cleft and signifies the end result of simultaneously operating healing process. Tympanosclerotic plaques (TSP) essentially consist of white chalky calcareous deposits beneath the lining epithelium. This is caused by thickening and fusion of collagenous fibres into a homogeneous mass interspersed with intra and extracellular deposition of calcium and phosphate crystals followed by ossification to a variable extent. The clinical significance of the TSP depends upon the anatomical disposition. It may present as isolated deposit in the tympanic membrane and middle ear or extend to ossicular ligaments, ossicles, interosseous joints, muscles, tendons and submucosal space leading to varying degree of immobility of ossicular chain. Tympanosclerosis clinically has been rarely found in active ears and with cholesteatoma [1,2]. This though has not been supported by pathological temporal bone specimens [3]. Tympanosclerotic plaque depending on its size, site and involvement of ossicular chain effects severely the sound transfer mechanism, and hearing restoration results following tympanoplasty.

Clinically Significant Tympanosclerosis (CSTS) has been defined as that requiring direct surgical removal to effect hearing improvement. It has been found to be present in less than half of those patients manifesting any degree of tympanosclerosis [4]. Thus significant TSP will necessitate surgical intervention in such ears during Tympanoplastic procedure to make

it functionally effective and rewarding.

Material and Methods

A total of 132 patients were operated in 3-year period. The youngest being 9 years and oldest 70-years. Over 60% patients were in age group 30-45 years. All the patients presented with history of deafness and/or otorrhea of varying duration. They were subjected to detailed ENT examination and investigation which included, otoscopy, tuning fork tests with 256, 512, 1024 Hz, free field hearing, pure tone audiometry, and X-ray mastoids. Pure tone averages of 0.5, 1, 2, 3 KHz were taken to assess the hearing level pre and post-operatively.

The presence of TSP was observed by otoscopic and/or Microscopic examination. The diagnosis, extent and site of TSP was confirmed intraoperatively while patients were taken for tympanoplasty. The removal of TSP was decided intra-operatively.

Observations and Results

A total of 23% (30/132) patients were found to have TSP. 37% (11/30) patients had clinically significant TSP. The site of involvement of TSP is as shown in Table-1. Nearly 64% (7/11) of CSTS were of open type that is with tympanic membrane perforation and 36% (4/11) of close type (intact tympanic membrane). 82% (9/11) of CSTS had involvement of malleus, incus, tensor tympani tendon, promontary and stapedial rim in combination or alone. In 18% (2/11) cases involving tympanic membrane direct removal by under mining the TSP with fine hooks was possible. 64% patients needed tympanoplasty (type II/III) using various prosthesis depending upon ossicular involvement. One patient (9%) with involvement of stapes rim, showed good result initially with stapedial mobilization but was found to have sensorineural hearing loss later on. One patient (9%) was found inoperable and abandoned with advice to use hearing aid.

An incidence of 8.3% of clinically significant tympanosclerosis has been found in this study which is close to Emmet and Shea, and Ogale 13% [5].

The hearing results in patients with CSTS with reference to improvement in air conduction and preoperative and postoperative air bone gap closure have been evaluated. The pre-operative average of PTA of all 11 cases has been found to be 49.02 db with

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TABLE 1
Distribution of tympanosclerosis

SITE	No of cases of TSP (n = 30)	CSTS* (n = 11)
Tympanic membrane only	19 (63%)	2 (18%) (A)
Ossicles (Malleus, Incus)	07 (23%)	7 (64%) (B)
Promontary and/or stapes	03 (10%)	1 (09%) (C)
Stapes footplate	01 (03%)	1 (09%) (D)
Total	30	11

*CSTS - Clinically Significant Tympanosclerosis

TABLE 2
Clinically significant tympanosclerosis (CSTS) reconstruction procedure

SITE	No. of cases	Procedure	No.
Tympanic membrane	2	Tympanoplasty	2
Ossicles (Malleus, Incus)	7	Tympanoplasty	
		(a) Intact chain, mobilized	1
		(b) Malleus, Stapes horizontal assembly	4
		(c) Columella (TORP, PORP)	2
Promontary and stapes	2	(a) Stapes mobilization	1
		(b) Abandoned	1

standard deviation 7.39. The post-operative average was evaluated as 30.81 db with standard deviation 5.76. Air conduction improvement was achieved upto 19 db. Only one case showed moderate sensorineural hearing loss. Results of a small group of CSTS [11] with nontympanosclerotic tympanoplastic operation (132) would be incomparable and insignificant, nonetheless, results per-se are significant.

Discussion

Tympanosclerosis was first recognised by Caase-bohm in 1734 followed by detailed description by Troltsch in 1869. But Zollner and Beck in 1955 are considered responsible for generating the present day interest in TSP [6]. The microstructure of TSP consists of three-dimensional irregular collagen lattice with sphericle mineralized deposits in lacunar spaces enveloped by proteinaceous material on its surface.

Tympanosclerosis has predilection for certain Cul-de-sac area where mucosal cells have minimal glandular activity with diminished ciliary activity [7]. Stapes-Oval window area, upper prmontary, epitympanum, incus-malleus joint, fallopian canal and sub fallopian groove are the common predilective sites. Hypotympanum and mastoid cavity are rarely involved.

Harris (1961) described two types of tympanosclerosis. Histologically non-invasive superficial form which does not lead to involvement of adjacent mu-

cosa and periosteum. The other is invasive form which leads to mucoperiostitis with destruction of the underlying bone [8]. However, the predominant thinking is that bone destruction observed is unlikely to be due to tympanosclerotic process itself, but is due to the primary inflammatory disease which initiates abnormal healing process [9] and that TS is essentially an inactive process. The clinical affects of the TSP are due to its anatomical layout leading to mass stiffening effect. Thus, in any tympanoplastic procedure, which dampens the sound transfer mechanism, it will need removal by surgical intervention.

Tympanic Membrane : Removal of the TSP from Tympanic membrane is required only if there is extensive TSP effecting the compliance or else if it is present in association with ossicular fixation. TSP is removed either through the edges of perforation or after raising the tympanomeatle flap. A small tunnel is made with angled pick between the plaque and lateral epithelium and thereby gradually undermining the whole plaque thus removed with the grasping forceps. Anterior superior TSP maybe approached from top separately after extending the tympanomeatle flap anterior to short process of malleus. In this series we found only two cases of isolated tympanic membrane with extensive TSP requiring extraction. Small plaques do not in any way effect graft uptake or hearing restoration.

Ossicular Chain : Ossicles may be involved in isolation in combination leading to fixation in attic and/or at the oval window. This should be ascertained before deciding on the approach by visual examination and under magnification. It may be right to do atticotomy to analyse the malleus fixation. There are two ways of clearing this (a) by careful removal of plaque by fine pointed instrument over malleus incus head and disimpaction from rest of attic. To avoid refixation by fibrosis, a small silastic may be placed in the medial attic wall, (b) second and better approach is to disarticulate the incudo stapedial and incudo malleolar joint, remove the incus and nip the malleus. This should be followed by making malleus to stapes horizontal assembly using autologous freshened reshaped incus. In this series second option has been used in four cases, direct mobilization in one case and vertical collumella (PORP) in two cases (Table-2).

Oval Window Fixation : After having cleared the attic fixation if present, oval window should be checked. Any small plaques along the stapedial annular ligament should be removed by careful peeling off. Major tympanosclerotic plaque involving stapes footplate, and superstructure is removed by crurectomy

and en-block removal of the TSP by working with a fine hook just lateral to foot plate and lifting the plaque along with the remnant crura. This may be very difficult to do and is fraught with chances of damage to cochlear apparatus. The remnant footplate should be reinforced by composite perichondrium overlay before placement of TORP or autologous cartilage prosthesis from tympanic membrane to stapes footplate. Staged stapedectomy is another alternative but may be difficult to perform. In such situations safe alternative would be use of suitable hearing aid. In present series we had one such case.

To conclude it may be said that of all the otitis media cases taken up for tympanoplasty, clinically significant tympanosclerosis forms less than 1/10th of the total cases and about 1/3 of those with tympanosclerosis. The more difficult of such cases are ones which have involvement of ossicular chain either at attic or oval window which will need careful extraction followed by single or staged ossiculoplasty. In novice hands in extensive TS involving oval window area, it may be worthwhile to resort to use of suitable hearing aid.

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