

# The Role of Artificial Eustachian Tube in Cleft Palate Patients

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Children born with cleft palates are prone to develop middle ear problems—middle ear effusions, secretory otitis media, and acute and chronic suppurative otitis media. Many investigators (1-7, 9-18) have pointed out this high incidence of middle ear pathology in cleft palate children with its concomitant conductive-type hearing loss. Tangen (18) emphasized the frequent changes that occur in hearing and in middle ear findings on repeated examinations. Graham (2) carried this further with his longitudinal study, which showed that, at one time or another, about half of the cleft palate patients were found to have ear disease.

Although the basic reason for the increased difficulty is unknown, it is presumed to be related to a poorly functioning Eustachian tube. In his classical article on the physiology of the Eustachian tube, Rich (14) demonstrated that the tensor veli palatini muscle opened the Eustachian tube as effectively when the soft palate was artificially cleft as when it was intact, because of the attachment of the muscle to the hamular process of the pterygoid. That contention has been disputed, however, particularly by Holborow (5, 6). No one has determined whether patients born with cleft palates have congenital malformation or malfunction of the tensor muscle itself, whether cleft palate surgery interferes with tensor function by virtue of its proximity to the hamular attachment if not by actual fracture of the hamulus, or whether change in tubal function is secondary to mucous membrane reaction around the tubal orifice from whatever cause.

As a consequence of poor Eustachian tube function, the middle ear is not aerated each time the person swallows, yawns, or sneezes, as in normal function. Lacking this aeration, the oxygen in the middle ear is absorbed and a vacuum is created. One response to this vacuum is a marked retraction of the tympanic membrane—especially pars flaccida—and subsequently, the formation of a serous transudate which fills or partly fills the middle ear and which interferes with hearing. If the middle ear mucosa is hypertrophic, the vacuum may result in a middle ear filled with mucoid

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TABLE 1. In 98 cleft palate patients, 243 myringotomies were performed during 1964. The type fluid removed is indicated.

<i>Type of fluid</i>	<i>N</i>	<i>%</i>
Serous.....	48	19.3
Mucoid.....	112	46.1
Mucopurulent.....	20	8.2
No Fluid.....	39	16.0
Not Stated.....	24	9.9
	243	99.5

material (8) rather than a serous effusion. The middle ear filled with mucoid material is called a secretory otitis media and can also result from a low grade infection or from a more severe middle ear infection which has responded incompletely to antibiotic therapy. Acute suppurative otitis media appears to be common in patients with Eustachian tube dysfunction, whether associated with a cleft palate or not.

Basically, then, there are two types of ear problems in cleft palate patients. First, infection and second, inadequate aeration. Infection causes acute suppurative otitis media and several types of secretory otitis media. Inadequate aeration may result in serous middle ear effusion or one type of secretory otitis media.

Middle ear problems resulting from recurrent infection usually respond to removal of the tonsils and adenoids, allergic hyposensitization (when applicable), and occasionally the use of gamma globulin and continuous prophylactic antibiotics. For those cases of Eustachian tube dysfunction not caused by infection, the middle ear can be artificially aerated.

### **Purpose**

The purpose of this study was to determine the proportion of the cleft palate population having middle ear problems and to study the effectiveness of the attempts to establish middle ear aeration.

The study was carried out on all cleft patients undergoing myringotomy at the University of Iowa Hospital during 1964. During that year, 702 cleft palate patients were examined and of that total 98 (13.9%) had middle ear pathology requiring a total of 243 myringotomies. The type of fluid found is shown in Table 1. Following the myringotomies, and as decided by the surgeon, pressure equalizing tubes were inserted through the tympanic membrane of 165 ears. Sixteen were flared polyethylene tubes and 149 were Silastic® tubes<sup>1</sup>. The tube was presumably inserted in those patients whose past performance indicated chronically poor Eustachian tube function and the need for middle ear aeration, in addition to removal

<sup>1</sup> Silastic Artificial Eustachian tubes are manufactured by Dow Corning Corp., Midland, Michigan.

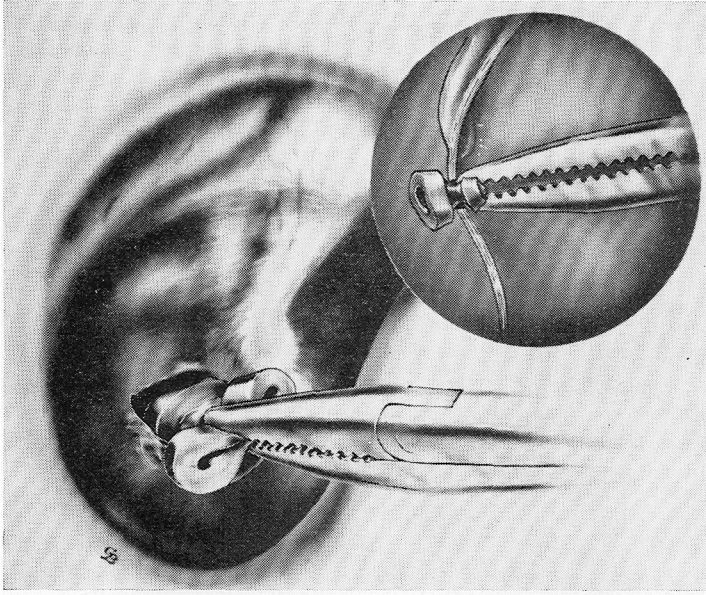


FIGURE 1. After a myringotomy has been performed, the Silastic tube is inserted until its inner flange passes through the tympanic membrane. The outer flange is then released, securing it in place.

of the fluid. Figure 1 shows the method of insertion of the Silastic tube after the myringotomy and fluid removal.

It was evident that Eustachian tube obstruction in ears with normal mucosa producing a serous effusion was relatively less common than Eustachian tube obstruction with abnormal mucosa or infection resulting in mucoid and mucopurulent fluid. Attention had already been directed toward the procedure of removing the adenoids in an attempt to eliminate recurrent Eustachian tube obstruction and infection in the area of the Eustachian tube. Sixty-four of the 98 patients had had adenoidectomies prior to or during 1964. As a matter of fact, nine re-adenoidectomies were performed in the group for adenoid regrowth.

Patients suspected of being allergic were evaluated by an allergist and were desensitized, if indicated. In an attempt to aerate the middle ear when Eustachian tube function was inadequate in spite of these other measures, tubes were inserted through the tympanic membrane to serve as pressure equalizers and to allow the tympanic membrane to resume its normal position and to recover some of its internal elasticity. Many drums have shown a remarkable ability to do this when allowed to rest for a month or two after being continually retracted. The tubes had a tendency toward extrusion in spite of the characteristics of Silastic® to be well tolerated by the body. In those ears that had serous fluid, 11.8% (two of 17) of the tubes were in place when seen three to six months later. A

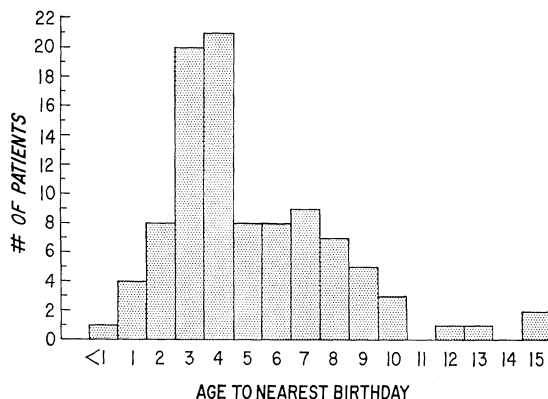


FIGURE 2. Ages of 98 cleft palate patients who had myringotomies during 1964.

higher percentage (17 of 58 or 29.3%) of the tubes were in place and working as long as three to six months in ears that had had mucoid material.

As can be seen in Figure 2, most of the myringotomies were performed in younger age groups. Eighty-six per cent of the myringotomies were performed in children who were eight years and younger with the most frequent age being in the three- and four-year-old category. Cleft palate patients have a consistent follow-up every six months, beginning at six months through age six years and annually thereafter. This distribution suggests, then, that younger children are more prone to have middle ear fluid which requires treatment than older children. As the child gets older, however, he is less likely to have fluid. Because of the difficulty in examination, the fluid may be overlooked in some of the children under three years of age, but there is no reason to feel that it was overlooked in a significant number of children over five years.

### Discussion

Goetzinger and associates (1) feel that middle ear infection in cleft palate patients runs its course before adolescence. Graham (2) concluded that hearing stability was reached by age six to eight years. The present study supports these observations, in that the findings indicate that most of the patients requiring myringotomy were younger than eight years old. Because these children appear to gain adequate Eustachian tube function by adolescence, if not earlier, it is important to preserve a healthy tympanic membrane and middle ear structure for this time. Loeb (10) feels that the '...treatment of hearing loss in the cleft palate child should be the same as in non-cleft patients. Adenoidectomy and/or tonsillectomy should be done without hesitation when the proper indications are present.' This approach has been followed at the center where these subjects received care. Tonsillectomy and/or adenoidectomy have

been performed when indicated. Myringotomies have been performed to remove ear fluid, and middle ear aeration has been achieved and maintained by the insertion and periodic replacement of a Silastic® tube. This may require myringotomies and tube insertion as often as every three months for a period of several years, but it appears to be worthwhile preventive medicine. By restoring middle ear aeration and preventing chronic middle ear retraction, the internal elasticity of the tympanic membrane appeared to improve. Drums previously partially adherent to the promontory frequently resumed their normal lateral position. Middle ear mucosa relieved of the infected fluid and negative pressure at times improved in appearance. It should be emphasized that not all ears responded this dramatically. In some, previous neglect of middle ear aeration had resulted in classical adhesive otitis media with a flail tympanic membrane not only draped over the promontory and ossicular chain but actually fused to them. Attempts to salvage these ears and to recreate a middle ear cleft were usually unrewarding, but many of them could probably have been prevented by adequate middle ear aeration as outlined above.

### Summary

During a 12-month period of routine examinations, 13.9% of the cleft palate patients were found to have middle ear pathology requiring one or more myringotomies. In an attempt to establish middle ear aeration in these patients with inadequate Eustachian tube function, Silastic® tubes were inserted. Although these tubes tended to be extruded sooner than desired in this group with its high incidence of middle ear infection, temporary middle ear aeration frequently improved the appearance of the tympanic membrane and allowed it to assume its normal position rather than a retracted one. While the results are not conclusive, continued effort to establish and maintain middle ear aeration is considered worthwhile.

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