Evolution of Eustachian Tube Surgery

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Introduction

The Eustachian tube (ET) is an anatomic structure with a dual identity. While usually considered a component of the auditory system, it shares an interface with the domain of the rhinologist at the nasopharynx. Eustachian tube dysfunction (ETD) is a common condition that lacks a widely accepted treatment. Attempts to address ETD surgically have spanned several centuries and have often fallen short of success. It is probable that its occult anatomic position, unclear function, and misunderstood physiology have contributed to the delayed development of effective interventions for ETD. This article traces the evolution of therapeutic interventions of the Eustachian tube through the present day. Reasons for success and failure are highlighted, with implications for the future of Eustachian tube surgery.

Belief in a Static Structure

With the rise of tympanoplasty in the mid-20th century came an appreciation that ET patency was necessary for long-term success of that operation28. On occasion, the otologic drill was used to enlarge a presumed stenosis of the bony ET, which anatomically represented the narrowest segment17. Techniques for drilling the temporal bone were described for both the transcanal29 and the middle fossa approach30. These were ultimately abandoned, in part out of concern for injury to the nearby carotid artery.

Subsequent attempts at improving middle ear aeration sought to bypass the ET entirely through creation of a new ventilation route. In 1967, Lapidot reported on transposition of Wharton's duct to create a conduit from the middle ear to the oral cavity31. In 1969, Drettnrer proposed a tympanomaxillary shunt, whereby a valved silicone tube traversed the infratemporal fossa to join the protympanum with the maxillary sinus32. Reports on tympanofrontal shunting were also published with limited acceptance33.

Irrigation and Insufflation

The earliest recorded attempt at surgical intervention on the ET was made by a French postmaster, Guoy, who in 1724 testified to the Royal Academy of Science that he had relieved his own deafness by passing a curved pewter tube into his mouth and beyond the palate13. Formal catheterization of the ET via the nose was described in 1741 by Archibald Cleland, a Scottish military surgeon, who developed several instruments for this purpose14 (Figure 2). Various substances were introduced with the irrigation fluid, including honey, camphor, benzoil, iodine and carbonic acid15.

Use of the ET catheter for insufflation did not come into practice until the early 19th century, when Itard advised it as a routine mode of treatment for deafness17. This practice of “air douche,” typically over a course of several weeks, became a mainstay of the treatment for deafness in European medicine18. Deleau was responsible for improvements of catheter injection design, and modified the insufflation catheter by adding an auscultation tube to aid the clinician (Figure 3). An array of other catheters and instruments for injection were developed by 19th century otologists, of which a common feature was a distal tip curved at approximately 120 degrees to mimic the trajectory of the ET19.

Revealing the Dynamic Organ

Building on reports of a functional valve at the distal ET, several contemporary investigators returned to a transpharyngeal approach to ETD treatment. Misurya reported in 1976 on the “functional Eustachian tuboplasty,” wherein the action of the tensor veli palatini was augmented by lessening the length of its tendon38. This was accomplished by transfixing the tendon on either side of the hamulus with a nylon suture. Jansen reported in 1985 on a mucosal-sparing technique to resect the posterior portion of the ET, assisted by fiberoptic endoscopy, although this approach received little notice39.

The most recent wave of innovations in ET surgery has been marked by the adaptation of current rhinologic techniques. In 1997, Kujawski introduced the laser Eustachian tuboplasty, whereby mucosa and cartilage were obliterated from the posterior wall of the ET2. This was performed transorally with transnasal endoscopic guidance2. Metson subsequently reported on an exclusively transnasal endoscopic technique, which entailed removal of mucosa from the torus tubarius using a tissue shaver3. Yanez described a modification of laser tuboplasty with incision of cartilage to alter its elasticity4. While early results are generally favorable, long-term results for all of these techniques remain to be seen.

References