Drainage of Effusion in Otitis Media: A Historical Review

Rajesh, Pallavi

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Abstract

Otitis media with effusion (OME) or middle ear effusion (MEE) refers to fluid in the middle ear space without symptoms of acute infection. The fluid may be thin and watery and when it is thick it is called "Glue ear". The collection of fluid in middle ear is secondary to the blockage of eustachian tube. This condition should be evaluated at the earliest, because of the risk of hearing loss, delayed speech and language or learning problems and needs prompt intervention so as to avoid a handicap in the child.

INTRODUCTION

Middle ear effusion occurs when the eustachian tube which connects the inside of the middle ear to the back of the throat, becomes blocked. This tube is a drainage conduit to prevent the build-up of secretions that are normally made in the middle ear. These secretions drain down the tube and are swallowed. The tube also functions to keep the air space in the middle ear at the same pressure as the air around us. In this way, the eardrum can move freely, and our hearing is most effective. Small children get more OME than older children because the tube is shorter, more horizontal, and wider. There is also increased incidence of OME associated with several congenital syndromes, craniofacial anomalies, and systemic diseases have increased incidence associated with OME, including cleft palate, Down syndrome, Treacher Collins syndrome, hemi facial microsomia, diabetes mellitus, human immunodeficiency virus (HIV) infection, and many types of mucopolysaccharidosis. The most common problem is hearing loss. Sometimes the hearing loss is mild, lasts only a few weeks and gets better by itself but it may go on for many months. The diagnosis is made by pneumatic otoscope and if the drum looks dull, cloudy or fluid can be seen behind it, glue ear is present. And further impedance audiometry is done to measure how well the eardrum can move. Acoustic reflectometry uses an acoustic otoscope to measure reflected sound from the tympanic membrane, the louder the reflected sound, the greater the likelihood of an MEE. About half of all bouts of glue ear will get better spontaneously within three months. Antibiotics appear to help in the short term but do not appear to improve the outcome for children with glue ear. Most cases of OME occur after an episode of acute otitis media, and 2/3 rd of patients develop an MEE. The mean duration of the effusions is 3 weeks, but many persist much longer. Most cases of OME spontaneously resolve but a MEE is harbored in 50% of ears after 1 month, 20% of ears after 2 months and 10-15% of ears after 3 months after an acute episode of otitis media. OME that persist longer than 3 months have spontaneous resolution rates of only 20-30%. Most cases of chronic OME are associated with conductive hearing loss, averaging approximately 25 dB. Complications of hearing loss leading to language delay, behavioral problems and poor academic performance have led to the urgency in its prompt management. The last two decades of the 20th century saw a dramatic rise in OME, largely due to increased pollution and increased use of early childhood day care and nurseries.

HISTORICAL EVENTS IN THE DRAINAGE OF MIDDLE EAR EFFUSION

ERA OF FIRSTS

Eustachius in 1563 first described the tube that came to be named after him. Valsala in 1704 described the maneuver that bears his name. Deleau in 1836 became the first to advocate infusion of pure air using a catheter through the eustachian tube. In 1863 Politzer was first to actively inflating the middle ear without using a catheter.

ERA OF ENTHUSIASM IN PIERCING THE DRUM.

Jean Riolan the Younger in 1649 perforated an ear drum accidentally while cleaning the external ear canal with an ear spoon. To his surprise the hearing of the patient improved. At the end of 18 th century, ear drum perforation, like perforation of a cataract was indiscriminately perforated by

itinerant quakes and “physicians” in Europe. Ear drum perforation was performed in many places even for the healing of deaf and dumb. In 1800 Astlee Cooper reported success with ear drum perforation and recommended the operation only in the presence of eustachian tube obstruction. Because of negative results of indiscriminate ear drum perforation, operation soon acquired a bad reputation and was not performed for decades.

ERA OF INTRODUCTION OF PARACENTESIS

Herrmann Schwartz introduced paracentesis into the daily practice of otrhinolaryngology. He was director of Royal ENT Clinic in Halle and published trailblazing treaties indicating values and success of this operation. As early as in 1867 thermo paracentesis was performed by Voltolini with the use of a galvanic cautery device. After more than 100 years, the Japanese physician Saito reintroduced thermo-paracentesis into the therapy of the eustachian tube ventilation disorders.

ERA OF PERMANENT PERFORATION

Since the physicians had soon realized the spontaneous healing properties of the ear drum to close after an artificial perforation. The need to maintain the patency of the paracentesis site was recognized for back as 19th century. Gruber resected half of the drum-unsuccessfully. To obtain the permanent perforation many put foreign bodies into the drum apertures such as catgut, whale bone rods, lead wires, silver cannulas and gold rings. The writings of Politzer and Dalby which were cited by Alberti described the use of all these materials unsuccessfully.

ERA OF ADVENT OF GROMMET

Martill Frank in 1845 described in his test book -a grommet made of gold foil. Politzer devised a rubber eyelit containing groves to fit into the drum. Limited success combined with a high rate of associated infection eventually led to the abandonment of this procedure.Voltolini manufactured an open hollow ring of gold foil or aluminum, which had to be fixed with handle of malleus. While Armstrong was not the inventor of grommet he was the first to reintroduce grommets in the middle of 20th century. In 1954 Armstrong [1] described a “new” therapy for OME consisting of a 1.5mm diameter straight shaft polyethylene tube to relieve a non-resolving middle ear effusion in an adult who had been refractory to the medical management and previous paracentesis. The tube was designed to remain in place for 2-3 weeks. Subsequent modifications in tube shape were made by Armstrong and others to promote longer tube duration within the tympanic membrane. House devised a polyethylene tube with one flared end to fit behind the eardrum, Shih introduced the short double-flared collar-button tube, and Lineman and Silverstein followed soon thereafter with the arrow tube design. In the mean time tube composition materials also changed with the aim to enhance biocompatibility. Teflon, Silastic, and stainless steel grommets all were introduced in the 1960's. Gold-plated silver and titanium alloy tubes appeared later in the 1980's. Clinical studies have failed to document any significant differences among these various tube materials from functional point of view.

ERA OF LONG AND SHORT TERM VENTILATING TUBES

In response to refinement of surgical skills and indications for myringotomy with tympanostomy tube placement, there were further diversification in the tube design occurred. For the initial treatment of otitis media with effusion in otherwise healthy children and adults, short-term ventilation is often warranted. Ideally the tubes chosen for this purpose should remain within the drum for at least 6 to 12 months. And complete tympanic membrane healing should follow after their desired spontaneous extrusion. Armstrong, Shephard and Reuter Bobbin tubes have been shown to be suitable for such ventilation purpose. Leopoid and McCabe found long polyethylene and Shephard tubes to remain functional for a time period of at least 6 months; Reuter-Bobbin tubes demonstrated a slightly better functional performance More recently Weigel et at [2] demonstrated 2-year post insertion extrusion rates of 94, 80 and 66% for Shephard, Armstrong. And Reuter-Bobbin tubes respectively. Patients with OME refractory to previous short-term ventilation management become candidates for long-term ventilation. Long-term ventilation should also be initially considered in adults and children with anticipated chronic OME problems. Included in this group are patients with cleft palates and other craniofacial abnormalities associated with chronic eustachian tube dysfunction as well as pharyngeal tumor patients treated by palatal resection or irradiation. The initial long-term ventilating tubes were redesigned to clip over the malleus [3] for retention purposes and incisions both anterior and posterior to the malleus were required and placement proved cumbersome Most long-term tubes utilized today incorporate a large medial flange and are made of pliable principally Silastic materials to allow for easier introduction and placement. The Per-lee [4] lube, for example, incorporates a wide circular flange and a large diameter stem. The Goode T-tube (86) is longer and of

narrower stern diameter. In both these tubes the medial flange and shaft can be shortened to facilitate insertion. The T-tube shape is designed to promote easy removability and this can often be done" an office procedure" in cooperative children and adults. This is less true of Per-lee tubes. Young children may require a general anesthetic for tube removal. This possible need for a second operative removal procedure should be strongly considered prior to the placement of long-term ventilation tubes in the pediatrics population.

ERA OF LONGEVITY VERSUS QUADRANT OF PLACEMENT OF VENTILATING TUBE.

The duration even a short -term tube remains within the tympanic membrane can be enhanced by selective placement. Van Baarle and Wentges [5] established the rate of tube extrusion to be a function of epithelial migration across the tympanic membrane. These authors' sentiments that an antero-superior tympanic membrane placement favoured tube longevity were further echoed by Armstrong who additionally advocated a subannular placement up against the fibrous annulus for tube retention. The tube longevity versus quadrant of insertion was critically assessed by Leopold and McCabe [6] .They found no significant difference in extrusion rate among three short -term tubes, Shephard long polyethylene with flange and Reuter-Bobbin types for the three quadrants of insertion anterosuperior, anteroinferior and posteroinferior. They did, however, note some tube specific patterns of preference. Shephard tubes for example were found to remain longer when placed in the anterosuperior quadrant where as the inferior quadrant promoted as having the advantage of a slower extrusion rate than other types for ventilation tubes.

LASER-ASSISTED TYMPANOSTOMY (LAT)

A new tympanostomy procedure, by CO2 laser [7] , which is known as tympanolaserostomy or laser-assisted tympanostomy (LAT). A CO2 laser is fitted with an adapter to an operative microscope and multiple low-power impacts of 0.8-1.0 W in 0.1 s are focused on a minimal spot 0. 18 mm and produce circular orifices 2.0 to 2.5 mm in diameter that closed in 30-40 days. LAT does not require anesthesia, tubes, or hospitalization; it reduces risk and complications, and consequently decreases costs.

AUTO INFLATION WITH "OTOVENT "

Most modern studies show that 50% of the ears with effusion are being cleared after auto inflation and it should be considered as first line of treatment before antibiotics or surgical treatment is planned. A device called Otovent® which is a plastic tube attached to a small balloon, can make the eustachian tube open up and help to clear glue ear. The method is simple to perform and is also suitable for children from the age of 3 years. However children, and a proportion of adults, have difficulty in performing this procedure. The steps are followed in this order. Attach the nose-adapter on to the balloon; hold the round part of the nose adapter tightly against the right nostril with the right hand. Close the left nostril with the left index finger, breathe in deeply, close the mouth and blow up the balloon and repeat the same procedure with the left nostril.

CORRESPONDENCE TO

Dr Rajesh Associate Professor Himalayan Institute of Medical Sciences, Jollygrant, Dehradun, Uttranchcal India E mail - drrajeshent@rediffmail.com

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Author Information

Rajesh, MS (ENT. P.G.I. CHANDIGARH)
Associate Professor, Department of ENT & Head and Neck Surgery, Himalayan Institute of Medical Sciences

Pallavi, M.B.B.S Std.
Department of ENT & Head and Neck Surgery, Himalayan Institute of Medical Sciences