Ventilation Tubes: Indications and Complications

Alberto Chinski

We are going to deal with middle ear ventilation that has been highly praised in some cases and not so much in others. About middle ear atelectasis and the possibility of avoiding it with a ventilation tube. This is a long and complex subject.

We are going to do some comments on ventilation tubes (VTs). You know that ventilation means making a hole in the tympanum. The first ventilation was made by chance in 1649 and it turned out to be therapeutics. Why? Because it was made in a person with a content in the middle ear. Later, surgeons and quacks accepted it as the most proper procedure. As it did not have the correct prescription and applied to fools or dummies, it quickly earned bad reputation.

Years later, several physicians started thinking about "how to avoid the tympanum to be closed" and I discovered just at that moment that the person I always praised, Politzer, as the pioneer of ventilation tubes, was not. Before him there were other physicians trying to find out ways of avoiding the tympanum to be closed, because that is the function of the VT, letting the air come in, supplementing the dysfunctional Eustachian tube and eventually draining fluid, if there was any. Among others, we can mention Frank Martell, who in 1845 tried to insert a gold foil VT. Other physicians used lead wires, whalebone rods and hard rubber rings.

It was only in the year 1952, half century ago, when Armstrong rediscovered the VT in vinyl material. He described it as a "new" technique, but as you can imagine, it was not for the previous physicians. And then several ventilation tubes appear with different duration, diameter, material, color, model and shape.

Besides, we must be aware of the factors favoring a surgery (**Table 1**) or the possibility of a surgery to define the steps to follow: if a surgery is needed, we must consider: bilateral process, under two years of age, recurrent otitis media (program question), attending daycare, passive smoker, time of the year, worst time: fall-winter, bilateral hearing loss, speech problems (generally not much unless there is a bilateral hearing loss greater than 30 dB), position and /or structural changes in the tympanic membrane, bad antibiotic tolerance, palatal fissure, immunodeficiency and other ENT surgeries performed. Therefore, if all these factors are present, it is very likely that a VT will be placed. Otherwise, a surgery may be needed.

Table 1. Factors favoring VT surgery and when surgery maybe needed

FACTOR	Surgery needed	Surgery may be needed
Overflow	Bilateral	Unilateral
Age	Under 2 years	Above 5 years
AOM	RAOM	Unusual
Development	At daycare	At home
Passive Smoker	Yes	No
Time of the year	Fall- winter	Spring
Hearing	Bilateral hypoacusis	Normacusis
Speech	Altered	Normal
Otomicroscopy	Structure and position changes in the TM	Only few overflow
Antibiotics	Bad tolerance	Good tolerance
Risk group	Palatal fissure and immunodeficiency	Normal
Other ENT surgery	Present	Absent

Now, we are going to deal with an algorithm stating when a VT should be inserted in the secretory otitis media (SOM) or Otitis Media with Effusion (OME).

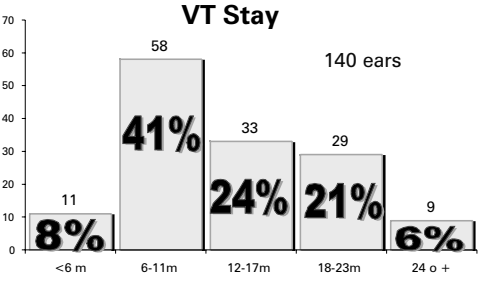
Let's think together. If an otorhinolaryngologist or a pediatrician suspects a secretory otitis media or otitis media with effusion, he will perform either a pneumatic otomicroscopy or otoscopy, i.e., unique method for the pediatrician.

If we suspect a SOM, a tympanometry is requested with research on stapedial reflexes and assessment is carried out to determine: if there is an alteration, we are dealing with a SOM, if the study is normal, we are not dealing with a SOM. Then, we make the following question: Are there position and / or structure changes in the tympanic membrane with persistent negative pressure? If the answer is affirmative, we suggest placing ventilation tubes. Otherwise, you must wonder: how long the process has been developing? If it less than two months, we suggest waiting. But if the development lasted more than two months, the patient would receive a treatment with amoxicillin and prednisone simultaneously during at least a 10-day period or 14-day period at the most. In the event there is a clinical cure, we must monitor the patient during 30 days more and the patient is discharged. But if there is no clinical cure, the question is the following: Is there a bilateral conductive hearing loss greater than 30 dB and more than 4 months of development? If the answer is affirmative, we must insert a ventilation tube. If the answer is negative and there is no hearing loss in time and hierarchy, we should monitor the patient during 30 more days. Failure in the procedure, results in the placement of a ventilation tube, otherwise the patient is discharged.

Thus, these are the indications for a ventilation tube insertion: failure in the medicamentous treatment, 6 month hearing loss development (i.e. chronic secretory otitis media), loss greater than 30 dB, bilateral secretion, position and / or structure changes in the tympanic membrane and persistent negative pressure. When all these factors appear, the VT indication is clear.

VT should be placed when needed, but its use is not harmless: there are ventilation tube complications. Even though we can control and solve all of them, we must be aware of their existence. According to statistics some years ago, we observe that the length of time the mid-term ventilation tubes stay in their place varies from 6 months to 2 years. The Shee model of silicone umbrella VTs was used.

Is it true that the longer it stays, the better the SOM development? Yes, when we talk about 91% of success, we mean it has been inserted for more than a year and a half or two years. 84% of success is very important meaning long-term stay and not too long-term stay (**Graphic 1**).



Graphic 1. VT time to stay

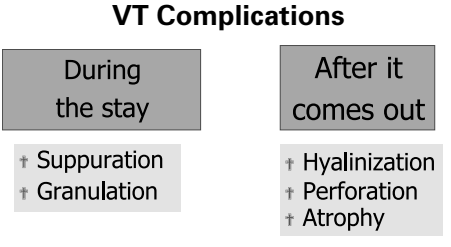
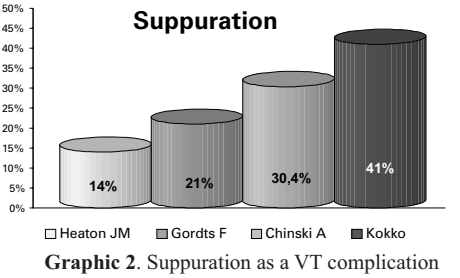


Figure 1. Complications of VT

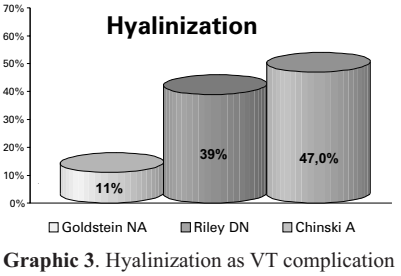
Ventilation tube complications may appear during VT stay or after falling out on its own. Suppuration (otorhea) may occur during the stay and when it comes out, there is hyalinization, perforation or atrophy in the area where it was placed (**Figure 1)**.

A comparative study was made and it was found that 3 out of 10 ears have otorhea at some time during the VT stay (**Graphic 2**). 10% during the first 7 days and the remainder 20% during the subsequent stay.



Graphic 2. Suppuration as a VT complication

When the VT falls out on its own, the tympanic perforation amounts to 1%, but other physicians have different percentages and even one states 0%. When VTs are removed, perforation increases to 3% and if T-VTs are removed, statistics show a new triplication: 9%. One out of two partial or total tympanic membrane hyalinization is found more frequently where the VT was inserted or around it **(Graphic 3)**. These tympanic membrane images are scarier for people seeing them than the patient hearing disorders.



Graphic 3. Hyalinization as VT complication

To sum up, I would ask you: What is the best surgery procedure? What is the most useful treatment **(Table 2)**? Surely, you will exchange opinions today and tomorrow.

Table 2. Surgeries procedures to improve middle ear ventilation

Procedure	Result
Only Myringotomy	Useless.
Only adenoid vegetation.	Useful in special cases.
Adenoid vegetations and myringotomy.	Better results than separately
Amygdalectomy	Useless.
Ventilation tube.	Very useful, silicone and mid term
Adenoid vegetations and ventilation tube.	stay preferred.
	Better future results.

Recommended readings

1. Rosenfeld RM. A practical classification of otitis media subgroups. Int J Pediatr Otorhinolaryngol. 2005 Aug;69(8):1027-9.
2. Rosenfeld RM, Lous J, Bluestone CD, Marchisio P, Casselbrant ML, Paradise JL, Chonmaitree T, Prellner K, Grote JJ, Schilder AG, Haggard MP, Stangerup SE. Recent advances in otitis media. 8. Treatment. Ann Otol Rhinol Laryngol Suppl. 2005 Jan;194:114-39.
3. Witsell DL, Stewart MG, Monsell EM, Hadley JA, Terrell JE, Yueh B, Rosenfeld RM, Hannley MT, Holzer SS. The Cooperative Outcomes Group for ENT: a multicenter prospective cohort study on the outcomes of tympanostomy tubes for children with otitis media. Otolaryngol Head Neck Surg. 2005 Feb;132(2):180-8.
4. Rosenfeld RM, Culpepper L, Doyle KJ, Grundfast KM, Hoberman A, Kenna MA, Lieberthal AS, Mahoney M, Wahl RA, Woods CR Jr, Yawn B; American Academy of Pediatrics Subcommittee on Otitis Media with Effusion; American Academy of Family Physicians; American Academy of Otolaryngology, Head and Neck Surgery. Clinical practice guideline: Otitis media with effusion. Otolaryngol Head Neck Surg. 2004 May;130(5 Suppl):S95-118.
5. Rovers MM, Schilder AG, Zielhuis GA, Rosenfeld RM. Otitis media. Lancet. 2004 Feb 7;363(9407):465-73. Erratum in: Lancet. 2004 Mar 27;363(9414):1080.