Variables Influencing the Extrusion Rate of Ventilation Tubes

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Abstract

Background: Otitis media with effusion (OME) is a frequent pediatric disorder. it is the most common cause of conductive hearing loss in children. It results in variable degrees of hearing loss which can affect the auditory system development during this early and important period of life . **Aim and objectives:** The study aimed to determine the factors which might affect the extrusion rate of ventilation tubes. **Subjects and methods:** This is a prospective study to determine the factors which might affect the extrusion rate of ventilation tubes. The study was conducted on 88 patients who were diagnosed with persistent bilateral otitis media with effusion.They were collected from ENT clinics of AL-Hussain university hospital and Mansheyat EL-bakry general hospital .They underwent myringotomy with ventilation tubes insertion with or without adenoidectomy, during the period from December 2019 to April 2022. **Results:**there was no statistically significant difference between age ,gender, recurrent post -operative upper respiratory tract infection , adenoidectomy needed or not, presence of cleft palate or not, grade of surgeon and the time of tube extrusion among study group, there was a statistically significant difference between site of tube insertion and the time of tube extrusion among study group p value=0.009 , postero -inferior insertion has more rapid tube extrusion than Antero- inferior and antero- superior insertion. there was a statistically significant difference between type of grommet and the time of tube extrusion among study group p value = 0.0001 as regards type of grommet as shepard has more rapid tube extrusion than Armstrong's grommets with statistical significant difference ,**Conclusion:** the current study showed factors that shorten ventilation tube extrusion time. there was a statistically significant difference between site of tube insertion,type of grommet tube and the time of tube extrusion. there was no statistically significant difference between age ,gender, recurrent post -operative upper respiratory tract infection , adenoidectomy needed or not, presence of cleft palate or not, grade of surgeon and the time of tube extrusion

Keywords: Otitis media with effusion; ventilation tube extrusion; Armstrong's grommets; tympanic membrane adhesions

DOI Number: 10.14704/nq.2022.20.8.NQ44080 NeuroQuantology 2022; 20(8) : 717 : 724

1. Introduction

Otitis media is one of the most common diseases of childhood. Up to 70%to 83%of children eventually have at least one episode of otitis media. [1] Otitis media (OM) is defined as fluid in the middle ear (ME) without acute infection signs or symptoms and the condition is considered chronic when it lasts for three months or more from the date of onset or the date of diagnosis. It is also named as serous, secretory, or non-suppurative otitis media **.** The fluid in the ME can be serous (thin) or mucoid (thick) and if it is very thick, the condition is called a "glue-ear". [2]

Otitis media with effusion is characterized by the collection of serous or mucous fluid behind an intact tympanic membrane cavity during an inflammatory process and the lack of acute signs and symptoms of infection. [3]

-Otitis media with effusion (OME) is a common cause of conductive hearing loss in children. It results in variable degrees of hearing loss which can affect the auditory system development during this early and important period of lif**e.**

For the child who is not at a high risk, 3-month period of watchful waiting from the date of effusion onset (if known) or diagnosis (if onset is unknown) is recommended, in order to avoid any unnecessary surgery, and its complications. [4]

However, children with recurrent acute otitis media, chronic otitis media with effusion (COME), tympanic membrane adhesions to middle ear structures, or complications of acute otitis media frequently require tympanostomy tubes for resolution of their disease. Tympanostomy tube placement is currently the most frequent ENT surgical procedure used that requires a general anesthetic. [1]

It is usually stated that ventilation tubes in current use tend to remain in place on average for 6 to 7 months before being spontaneously extruded, but their tenure is highly variable, sometimes days, sometimes years. [5]

The study aimed to determine the factors which might affect the extrusion rate of ventilation tubes.

2. Subjects and methods

This study is a prospective study to determine the factors which might affect the extrusion rate of ventilation tubes. The study was conducted on 88 patients who were diagnosed with persistent bilateral otitis media with effusion. They were collected from ENT clinics of AL-Hussain university hospital and Mansheyt EL-bakry general hospital then underwent myringotomy with ventilation tubes insertion with or without adenoidectomy, during period from December 2019 to April 2022.

Inclusion criteria: we included only patients with bilateral otitis media with effusion, of any age or gender.

Exclusion criteria: unilateral otitis media with effusion, revision cases of previous myringotomy with ventilation tube insertion or cases of myringotomy with T-tubes insertion.

Methods:

Through full history taking from the patients or the parents followed by full ENT clinical examination, those patients who fulfilled the inclusion criteria were enrolled in our study. The diagnosis was made by otoscopic examination, audiological assessment (pure-tone audiometric measurements or ABR according to age) and x-ray nasopharynx.

Patients with otoscopic signs of chronic otitis media with effusion, a type B tympanogram and any conductive hearing loss were considered positive for chronic otitis media with effusion. Myringotomy with bilateral tympanostomy tubes insertion operation was performed on patients whose chronic otitis media with effusion lasted more than 3 months not responding to treatment. adenoidectomy also was done if needed for patients with hypertrophied adenoid showed in nasopharynx Xray.

All cases were examined postoperatively at ENT clinics in our hospitals once in every month until extrusion of tympanostomy tubes.

The 8 Items fulfilled and recorded with each patient: Age, Gender, Presence of cleft palate or not, adenoidectomy was needed with myringotomy operation or not, site of tube insertion in each tympanic membrane, type of tympanostomy tube, grade of surgeon and recurrence of post-operative upper respiratory tract infection.

Just 80 patients came regularly to ENT clinics of our hospitals every month after surgery until ventilation tubes were extruded (8 patients were not regular follow –up, so they were excluded from the study).

This study was approved by ethical committee of Ear, Nose and Throat department, Faculty of Medicine, Al Azhar University.

Statistical methods: Data were coded and entered using the statistical package for the social sciences (SPSS) pass11 program. Data was summarized using mean, median and standard deviation .P values less than 0.05 were considered at statistically significant.

3. Results

This study is a prospective study to determine the factors which might affect the extrusion rate of ventilation tubes. The study was conducted on 88 patients who were diagnosed with persistent bilateral otitis media with effusion. They were collected from ENT clinics of AL-Hussain university hospital and Mansheyt EL-bakry general hospital then underwent myringotomy with ventilation tubes insertion with or without adenoidectomy. Just 80 patients came regularly to ENT clinics of our hospitals every month after surgery until ventilation tubes were extruded (8 patients were not regular follow –up, so they were excluded from the study).

Our study shows that there is no statistically significant relation between gender and rate of tube extrusion among study group.

Our study shows that there was very weak positive correlation with no statistically significant relation between age and duration of tube extrusion of study group by using r test.

Our study shows that there is no statistically significant relation between postoperative recurrent Upper respiratory tract infections (URT infection and rate of tube extrusion among study group).

Our study shows that there is no statistically significant relation between Adenoidectomy and rate of tube extrusion of study group.

Our study shows that there is a statistically significant relation between site of tube insertion and duration of tube extrusion among study group p value=0.009. By use post hoc test in the ANOVA test revealed that there is a statistically significant difference between Antero- inferior and postero - inferior insertion as p value=0.049 and there

is a statistically significant difference between posterior inferior and antero-superior insertion as p value=0.017, so postero -inferior insertion has lower duration of tube extrusion than Anterior- inferior and antero- superior insertion.

Our study shows that there is a statistically significant relation between Type of grommet and duration of tube extrusion among study group as there is a statistically significant difference between shepard and Armstrong's grommets p value = 0.0001 as regards type of grommet as shepard has more rapid tube extrusion than Armstrong's grommets with statistical significant difference.

Table (1): Demographic data of study group (80 patients) as regard age and gender:

Variables	Study Group N=80
Age: - (mean + SD)	6.4 + 3.19
Gender Male Female	51 (63.7 %) 29 (36.3%)

Table (2): percentages of post-operative recurrent upper respiratory tract infections, adenoidectomy, cleft palate among study group:

`Variables	Study Group N=80
Post –operative recurrent (URT infection): - +ve infection - none	55 (68.8%) 25 (31.3%)
Adenoidectomy: -Needed and done with myringotomy - Not needed and not done	71 (88.8%) 9 (11.2%)
cleft palate: - Present - Not Present	12(11.3%) 68 (88.7%)

Table (3): percentages of Site of insertion, type of grommet, Grade of surgeon and mean duration of extrusion among study group:

Variables	Study Group Number of tubes=160
Site of tube insertion: - Postero- inferior - Antero- inferior - Antero- superior	52 (32.5%) 64 (40 %) 44 (27.5%)
Type of grommet: - Shepard - Armstrong's grommets	100 (62.5%) 60 (37.5%)
Grade of surgeon: - Resident - specialist - consultant	55 (34.4 %) 59 (36.9%) 46 (28.7%)
Duration of extrusion: mean + SD)	8.45 + 2.1

Table (4): Relation between gender and duration of tube extrusion among study group:

Variables	Male patients N*=51	Female patients N=29	t test	P value
Duration of tube extrusion: Mean + SD	8.49 + 2.08	8.38 + 2.2	0.296	0.82

eISSN 1303-5150

Table (5): Relation between age and duration of tube extrusion among study group:

Age (6.4+ 3.1)	r test*	P value
Duration of tube extrusion (8.4+2.1)	0.066	0.558

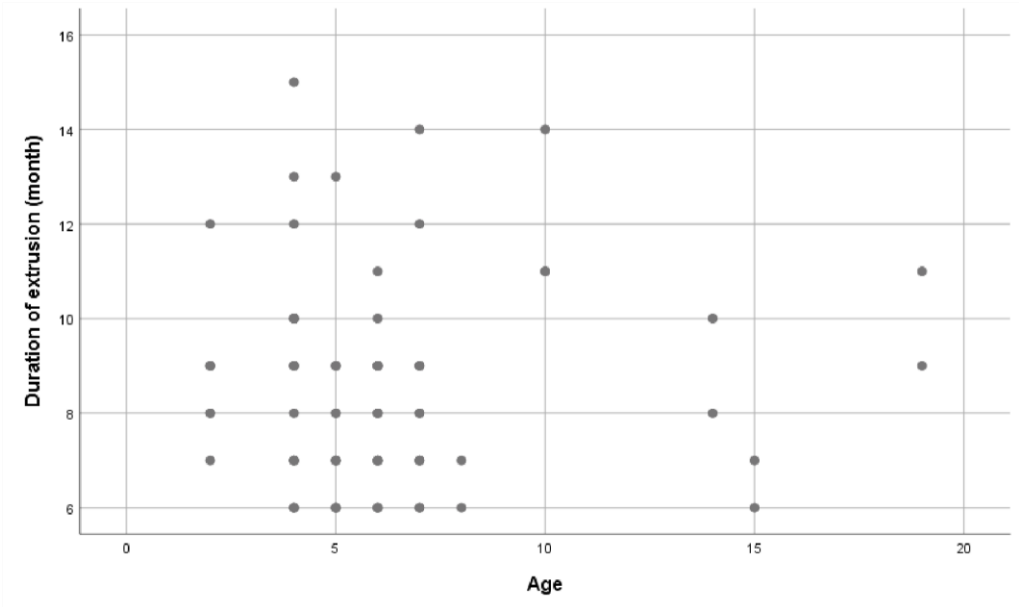

Figure 1: shows relation between age and duration of tube extrusion among study group

Table (6): Relation between recurrent post-operative upper respiratory tract infections and duration of tube extrusion among study group:

Variables	URT infection recurrent post-operative		t test	P value
Duration of tube extrusion:	+ ve	-ve	0.198	0.844
	N=55	N= 25		
Mean + SD	8.42 +2.05	8.5 +2.3		

Table (7): Relation between Adenoidectomy and duration of tube extrusion among study group:

Variables	Adenoidectomy		t test	P value
Duration of tube extrusion:	Needed and Done N=71	Not needed N=9	1.16	0.249
Mean + SD	8.35 +2.1	9.2 +1.9		

Table 8 : Relation between site of tube insertion and duration of tube extrusion among study group

Variables	Site of tube insertion			Test of Significance	P value
Duration of tube extrusion:	Postero- inferior N=52	Antero-inferior N=64	Antero-superior N=44	ANOVA test*	0.009 **
Mean + SD	7.7 +1.5	8.6 +2.03	8.95+2.57		

eISSN 1303-5150

Table (9): Relation between Type of grommet and duration of tube extrusion among study group:

Variables	Type of grommet		t test	P value
Duration of tube extrusion: **Mean + SD**	**Shepard** **N=100**	**Armstrong's grommets** **N=60**		
	7.78 + 1.7	9.57 +2.1	5.36	0.0001*

**Statistically significant at p- value <0.05

4. Discussion

Otitis media with effusion (OME) is the most common cause of conductive hearing loss in children. It results in variable degrees of hearing loss which can affect the auditory system development during this early and important period of life. **Dai et al.** [6] **O**titis media with effusion (OME) is a frequent pediatric disorder. The diagnosis is essentially clinical and is based on otoscopy and audiological assessment. **Mulvaney et al .** [7]

The study was conducted on 88 patients who were diagnosed with persistent bilateral otitis media with effusion. They were collected from ENT clinics of AL-Hussain university hospital and Mansheyt EL- bakry general hospital then underwent myringotomy operation with ventilation tubes insertion with or without adenoidectomy, during period from December 2019 to April 2022.

The present study showed that 63.7% of patients were male while 36.3% were female and the minimum age was 2 and the maximum age of study group was 19, as mean age of patients are 6.4 years old. There was no statistically significant relation between gender and rate of tube extrusion among study group. There was very weak positive correlation with no statistically significant relation between age and duration of tube extrusion of study group. The present study showed 68.8 % of patients had post-operative recurrent upper respiratory tract infections, 11.2% of patients had adenoidectomy with myringotomy and 11.3 of patients had cleft palate. There is no statistically significant relation between post-operative recurrent Upper respiratory tract infections (URT infection and rate of tube extrusion among study group. There is no statistically significant relation between Adenoidectomy or presence of cleft palate and rate of tube extrusion of study group.

Our results were supported by study of **Song et al.,** [8] as they reported that the extrusion time tended to increase with an increase of adenoid hypertrophy (grade 0, 202 days; grade 1, 231 days; grade 2, 266 days; grade 3, 307 days). However, there was no statistical significance (P=0.362). There was no difference in the extrusion time between the patients who had ventilation tube (VT) insertion accompanied by adenoidectomy (mean, 272 days) and those who had VT insertion without adenoidectomy (mean, 252 days; P=0.516).

Adenoid hypertrophy and chronic or recurrent adenoiditis have been postulated as contributing factors in the development of recurrent AOM and chronic OME. Yet in relation to the removal of the adenoid, **Iwaki et al.,** [9] reported that adenoidectomy did not influence the recurrence rate of OME.

Whereas in the study of **Lin et al.,** [10] they reported that patients with predisposing factors,

such as presence of gluey middle ear effusion, and no post-operative ear infections, had longer extrusion times compared to those without predisposing factors. The current study showed that there is no statistically significant relation between Grade of surgeon and rate of tube extrusion of study group.

In the present study, most of patients (40% of patients) had – site of insertion (Antero- inferior) and most of them (62.5%) of patients had shepherd as type of ventilation tube. Most operations were done by specialist (36.9%) and the mean duration of tube extrusion was 8.5 months.

There was a statistically significant relation between site of tube insertion and duration of tube extrusion among study group p value=0.009. By use post hoc test in the ANOVA test revealed that there is a statistically significant difference between Antero- inferior and postero -inferior insertion as p value=0.049 and there is a statistically significant difference between posterior -inferior and antero-superior insertion as p value=0.017, so postero -inferior insertion has lower duration of tube extrusion than Anterior- inferior and antero- superior insertion.

There was a statistically significant relation between Type of grommet and duration of tube extrusion among study group as there is a statistically significant difference between shepard and Armstrong's grommets p value = 0.0001 as regards type of grommet as shepard has more rapid tube extrusion than Armstrong's grommets with statistically significant difference.

Our results were supported by study of **Lin et al.,** [10] as they reported that found that the extrusion process happened more quickly in smaller tubes than in larger ones in adults and children. In their study, a VT diameter larger than 1 mm was also found to increase the chance of maintaining the VT in place for more than 12 months in children. Therefore, a different tube size should be considered when prolonged ventilation duration is required, and we recommend avoiding the usage of VTs with diameters less than 1 mm in children to prevent early extrusion.

Interestingly, a more recent article by **Kim et al.,** [11] demonstrated that there was a significant increase in the time to extrusion in ears where a 1.02 mm-sized thermoplastic elastomer VT was inserted compared to that in the 1.14 mm-sized silicone VT. The authors stated that although, generally, the larger inner diameter of the tube lasts longer in the eardrum, the contrasting result is thought to be due to the different material properties of both VTs.

Paparella, [12] recommend choosing an appropriate VT size according to short-term or long-term purposes, as tubes with a diameter of approximately 1.1 mm maintain for 1 year and 1.5 mm tubes maintain for more than 1 year.21

The study by **Dingle et al.,** [13] and **Shone et al.,** [14] demonstrated that the duration for the tube to be in place and functional was longer for titanium VTs compared to Teflon VTs.

However, it was also demonstrated that, as long as the middle ear cavity remained healthy, no significant difference was seen for transient dysfunction and tube extrusion rates between fluoroplastic and titanium tubes, although better biocompatibility was observed for the titanium tubes. While titanium tubes might be the better choice for adult patients lacking Eustachian tube dysfunction and OME, Handler et al proposed that there were no differences in extrusion times between titanium VTs and silicone VTs and addressed the issue regarding the considerable cost differences between these 2 types of tubes. [15]

5. Conclusion

The current study showed factors that shorten ventilation tube extrusion time. there was a statistically significant difference between site of tube insertion,type of grommet tube and the

time of tube extrusion. there was no statistically significant difference between age ,gender, recurrent post -operative upper respiratory tract infection , adenoidectomy needed or not, presence of cleft palate or not, grade of surgeon and the time of tube extrusion.

Conflict of Interest: None

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