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Compartive study between anterosuperior and anteroinferior insertion of tympanostomy tubes in treatment of otitis media with effusion

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***Abstract*---**Background: Otitis media with effusion (OME) is the condition in which fluid was presented in the middle ear cavities with absence of signs or symptoms of acute infection. Most episodes of OME resolve within 3 months, without need for surgical intervention. The placement of tympanostomy tubes (TTs) is the treatment for persistent OME. Objective: This study is performed to compare between anterosuperior and anteroinferior insertion of tympanostomy tubes in treatment of otitis media with effusion. Methods: The study included 40 patients with bilateral OME (at least 3 months did not respond to medical treatment) , divided into two groups: Group (I) included 40 patients who had been undergone myringotomy and tympanostomy tubes insertion at antero-superior quadrant of one ear (Right ear). Group (II) included the same 40 patients who had been undergone myringotomy and tympanostomy tubes insertion at antero-inferior quadrant of other ear (left ear). All patients were exposed to complete history taking, ENT examination and audiological investigation (Tympanometry, Pure Tone Audiometry), follow up of cases by clinical and audiological investigations were performed at 1,2 and 6 months. Results: As regard hearing improvement , At one month post-operative .the mean postoperative gain in AB gap was about 21.79 dB for group I and 17.73db for group II. At two months post-operative .the mean gain was21.43 dB for group I and 17.37dB. At six months post-operative .the mean gain was 20.93 dB for group I and 16.3 dB for group II As regard the incidence of complications, we noticed that post-operative complication as myringoscelorosis and residual perforation were more prevelant in group II than group I Conclusion The surgical benfits of insertion the tubes at antero-

superior quadrant of tympanic membrane is better than antero-inferior quadrant

***Keywords*---**OME, tympanostomy, tubes.

Introduction

Otitis media with effusion (OME) is the presence of middle ear effusion without signs of acute infection [1] (Rosenfeld *et al.,*2016). OME occurs after acute otitis media (AOM), also may occur with Eustachian tube dysfunction in the absence of AOM [2] (Paradise *et al.,*1997). Local inflammatory process leading to epithelial changes (metaplasia) and fluid collections in middle ear cavities [3] (Blanc *et al.,* 2018). OME resolve spontaneously within 3 months, but about 20% to 40% of cases have repeated OME episodes and 5% to 10% of episodes last more than 1 year [4] (Williamson *et al.,*1994).

As result of persistent middle ear fluid, decreased mobility of the tympanic membrane occurred leads to decreasd sound conduction and hearing impairment [5](Williamson, 2002). perisistance of OME for more than 3 months always leads to hearing impairment, vestibular malfunction , poor school performance, behavioral changes and ear discomfort[6] (Rosenfeld *et al.*, 2013) Structural damage to the tympanic membrane may requires surgical intervention[7] (Rosenfeld and Kay, 2003). Myringotomy and Tympanostomy tubes (TTs) insertion is the treatment for persistent OME with a functional effect on hearing due to tympanic membrane damage[9] (Simon et al., 2018).

The most common complication of TTs insertion is otorrhoea which occurs in about 50% of cases after surgery. In most cases, otorrhoea is usually isolated and does not lead to effect[10] (Vlastarakos et al., 2007). The expulsion, blockage or removal of the TT is related to the growth and the migration of the tympanic epithelial tissue. The rate of obstruction varies from 0% to 30.3%, and the rate of early expulsion is about 3.8%. In 0.5% of cases, the TT migrates into the the middle ear. The occurrences of those complications depend on the type and the site of TT, the surgeon's level of experience. For TTs as whole, the frequency of residual perforation varies from 2 to 10% [11](Kay et al., 2001). The ventilation tubes remains in its site depends on many factors included tube insertion technique and absence of intraoperative infection[12] (Moore, 1990). The size of incision in myringotomy and insertion of ventilation tubes is the small radial incision, and the preferred site for incision based on epithelial migration is the superior site better than inferior[13] (Armstrong,1983).

Patients and Methods

Study population

Forty patients with history of bilateral OME of at least 3 months which did not respond to medical treatment (22 males and 18 females), attending ENT Department and Outpatient clinic, AL-Azhar University Hospital (Assiut), Egypt, from December 2019 until Mars 2021, were enrolled in this study. Their age

ranged from 2 to12 years. They were divided into two groups according to the site of myringotomy tube insertion, Group I: tympanostomy tubes insertion at antero-superior quadrant of one ear (Right ear) and Group II: tympanostomy tubes insertion at antero-inferior quadrant of other ear (left ear). All patients were exposed to complete history taking, ENT examination and audiological investigation.

Diagnosis of OME

OME was diagnosed clinically, by history of diminution of hearing, by otoscopic examination (liquid film, bubbles, opacity, bluish coloration, and central retraction of the tympanic membrane may be apparent) and by a pneumatic otoscope. The tympanogram provides an assessment of tympanic compliance. Type B tympanogram (i.e. a flattened curve) with low volume is suggestive of OME

Inclusion criteria: Patients with history of bilateral OME of at least 3 months which did not respond to medical treatment, patients with bilateral OME with or without adenoid and tonsillar hypertrophy, patients had bilateral OME with or without history of allergy, the procedure could be associated with adenoidectomy or tonsillectomy or both in the same session.

Exclusion criteria: Unilateral OME, history of sensorineural hearing loss (SNHL), patients not suitable for general anesthesia, patients with acute infection and patient refusal. Written informed consent from the included subjects was obtained. The study protocol will approved by the ethical committee of Faculty of Medicine,AL-Azhar University.

Myringotomy and insertion of ventilation tubes

Operation was done using surgical microscope under general anesthesia incision is made on tympanic membrane using myringotomy knife and operation was performed according to Armstrong technique[14]

Follow up: Follow up of patients at one and two weeks, one, two, and six months postoperatively.
Follow up of all cases was included: • Hearing improvement after tube insertion by PTA , Complications of tube insertion (otorrhea, residual perforation, blockage of the tympanostomy tube, tympanic membrane atrophy, myringosclerosis, and relapse of effusion), And Tube extrusion (in the external auditory canal or in the middle ear).

Results

Table (1): Demographic data and risk factors for OME

Variable		All patients (N=40)	P value
Age (years): Mean		8.36	
Age categories	<5	2(5%)	
	5-	31(77.5%)	

10		7(17.5%)	
>10			
Gender N (%) Female	Male	22 (55%) 18 (45%)	NS
Residence Rural N(%) Urban		28(70%) 12(30%)	**<0.05**
Adenoid Yes N(%)	No	30(75%) 10(25%)	**<0.05**
Allergy Yes N(%) No		22(55%) 18(45%)	NS
Frequent URTI Yes No		32(80%) 8(20%)	**<0.05**

Table (2) symptoms distribution (n=40)

Symptoms N (%)	N=40
Hearing impairment	40(100 %)
Otalgia	28(70 %)
Nasal obstruction	32 (80%)
snoring	30(75 %)
Runny nose	32(80%)

Table (4): The postoperative mean air bone gap for group I and II

A-One month post-operatively			
A-B gap	Group I (n=40)	Group II (n=40)	*P value*
Range(min-max)	0-15	0-20	< 0.05
Mean+SD	7.143 ± 4.518	12.143 ±7.726	
B-Two months post-operatively			
Range(min-max)	0-15	0-20	<0.05
Mean±SD	7.5±4.33	12.5±7.56	
C-Six months post-operatively			
Range(min-max)	0-15	0-20	0.032
Mean±SD	8.75±4.146	13.57±7.302	

A-B GAP=air bone gap n=number SD=standard deviation
Min=minimum Max=maximum
Kruskal wallis non parametric test was used to compare between groups*p-value is significant if p<0.05.

Table (5): Postoperative complications of the study cases after 1 month

complication	Group I		Group II		P Value
	N	%	N	%	
Early tube extrusion	0	0	2	5%	0.002
Plugged tube	1	2.5%	3	7.5%	
Falling tube in ME	0	0	0	0	
Otorrhea	1	2.5%	3	7.5%	
Residual perforation	0	0	2	5%	
Myringosclerosis	0	0	1	2.5%	

ME= middle ear n=number
p=percent
Chi square test was used to compare between groups *p-value is significant if p<0.05

Table (6): Postoperative complications of the study cases after two months

Complications	Group I		Group II		*P* value
	N	%	N	%	
Recurrence of OME	1	2.5%	2	5%	0.004
Residual perforation	1	2.5 %	1	2.5%	
Otorrhea	1	2.5%	4	10%	
Myringosclerosis	4	10%	5	12.5%	
Plugged tube	1	2.5%	3	7.5%	
Tube extrusion	2	5%	3	7.5%	

OME= otitis media with effusion n=number
p=percent
Chi square test was used to compare between groups *p-value is significant if p<0.

Table (7): Postoperative complications of the study cases after sixth months

Complications	Group I		Group II		*P* value
	N	%	N	%	
Plugged tube	2	5%	1	2.5%	<0.001
Recurrence of OME	5	12.5%	8	20%	

Residual perforation	1 2.5%	1 2.5%
Myringosclerosis	10 25%	12 30%
Tube extrusion	35 87.5%	38 95%

OME= otitis media with effusion n=number
p=percent
Chi square test was used to compare between groups *p-value is significant if $p<0.05$

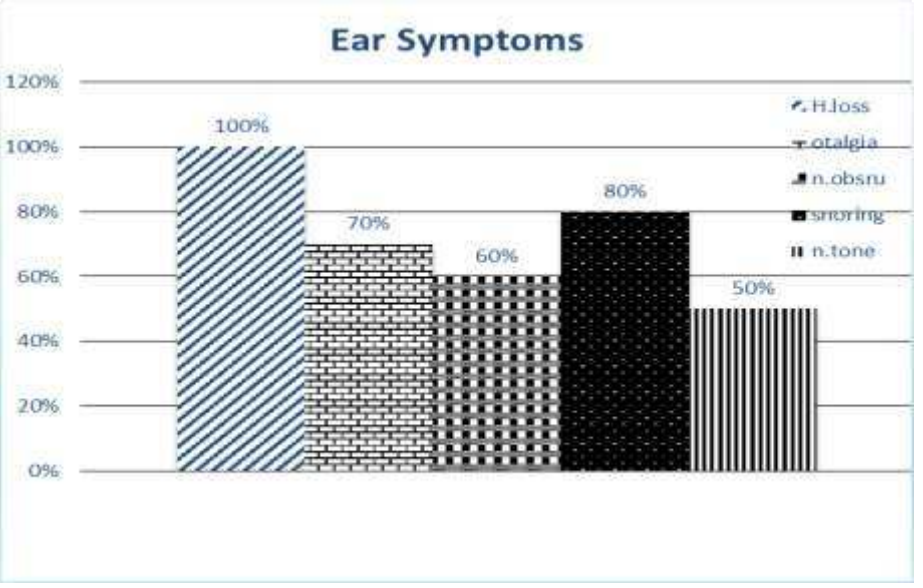

Figure (1): Symptoms distribuation of the study cases

Disscusion

Otitis media with effusion (OME) is the presence of fluid in the cavities of the middle ear with absence of signs or symptoms of acute infection[15] (Mawson, 1976). OME which has not respond to medical treatment for 3 months is the most common indications for tympanostomy tube (TT) placement[1] (CDC, 2008). Analysis of demographic data in the present study showed that 55% of the study cases were male child and 45% were female with no statistical significance between two groups. This finding was in agreement with[16] Atkinson *et al., 2015* who mentioned that There is no gender difference regarding incidence of OME . Regarding residence most of the study cases came from rural area 70% This finding was disagree with[17] *Essam et al., 2015* who mentioned that most of the cases in his study coming from urban areas.

Comparison between group I and II, one month post-operatively, there were statistical significant differences between two groups , the mean postoperative gain in AB gap was about 21.79 dB for group I and 17.73dB for group II with gain in A-B gap about 4db in group I higher than groupII. Comparison between

group I and II, two months post-operatively, there were statistical significant differences between two groups, the mean postoperative gain in AB gap was about 21.43 db for group I and 17.37db for group II with gain in A-B gap about 4db in group I higher than group II . this was agree with [20] Abbas and Shayani 2002, whose study was performed in 34 patients with mean age of 9 years. In patients operated for Antero superior ventilation tube (A S. VT) insertion, preoperative mean PTA-Gap 26.79 dB, and in patients operated for Antero inferior ventilation tube (AI VT) insertion was 24.53 dB. Post-operative results of PTA–Gap in A S. VT insertion was 16.88 dB in comparison to the AI VT results of 18.91 dB. The differences were significant ($p<0.01$).

After six months post operative there were statistical significant differences between two groups (p value<0.05), The mean postoperative gain in AB gap was about 20.93 db for group I and 16.3db for group II with gain in A-B gap about 4db in group I higher than group II this was agree with [21] Hassan et al., 2020 in comparative study of ventilation tubes insertion at antero superior quadrant with or without adenoidectomy with more hear gaining at antero superior quadrant with adenoidectomy.

Regarding complications at one month post operative In group I, tube is plugged in (2.5%) and otorrhea was present in (2.5%).. In group II, Tube was extruded in (5%) and plugged in (7.5%), Residual perforation was present in (5%), myringosclerosis seen in (2.5%) and otorrhea was prevelant in (7.5%). so at one month the prevelance of complications are relevant in anteroinferior tubes this agree with meta analytic study of [22] Kay *et al.,* 2001 which reported that tubes obstruction in 7% of ears and premature extrusion in 3.9% after TTs insertion in antero inferior quadrant. the prevalence of complications at two months of insertion of the tympanostomy tubes. In group I, Myrimgosclerosis was present in (10%), Plugged tube in (2.5%), Extrution of the tube in (5%), Residual perforation seen in (2.5%), Otorrhea in (2.5%) and recurrence of OME occurred in (2.5%). In group II, Tubes were extruded in (7.5%) and plugged in (7.5%), Residual perforation prevelant in (2.5%), Myringosclerosis seen in (12.5%), Otorrhea in (10%) and Recurrence of OME occurred in (5%). There were statistical significant differences between two groups , this was agree with the study of TulP et al., 2001 who found that plugged tube more at anteoinferior side and was common in about 8-22% of cases and residual perforation from 2% to 7%. According to the prevalence of complications at six months of insertion of the ventilation tubes (late complications). The most common complication was Myringosclerosis present in (25%) of cases in group I and (30%) of cases in group II, this was agree with the study of [23]Branco *et al.,* 2017 who mentioned that the anterior inferior quadrant was the most frequent location of for myringosclerosis with percentage of tympanic involvement higher than 25 %. Plugged tube (5%) in group I and (2.5 %) in group II). Residual perforation (2.5% in group I and II), this was agree with the study of TulP et al., 2001 as mentiond before . Recurrence of OME was occuried in 5 (12.5%) in group I and (20%) in group II, this was agree with the study of [20] Abbas and Shayani 2002 who mentioned that recurrence of OME was significantly higher at the antero-inferior side .

Our study founded that the prevalence of complications were higher at the anteroinferior side in addition to less hear gaining , this was agree with Morris,

1999 who mentioned that Anterosuperior placements is better matched to the natural anatomy of bony eustachian tube for ventilation of the middle ear, also agree with results of Abbas and Shayani 2002 study, who showed AS placement was associated with better recovery rate and low sequelae and easier performance versus AI placement, and he recommended that, VT insertion should be performed in AS quadrant and it is an excellent replacement for eustachian tube dysfunction, but other studies like Kivekas et al., 2015 mentioned the benefit of giving incision in anteroinferior quadrant because the tympanostomy tube remains at its place for longer time, ossicular chain damage is avoided and further hearing loss is prevented. Marcos and Timathy 1998 mentioned that anteroinferiar placement is associated with easier performing, also placement of the anterosuperioer (AS) quadrant reintroduced better middle ear and eustachian tube function. In addition AS quadrant insertion was associated with increasing retention time and perforation and AI quadrant with easy performance

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