The Egyptian Journal of Hospital Medicine (July 2017) Vol.68 (3), Page 1316-1324

Conservative Management versus Ventilation Tube Insertion in Children with Otitis Media with Effusion Accompanying Cleft Palate

Mohamed Abd El Raouf Masoud, Ayman Mohamed ElKahky, Mohamed Amir Hassan, Nadia Hassan Shahba

Department of Otorhinolaryngology, Faculty of Medicine, Ain Shams University

*Corresponding author: Nadia Hassan Shahba tel +201065333627 email: nadia.shahba89@gmail.com

ABSTRACT

Background: Otitis media with effusion (OME) is a collection of non-purulent fluid in the middle ear space; it is almost universal in children with cleft palate. Cleft palate (CP) is among the most common congenital malformations, with an overall incidence of around 1 in 700 individuals. Surgical closure of the cleft palate may lead to improvement in the audiological status of the patients, but whether early surgical correction can improve the middle ear status in CP children remains open for debate.

Aim: A meta-analytical study to evaluate and compare the outcome of ventilation tube insertion versus conservative management in management of otitis media with effusion accompanying cleft palate.

Methods: A review process was used to assess eligible studies drawn from included published medical articles about conservative management versus ventilation tube insertion in children with otitis media with effusion accompanying cleft palate through searching the Medline data base (www.pubmed.com) and Cochrane library. Then Data were extracted and analyzed from the included studies.

Results: 30 relevant articles were found, by application of inclusion criteria 8 articles were found meeting the inclusion criteria and could undergo Meta-analysis. Our results have shown that OME in children with repaired cleft palate can be managed satisfactorily without routine use of ventilation tube (VT). The presence of OME does not lead to long term complications in all patients. Hearing impairment due to OME can be satisfactorily treated with hearing aid (HA) in a majority of children. VT need to be inserted only if the child is not compliant with using a HA or develops recurrent suppurative otitis media. Patients should be followed-up closely for OME to prevent complications. **Conclusion:** Routine use of ventilation tube in CP patients should be discouraged; instead Treatment should be based on the need and willingness of the children and their parents. Also with respect to individual bases such when the child is proved to have OME and hearing loss that affect child language and speech development. Insertion of ventilation tubes should be offered as an alternative to hearing aids or conservative management by close otological and audiological follow up.

Keywords: - Otitis media with effusion, Cleft palate, ventilation tube, conservative management

INTRODUCTION

Otitis media with effusion (OME) is a collection of non-purulent fluid in the middle ear space; it is almost universal in children with cleft palate. Cleft palate (CP) is among the most common congenital malformations, with an overall incidence of around 1 in 700 individuals [(1)].

Children with cleft palate are highly susceptible to OME because of abnormal insertion of the levator veli palatini and tensor veli palatini muscles on the Eustachian tube, resulting in poor active opening of the tube and developing OME[(2).]

Surgical closure of the cleft palate may lead to improvement in the audiological status of the patients, but whether early surgical correction can improve the middle ear status in CP children remains open for debate [(3)]. In fact, CP patient will develop particular problems because of the earlier age of onset, prolonged course, higher rate of recurrence, higher incidence of surgery and later complications, and potential diagnostic difficulties [(4).] OME can impair hearing at stages thought to be important in the development of language, behavioral and social relationships. As a consequence it can influence the quality of life in these individuals [(5)].

The aim of this study is to evaluate different protocols for management of OME accompanying CP children. Outcomes measured in this study are effectiveness of ventilation tube insertion (VTI) versus conservative management for hearing, speech and language development. Complications and sequelae of the treatment modality in the form of tympanic membrane

Received: 12/ 06 /2017
Accepted: 21/ 06 /2017

DOI: 10.12816/0039668

perforation, retraction and tympanosclerosis were discussed.

MATERIAL AND METHODS

Eligibility Criteria

This study followed the methods used in Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Eligibility criteria were Studies

Inclusion criteria

Papers in English language, Papers in the last 30 years, only ones conducted on humans and comparing outcomes of two management protocols of treatment either conservatively or by inserting VT. The patient population was defined as children (<18 years old) diagnosed with any type of cleft palate, including unilateral or bilateral cleft palate with or without cleft lip, cleft palate only, and submucous cleft palate or Including patients follow up as regard one or more of the following: Hearing results-Language development- Complications or sequelae of treatment.

Exclusion criteria

Papers not in English language, Studies before 30 years, Patients without cleft palate or CP patients with other associated otological diseases, Papers not including follow up or Articles containing only one group of patients treated either conservatively or by inserting VT.

Only articles fulfilling the criteria of screening are included for further steps of data collection, analysis and reporting.

Screening and evaluation

Included published medical articles about conservative management versus ventilation tube insertion in children with otitis media with effusion accompanying cleft palate through searching the Medline data base (www.pubmed.com) and Cochrane library, following key words:

Otitis media with effusion in cleft palate patients, Cleft palate and glue ear, Timing of tympanostomy tube placement for cleft palate patients, Conservative management of OME in children with cleft palate or hearing loss in children with cleft palate.

Studies yielded by the Medline search, after blinding the author name and journal name, were screened by the investigators. Screen form of the articles:

Included articles: These are which fulfilled the above mentioned inclusion criteria.

Excluded articles: Articles which miss one or more of the above mentioned inclusion criteria or with one or more of the above mentioned exclusion criteria.

Irrelevant articles: articles that may have one of the keywords but different purpose from our study.

Relevant articles: after exclusion of repeated and non-relevant articles, articles which contain one or more from the above keywords were included.

IV) Data collection:

This study used a standardized data extraction sheet for the articles deemed eligible. Data were extracted from the included studies by 1 author and then checked by other authors.

The study was approved by the Ethics Board of Ain Shams University.

Statistical methods

Statistical analysis was done using MedCalc© version 15.8 (MedCalc© Software bvba, Ostend, Belgium).

VI) Reporting and interpretation (results).

Testing For Heterogeneity

Studies included in meta-analysis were tested for heterogeneity of the estimates using the following tests:

1. Cochran Q chi square test: A statistically significant test (p-value <0.1) denoted heterogeneity among the studies.
2. I-square (I^2) index which was interpreted as follows

- I^2 = 0% to 40%: unimportant heterogeneity
- I^2 = 30% to 60%: moderate heterogeneity
- I^2 =50% to 90%: substantial heterogeneity
- I^2 = 75% to 100%: considerable heterogeneity

Pooling of Estimates

Binary outcomes were compared by estimation of the odds ratio (OR) for unwanted outcomes with the intervention arm referenced to the conservative arm as a control. The 95% confidence limits for the effect size (OR) was provided as a measure of precision. Estimates from included studies were pooled using both the DerSimonian laird random-effects method (REM) and the Mantel-Haenszel fixed-effects method (FEM). The effect size estimated with the random-effects method was considered if there was evidence for heterogeneity across the studies. Otherwise, the fixed-effects estimates were considered.

Examination of publication bias

Publication bias was examined using the following methods:

1. Funnel plot

The funnel plot is a plot of the estimated effect size (OR) on the horizontal axis versus the standard error for the effect size (as a measure of study size) on the vertical axis. Large studies appear toward the top of the graph, and tend to cluster near the mean effect size. Smaller studies appear toward the bottom of the graph, and (since there is more sampling variation in effect size estimates in the smaller studies) will be dispersed across a range of values. In the absence of publication bias the studies are expected to be distributed symmetrically about the combined effect size. By contrast, in the presence of bias, it is expected that the bottom of the plot would show a higher concentration of studies on one side of the mean than the other. This would reflect the fact that smaller studies (which appear toward the bottom) are more likely to be published if they have larger than average effects, which makes them more likely to meet the criterion for statistical significance.

2. Duval and Tweedie's Trim and Fill

If the meta-analysis had captured all the relevant studies the funnel plot is expected to be symmetric. That is, it is expected that studies would be dispersed equally on either side of the overall effect. Therefore, if the funnel plot is actually asymmetric, with a relatively high number of small studies (representing a large effect size) falling toward the right of the mean effect and relatively few falling toward the left, one may be concerned that these left-hand studies may actually exist, and are missing from the analysis.

Duval and Tweedie's Trim and Fill method allows one to impute these studies. That is, one determines where the missing studies are likely to fall, adds them to the analysis, and then re-computes the combined effect.

The method is known as 'Trim and Fill' as the method initially trims the asymmetric studies from the right-hand side to locate the unbiased effect (in an iterative procedure), and then fills the plot by re-inserting the trimmed studies on the right as well as their imputed counterparts to the left of the mean effect.

RESULTS

Study Selection

Over 420 articles were found, after removal of duplicates they narrowed to about 260 articles, with application of exclusion criteria about 30 relevant articles were found, by application of inclusion criteria 8 articles were found meeting the inclusion criteria and could undergo Meta-analysis.

I. Comparative effectiveness of VTI versus conservative management for hearing, Speech and language outcomes.

A- Hearing:

Two retrospective cohort studies in this meta-analytical study [6,7] included comparisons of the hearing outcomes between children receiving VTI and those undergoing watchful waiting in a 3 to 9 year follow-up period. Normal hearing was defined as an average of the pure tone thresholds at 500Hz, 1 Hz, and 2 kHz of less than or equal 20 db. Studies are of moderate quality and level 4 of evidence.

The two studies included in our meta-analysis with total number of 157 patients and the effect was estimated using odds ratio, and P-value with CI 95%. There was substantial heterogeneity of the estimates reported by the included studies (Cochran Q3.810, p-value, 0.051; I2 (inconsistency) 73.6%).

Pooling of the studies using a fixed effects model showed an odds ratio of 1.561 with a 95% CI of 00.719 to 3.391which was not statistically significant (p-value, 0.260).

Table (1): Meta-analysis for abnormal Hearing

Study	Intervention	Control	Odds ratio	% CI	z	p-value
Gordon et al., 1988	14/48	6/50	3.020	1.050 to 8.680		
Robson et al., 1992	5/31	7/28	0.577	0.160 to 2.083		
Total (fixed effects)	**19/79**	**13/78**	**1.561**	**0.719 to 3.391**	**1.125**	**0.260**

Test for heterogeneity	
Q	3.810
DF	1
p-value	0.051
I^2 *(inconsistency)*	73.6%
95% CI for I^2	0.00 to 94.1

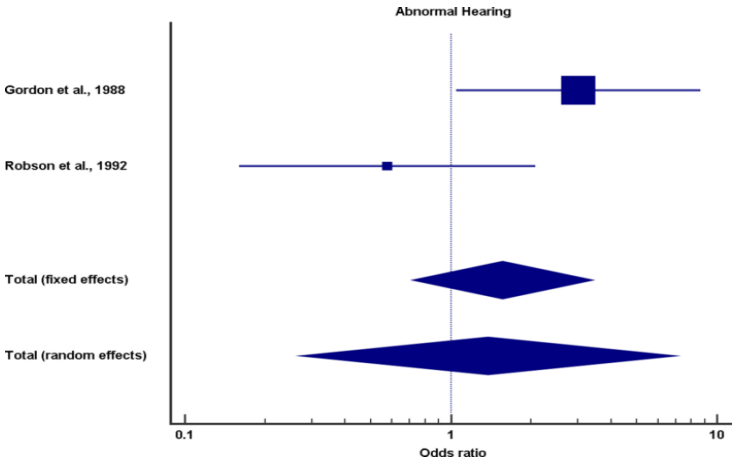

Figure (1): forest plot showing the odds ratio for development of abnormal hearing.

B- Speech and language development:

In our study, comparisons of speech and language outcomes between children with and without VTI for OME were performed in 3 studies [7, 8, 9]. Two of them are moderate quality retrospective cohort studies and showed that VTI is beneficial for speech and language outcomes in children with cleft palate and OME [8, 9].

The three included articles in our meta-analysis had total number of 313 CP patients. Speech and language development were assessed at the age of three and followed up then reassessed at the age of five. This period was supposed to be critical for language development.

The effect was estimated using odds ratio, and P-value with CI 95%.There was moderate heterogeneity of the estimates reported by the included studies (Cochran Q3.764, p-value, 0.152; I2 (inconsistency) 46.9%).

Pooling of the studies using a fixed effects model showed an odds ratio of 0.448 with a 95% CI of 0.251 to 0.800 which was statistically significant (p-value, 0.007) favoring interventional management. Using Trim and Fill the imputed point estimate is 0.274 (0.167 to 0.452).

Table (2): Meta-analysis for abnormal speech.

Study	Intervention	Control	Odds ratio	95% CI	z	p-value
Kobayashi et al., 2012	9/82	31/100	0.274	0.122 to 0.618		
Robson et al., 1992	6/31	5/28	1.104	0.296 to 4.112		
Shwan et al., 2003	15/20	42/52	0.714	0.210 to 2.431		
Total (fixed effects)	**30/133**	**78/180**	**0.448**	**0.251 to 0.800**	**-2.717**	**0.007**
Total (random effects)	30/133	78/180	0.529	0.222 to 1.262	-1.436	0.151
Test for heterogeneity						
Q	3.764					
DF	2					
p-value	0.152					
I^2 *(inconsistency)*	46.9%					
95% CI for I^2	0.0 to 84.4					

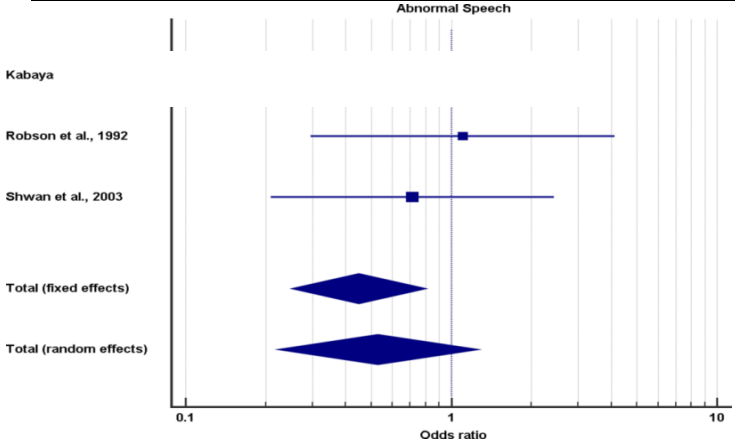

Figure (2): forest plot showing the odds ratio for development of abnormal speech.

II.Complications and sequelae of VT insertion versus conservative management for OME in CP patients.

Six of the articles included in this study reported post-VTI complications and sequelae [6,7,10,11,12,13].

We extracted the results as regard tympanic membrane perforation, retraction and tympanosclerosis.

It provided comparisons of these problems in cases where VTI was or was not implemented to deal with OME. Patients who did not receive VTI were managed conservatively either by watchful waiting or using hearing aids. Data obtained from these articles revealed significantly higher rate of complications among children who received VTI, compared with those who did not receive this treatment. Among the various types of ation, eardrum perforations (incidence 1.3%–19%) are the most commonly reported sequelae after VTI, followed by eardrum retraction (incidence 11.5%–36.8%) and tympanosclerosis (incidence 11%–37%).

A-tympanic membrane perforation:

As regard tympanic membrane perforation, four retrospective cohort, moderate quality and level 4 of evidence studies were included in our meta-analysis with total number of 366 CP patients [6, 10, 11, 12].

pooling of the four studies using a fixed effects model showed an odds ratio of 9.119 with a 95% CI of 2.120 to 39.226 which was statistically significant (p-value, 0.003) favoring conservative management. Measures of heterogeneity revealed unimportant heterogeneity of the estimates reported by the included studies (Cochran Q1.479, p-value, 0.687; I^2 *(inconsistency)* 0.0%). Under the fixed effect model the point estimate and 95% confidence interval for the combined studies is 9.119 (2.120 to 39.226). Using Trim and Fill, these values are unchanged.

Table (3): Meta-analysis for ear drum perforation.

N Study	Intervention	Controls	Odds ratio	95% CI	Z	p-value
Gani et al., 2012	5/47	0/24	6.341	0.336 to 119.648		
Gordon et al., 1988	7/50	0/50	17.414	0.967 to 313.749		
Kwan et al., 2011	1/80	0/45	1.717	0.069 to 43.030		
Maheshwar et al., 2002	4/26	0/44	17.800	0.917 to 345.385		
Total (fixed effects)	**17/203**	**0/163**	**9.119**	**2.120 to 39.226**	**2.969**	**0.003**
Total (random effects)	17/203	0/163	8.159	1.824 to 36.495	2.746	0.006
Tests for heterogeneity						
Cochran Q	1.479					
DF	3					
p-value	0.687					
I^2 *(inconsistency)*	0.0%					
95% CI for I^2	0.0 to 73.8					

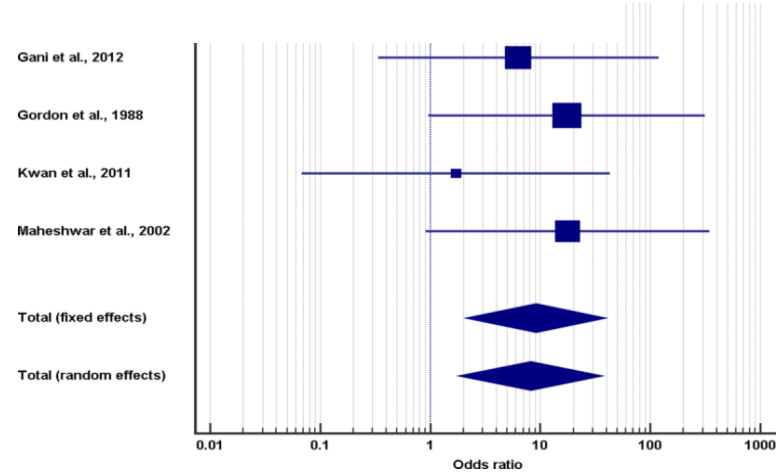

Figure (3): forest plot showing the odds ratio for occurrence of ear drum perforation.

B- Tympanic membrane retraction:

As regard tympanic membrane retraction, five articles were included [6, 7, 10, 11, 12]. Pooling of their results using a fixed effects model showed an odds ratio of 4.658 with a 95% CI of 2.046 to 10.603 which was statistically significant (p-value, <0.001) favoring conservative management. Measures of heterogeneity revealed unimportant heterogeneity of the estimates reported by the included studies (Cochran Q1.323, p-value, 0.858; I2 (inconsistency) 0.0%). Under the fixed effect model the point estimate and 95% confidence interval for the combined studies is 4.658 (2.046 to 10.603). Using Trim and Fill, these values are unchanged.

Table (4): Meta-analysis for ear drum retraction.

Study	Intervention	Controls	Odds ratio	95% CI	Z	p-value
Gani et al., 2012	1/47	0/24	1.581	0.062 to 40.273		
Gordon et al., 1988	11/50	4/50	3.244	0.956 to 11.001		
Kwan et al., 2011	5/80	0/45	6.629	0.358 to 122.715		
Maheshwar et al., 2002	3/26	1/44	5.609	0.552 to 57.024		
Robson et al., 1992	12/31	2/28	8.211	1.642 to 41.060		
Total (fixed effects)	**32/234**	**7/191**	**4.658**	**2.046 to 10.603**	**3.666**	**<0.001**
Total (random effects)	32/234	7/191	4.498	1.963 to 10.304	3.555	<0.001
Tests for heterogeneity						
Cochran Q	1.323					
DF	4					
p-value	0.858					
I^2 (inconsistency)	0.0%					
95% CI for I^2	0.0 to 40.79					

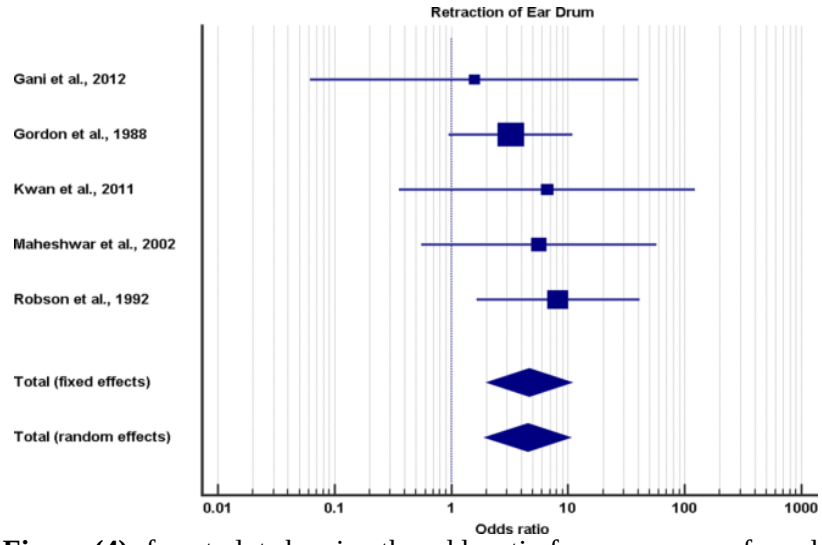

Figure (4): forest plot showing the odds ratio for occurrence of ear drum retraction.

C- Tympanosclerosis:

As regard tympanosclerosis: Pooling of the five studies [6,7,10,11,13] using a random effects model showed an odds ratio of 4.671 with a 95% CI of 0.494 to 44.136 which was not statistically significant (p-value, 0.179) denoting equivalence of both management strategies. Measures of heterogeneity revealed considerable heterogeneity of the estimates reported by the included studies (Cochran Q19.424, p-value, 0.0006; I2 (inconsistency) 79.41%).

Under the random effects model the point estimate and 95% confidence interval for the combined studies is 4.671 (0.494 to 44.136). Using Trim and Fill, 3 studies are missing and the imputed point estimate is 0.531 (0.055 to 5.118).

Table (5): Meta-analysis for tympanosclerosis.

Study	Intervention	Controls	Odds ratio	95% CI	z	p-value
Ezzi et al., 2015	3/67	14/87	0.244	0.0672 to 0.889		
Gani et al., 2012	5/47	0/24	6.341	0.336 to 119.648		
Gordon et al., 1988	16/50	1/50	23.059	2.918 to 182.216		
Kwan et al., 2011	5/80	0/45	6.629	0.358 to 122.715		
Robson et al., 1992	8/31	0/25	18.447	1.008 to 337.530		
Total (fixed effects)	37/275	15/231	2.420	1.306 to 4.483	2.809	0.005
Total (random effects)	**37/275**	**15/231**	**4.671**	**0.494 to 44.136**	**1.345**	**0.179**
Tests for heterogeneity						
Cochran Q	19.424					
DF	4					
p-value	**0.0006**					
I^2 *(inconsistency)*	79.41%					
95% CI for I^2	51.17 to 91.32					

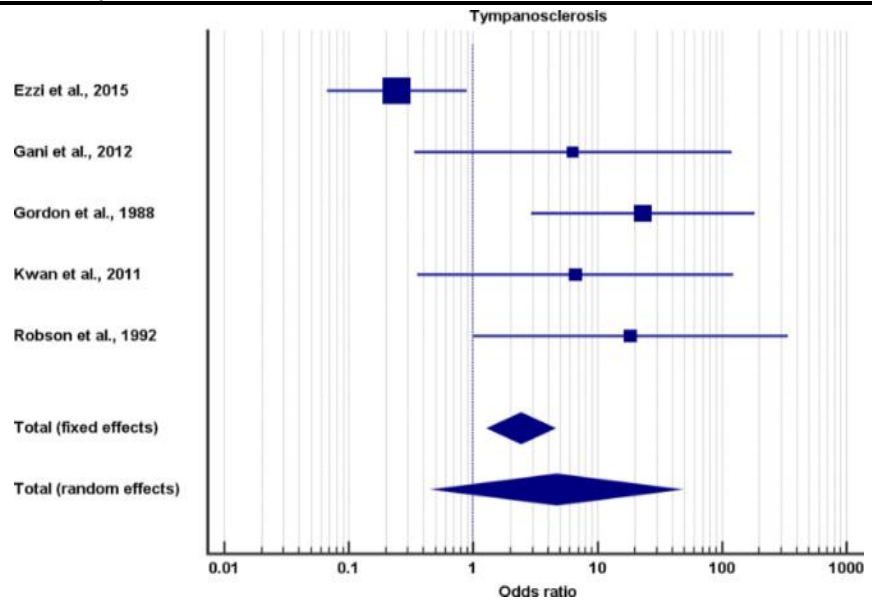

Figure (5): forest plot showing the odds ratio for occurrence of tympanosclerosis.

DISCUSSION

The care of children with cleft palate who are suspected of having OME should be undertaken by the local otological and audiological services with expertise in assessing and treating these children in contact with the regional multidisciplinary cleft lip and palate team [14].

Management of OME in cleft palate children is a controversial issue; some believe that surgical intervention by routine ventilation tube insertion is very helpful and advocate it, while others do not recommend the aggressive treatment and prefer conservative management in the form of watchful waiting or using hearing aids.

The purpose of ventilation tube insertion in cleft palate patients is to improve hearing at an important cognitive and language learning time and also to try and prevent long-term ear disease However, the insertion of ventilation tubes should not solely be based on the presence of fluid in the middle ear [6].

In our study we have shown that OME in children with repaired cleft palate can be managed satisfactorily without routine use of VT. The presence of OME does not lead to long term complications in all patients. Hearing impairment due to OME can be satisfactorily treated with HA in a majority of children. VT need to be inserted only if the child is not compliant with using a HA or develops recurrent suppurative otitis media. Patients should be followed-up closely for OME to prevent complications.

Owing to the results of our meta-analysis, , it was found that hearing acuity was less impaired in the active treatment group, though the small difference in magnitude may mean limited clinical importance. Speech and language development were better in group underwent VTI. Higher complications rate was recorded with the intervention group. By following the conservative policy, our complication rate is minimal and the children have satisfactory hearing levels. The lack of evidence on the optimal treatment for OME in children with CLP should raise the attention for a relatively conservative approach. However, only a consensus between patients/parents and surgeons regarding the most suitable treatment strategy for OME can ensure the greatest benefit to individual patients. Future, more focused, well conducted; adequately powered randomized control trials could be considered.

The main limitation of our study was that the included articles included small sample size, different age groups and different periods of follow up. The heterogeneous nature of these studies made the meta-analysis difficult. There are few well-conducted, high-quality, and randomized controlled trials (RCTs). One of the reasons may be that most parents need strong recommendations on effective treatment rather than allowing their children to be randomly selected into either an experimental or control group, especially if these children have undergone or will undergo a series of major invasive surgeries following birth. Another reason for the lack of adequately powered RCTs in this population is that it might be harder to obtain ethical permission for this group of patients.

Future, more focused, well conducted randomized control trials could be considered on a specified age group, or standardizing a particular practice to determine the most appropriate protocol for management of OME in cleft palate populations. These suggestions are consistent with the research recommendations recently published by the UK National Institute for Health and Clinical Excellence [4], which stated; “There is no doubt that studies of OME in patients with CP require careful planning, multidisciplinary teamwork, and long-term follow up. Furthermore, there are also many different outcome measures that need to be assessed. Experiences and results obtained from existing studies on cleft and non-cleft populations can help inform future studies in children with cleft lip and palate”.

CONCLUSION

Owing to the results of our meta-analysis, it was found that hearing acuity was less impaired in the active treatment group, though the small difference in magnitude may mean limited clinical importance. Speech and language development were better in group underwent VTI. Higher complications rate was recorded with the intervention group. By following the conservative policy, complication rate is minimal and the children have satisfactory hearing levels.

REFERENCES

1- Flynn T, Möller C, Jönsson R, Lohmander A (2009): The high prevalence of otitis media with effusion in children with cleft lip and palate as compared to children without clefts. Int J Pediatr Otorhinolaryngol., 73(10):1441-6.

2- Dougherty W, Kesser BW (2015): Management of conductive hearing loss in children. Otolaryngologic Clinics of North America, 31(6):955-74.

3- Yang FF, Mcpherson B (2007): Assessment and management of hearing loss in children with cleft lip and/or palate. Asian Journal of Oral and Maxillofacial Surgery, 19(2):77-88.

4- NICE Clinical Guideline (2008): Surgical Management of Otitis Media with Effusion in Children, National Collaborating Centre for Women‟s and Children‟s Health (UK), London, http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0009526/.

5- Harman NL, Bruce IA, Callery P, Tierney S, Sharif MO, O'Brien K, Williamson PR (2013): MOMENT–Management of Otitis Media with Effusion in Cleft Palate, protocol for a systematic review of the literature and identification of a core outcome set using a Delphi survey, 14(1):70.

6- Gordon AS, Jean-Louis F, Morton RP (1988): Late ear sequelae in cleft palate patients. Int J PediatrOtorhinolaryngol., 15(2):149-56.

7- Robson AK, Blanshard JD, Jones K, Albery EH, Smith IM, Maw AR (19920: A conservative approach to the management of otitis media with effusion in cleft palate children.The Journal of Laryngology & Otology, 106(9):788-92.

8- Kobayashi H, Sakuma T, Yamada N, Suzaki H (2012): Clinical outcomes of ventilation tube placement in children with cleft palate. Int J PediatrOtorhinolaryngol., 76(5):718-21.

9- Shaw R, Richardson D, McMahon S (2003): Conservative management of otitis media in cleft palate. Journal of Cranio-Maxillofacial Surgery, 31(5):316-20.

10- Gani B, Kinshuck AJ, Sharma R (2012):A review of hearing loss in cleft palate patients.Int J PediatrOtorhinolaryngol., 12:2012.

11- Kwan WM, Abdullah VJ, Liu K, van Hasselt CA, Tong MC(2011): Otitis media with effusion and hearing loss in Chinese children with cleft lip and palate. The Cleft Palate-Craniofacial Journal, 48(6):684-9.

12- Maheshwar AA, Milling MA, Kumar M, Clayton MI, Thomas A(2002): Use of hearing aids in the management of children with cleft palate. Int J PediatrOtorhinolaryngol., 66(1):55-62.

13- El Ezzi O, Herzog G, Broome M, Trichet-Zbinden C, Hohlfeld J, Cherpillod J, de Buys Roessingh AS (2015): Grommets and speech at three and six years in children born with total cleft or cleft palate.IntJ PediatrOtorhinolaryngol., 79(12):2243-7.

14- Khanna R, Lakhanpaul M, Bull PD (2008): Surgical management of otitis media with effusion in children: summary of NICE guidance. Clinical Otolaryngology, 33(6):600-5.