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Complications of Shepard tympanostomy tube in children and the effect of adenoidectomy on it

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Abstract

Background & objectives: the aim of the study is to evaluate the postoperative complications following tympanostomy tube insertion for children with otitis media with effusion and the effect of adenoidectomy on the complications.

Methods: This is a case series study on 78 patients who underwent Shepard tympanostomy tube insertion, adenoidectomy was done for 52 of them. The operated cases for the period between March 2016 to March 2017 were included in the study, the patients were followed up postoperatively by a thorough otoscopic examination (by microscope or endoscope) at 1 week and at 1 month. Further control examinations were done once in every 3 months for further two years.

Results: Seventy four children enrolled in the study, 43 were male and 31 were female, aged 3-12 years. Early otorrhea occurred in (0.7%), late otorrhea occurred in (4.7%), granulation tissue was seen in (2.0%), early extrusion in (3.4%), plugged tubes in (0.7%), persistent perforation in (1.4%), myringosclerosis in (22.3%), atrophy in (0.7%). In three patients; two complications occurred in the same ear as follows: late otorrhea and myringosclerosis in the same ear in (1.4%), late otorrhea and persistent perforation in (0.7%), early otorrhea and atrophy in (0.7%). In our study medial displacement, retraction and cholesteatoma were not seen.

Conclusions: Shepard tympanostomy tube insertion is an effective and safe procedure; nevertheless, it is associated with complications. Over all complications were less in patients who underwent tympanostomy tube insertion with adenoidectomy, especially late otorrhea

Keywords: Otitis media with effusion; Tympanostomy tube; Grommet.

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Introduction

Otitis media with effusion (OME) is a disease characterized by the presence of fluid in the middle ear cavity behind intact tympanic membrane of different viscosity lasting at least three months[1]. It is regarded as a sequel of the inflammation that happens following recurrent attacks of acute otitis media, this fact is established in experimental studies on animals[2]. Otitis media is regarded as a common disease in childhood; nearly 90% of children have experienced at least one attack of otitis media under the age of two years[3,4].Appropriate diagnostic measures include children and parent's reports, complete otolaryngological examination focusing on microscopic or ear examination, tympanometry and hearing test[1]. Established bilateral OME may lead to ongoing cognitive and language problem in the diseased child[5,6]. Armstrong in 1954 presented tympanostomy or ventilation tube treatment to resolve otitis media with effusion, reinstate hearing, and avoid language developmental problems[7]. Currently tympanostomy tubes have been considered effectual treatment modality for persistent otitis media with effusion. The routine indications for ventilation tube insertion are; persistent otitis media with effusion, recurrent acute suppurative otitis media, and chronic hypoventilation of the middle ear[8]. Standard pattern ventilation tubes like Shepard, Shah remain in place for a shorter period than longer- term T-tube designs, but the longer a tube stays in situ, the higher incidence of complications[9].In United States; tympanostomy tube insertion is one of the most common surgeries in pediatric patients and the main reason a child receives general anesthesia[10]. The expected gain from the surgical procedure is the restoration of ventilation of the middle ear, and a fast increase in hearing[11].Adenoids have a role in the pathogenesis of OME by mechanical obstruction of the Eustachian tube (Hypertrophy) or functional obstruction due to inflammation (adenoiditis), If ventilation tubes are to be inserted, adenoidectomy is considered effectual adjuvant procedure[9]. Even though tympanostmy tube insertion is considered an easy procedure with significant benefits, complications can occur[12]. The chief complications of tympanostomy tubes insertion incorporate; otorrhea, blocked tubes, early extrusion, granulation tissue, myringosclerosis,

perforation of the tympanic membrane, atrophy, retraction, medial displacement of tube and rarely cholesteatoma[13,14]. Kenna et al added recurrence of effusion, although minor, is regarded as a concern[15]. The objective of this study is to determine tympanostomy tube complications in children with chronic otitis media with effusion who were treated with Shepard grommet tympanostomy tube insertion and the effect of adenoidectomy on the rate of complications. This tube type was chosen, as it is the most commonly used one in our hospital.

Patients and methods

Seventy-eight children scheduled for bilateral tympanostomy tube insertion at Rizgari teaching Hospital with diagnosis of bilateral chronic otitis media with effusion following failure of medical treatment for more than 3 months were enrolled in this study. In 52 patients, in addition to tympanostomy tube insertion adenoidectomy was done. Cases operated between March 2016 to March 2017, all patients followed up regularly for two years. The diagnoses were made by otomicroscopic examination, tympanometry and pure-tone audiometry when it's applicable. Written informed parental consent for participants were obtained, to whom full explanations about the study was given. Surgery was done under general anesthesia. A fluoroplastic ventilation Shepard tube, from Xomed, with 1.14 nm, was used in all cases. Adenoidectomy was done under general anesthesia, patient was placed in Rose position using a head light and mouth gag. The adenoid was removed by curette. All cases were examined postoperatively at 1 week and 1 month, then once in every 3 months for two years. Frequency of otorrhea, blocked tubes, granulation tissue, medial displacement, persistent perforations in addition structural tympanic membrane changes after extrusion of tympanostomy tubes like (myringosclerosis, atrophy, retraction) and cholestatoma were recorded. The exclusion criteria were the existence of myringosclerosis before surgery; patients skipping follow up appointments. Analysis of data done by Statistical Package for the Social Sciences (SPSS) Version 25. For difference T test, and for relation Chi-square test were used. The level of significance adopted was = 0.05. The study was approved by the ethical committee in college of Medicine /Hawler Medical University.

Results

All 78 children included in the study received insertion of tympanostomy tubes bilaterally, totaling 156 operated ears. The children were between 3-12 years of age. Four patients were excluded because of loss of follow-up after the first postoperative assessment, 43 (58.1%) were male and 31 (41.9%) were female. Demographic data shown in Table (1).

Table (1): Age Distribution

Age	Frequency	Percent
3	12	16.2
4	12	16.2
5	16	21.6
6	11	14.9
7	13	17.6
8	6	8.1
9	1	1.4
11	1	1.4
12	2	2.7
Total	74	100.0

In 52 (70.27%) cases; adenoidectomy was done with the tympanostomy tube insertion while in 22 patients (29.729%) only the tympanostomy tube insertion was done. Table (2).

Table (2): Gender Distribution according to type of operation.

	Gender		Total
	Male	Female	
Ventilation tube+ Adenoidectomy	26	26	52
Ventilation tube	17	5	22
Total	43	31	74

Among 148 ears; complications were: early otorrhea occurred in 1 (0.7%), late otorrhea occurred in 7 (4.7%), granulation tissue was seen in 3 (2.0%), early extrusion in 5 (3.4%), plugged tubes in 1 (0.7%), persistent perforation in 2(1.4%), myringosclerosis in 33 (22.3%), atrophy in (0.7%), late otorrhea and myringosclerosis in 2(1.4%), late otorrhea and persistent perforation in 1(0.7%), early otorrhea and atrophy in (0.7%). Medial displacement, retraction and cholesteatoma were not seen as shown in Table (3).

Table (3): Complications of Shepard Tympanostomy tube.

			Type of Operation		
	Frequency	**Percent**	**Ventilation tube + Adenoidectomy**	**Ventilation tube**	**p- value**
No Complications	91	61.5	70	21	0.015
Early Otorrhea	1	0.7	1	0	
Late Otorrhea	7	4.7	2	5	
Plugged tubes	1	0.7	1	0	
Granulation tissue	3	2.0	1	2	
Early extrusion	5	3.4	2	3	
Myringosclerosis	33	22.3	25	8	
Persistent perforation	2	1.4	1	1	
Atrophy	1	0.7	1	0	
Late Otorrhea and Myringosclerosis	2	1.4	0	2	
Late Otorrhea and Persistent perforation	1	0.7	0	1	
Early Otorrhea and Atrophy	1	0.7	0	1	
Total	148	100.0	104	44	

The most common complications were otorrhea and myringosclerosis. Regarding early otorrhea, p- value was not significant among patients who underwent ventilation tube insertion and those who did ventilation tube insertion and adenoidectomy, but it was significant in late otorrhea. Regarding myringosclerosis p- value was not significant among patients who underwent ventilation tube insertion and those who did ventilation tube insertion and adenoidectomy, as shown in table(4).

Table (4): Type of operation, relation to otorrhea and myringosclerosis.

	Type of operation		**Total**	**p- value**
	Ventilation tube+ Adenoidectomy	**Ventilation tube**		
Non - Early Otorrhea	103	44	147	0.514
Early Otorrhea	1	0	1	
Non - Late Otorrhea	102	39	141	0.013
Late Otorrhea	2	5	7	
Non-Myringosclerosis	79	36	115	0.434
Myringosclerosis	25	8	33	
Total	104	44	148	

Discussion

Tympanostomy tube insertion is a common surgical procedure performed for children in otolaryngology practice. Otorrhea is one of the most frequent complications of this procedure. The incidence ranges from 0.8 to 83%[8,16]. Early otorrhea occurs within 2–4 weeks postoperatively, and delayed otorrhea seems more common after first month postoperatively[17]. Otorrhoea in association with a ventilation tube in situ may occur after an acute upper respiratory tract infection or can be the result of a chronic biofilm infection of the tube itself [9]. In this study early otorrhea within the first four weeks postoperatively was (0.7%), late otorrhea occurred in (4.7%), they were treated with systemic antibiotic and topical antibiotic/corticosteroid drugs. Kay et al in his meta-analysis study, had found early otorrhea in 16% of patients and delayed

otorrhea in 26% of patients[13]. Higher occurrence of otorrhea is reported in long-term tubes like T-tubes (32.5%) than short trem tubes like Shepard and Shah (14.8%)[13]. In other studies; otorrhea rates were (5.3%), (8.2%) and (47.3%) respectively[18-20]. Klopp-Dutote[21] and Yaman[22] who used (Shepard grommet-type) otorrhoea occurred in (4.6%), (5.6%) respectively. The results in these two studies are nearest to our results, as they used Shepard ventilation tubes. In the literature; several factors were mentioned contributing for the occurrence of otorrhea such as younger age, external auditory canal contamination during surgery, upper respiratory tract infection, mucoid or purulent middle ear effusions[8,23]. Otorrhea is not serious in most cases. In our study; it was less than in many other studies we mentioned because in all our cases we used topical antibiotics (ciprofloxacin) 3 times a day for 3 days postoperatively. In this study, granulation tissue was seen in three ears (2.0%), which was accompanied by otorrhea. In meta-analysis by Kay; the mean incidence of granulation tissue occurring after tympanostomy tube insertion was less than 5%[13]. This complication rate was 0.3% for Shepard tubes, and 13% for T-tubes[8]. Yaman et al reported granulation tissue as (1.2%)[22], which is similar to our results. We treated our cases of granulation tissue with topical antibiotic–steroid ear drops. Plugged tubes occurred in one ear (0.7%) in our study and we treated it by a simple suction, while in a study by Ragab et al was (6.3 %) [18]. Erdoglija and Kay reported early extrusion of tube in (3.9%) of their cases[1,13]. While in a study by Ragab et al the result was (2.1%)[18]. This result is similar to our results (3.4%). Possible causes of early extrusion are otorrhoea, quadrant of insertion of tube, large myringotomy and the character of the fluid[1,18]. In Our study persistent perforation was found in (1.4%). Klopp-Dutote reported perforation of the tympanic membrane in (6.5%)[21]. Yaman et al reported persistent perforation in (5.6%), several types of patching materials including paper, absorbable gelatin film, and fat plug was used to treat persistent perforation after tube removal[22]. Brown et al reported the rate of persistent perforation with short-term tubes and long-term tubes was significantly different (6.6% and 20% respectively)[23]. These results are in accordance to our results regarding short term tubes,_we didn't use paper patching for the persistent perforation, and follow up of these patients is necessary

to ensure that the eustachian function is good before closing the perforation.

Myringosclerosis is a pathological condition that occurs when tissue restoration happens, wherein high amounts of collagenic tissue are accumulated in the lamina propria that covers the ossicles, the walls of the middle ear cavity and the medial layer of the tympanic membrane. Clinically it is important if it affects the hearing through interfering with sound transmission through middle ear structures[24]. In a study by Yaman et al[22], myringosclerosis was the most common late complication of tympanostomy tube insertion; the incidence rate was of 34.6%. The occurrence of this complication was similar to what is reported by Kay et al. and Johnston et al. [13,25], in which this complication was seen in 32% and 40.4% respectively. It was usually situated on the inferior quadrants of eardrum. Klopp - Dutote et al in his last follow-up, had found that the most common complications were tympanosclerosis (6.9%)[21]. Ragab et al reported myringosclerosis in (1.6%) ears[18]. Saki et al reported myringosclerosis in (37.9%)[19]. In a study by Branco et al myringosclerosis was identified in (35.4%) of the operated ears[24]. Myringosclerosis was observed in 22.3% in our study. Again we can see discrepancy in results of different studies because of different materials and types of tube used and the duration of follow up. Serious complications may be due to atrophy like spontaneous perforations. Segmental atrophy seems to be produced by the tube insertion where as thickening and minor atrophic scars are more related to middle ear diseases[18]. Yaman et al reported atrophy of tympanic membrane in (23.5%) without hearing loss[22]. Ragab et al found atrophy in (0.5%) of ears that had been operated on, with no effect on hearing[18]. In our study atrophy was (0.7%). We think that the variability in the results due to the variable tube types and relatively short follow up period postoperatively. Yaman et al reported retraction of tympanic membrane in (16.7%) with maximum follow up of 66 months[22]. No retraction was found in our study, probably because of the short duration of the follow up comparing to the mentioned studies. Medial displacement of tympanosto my tubes are very rare[13]. We didn't have this complication in our study. Cholesteatoma as a sequel to tympanostomy tube insertion is very rare, but it is the most serious complication after tympanostomy tube insertion, for short-term tubes, the incidence is 0.8%[13,17]. However we didn't have cholestatoma in our study. We suspect that

cholesteatoma in the reported cases is related to disease process and not to tube insertion as both diseases usually occur because of poor Eustachian tube function.

Regarding late otorrhea, p- value was significant (0.013) among patients who underwent ventilation tube insertion and those who did ventilation tube insertion and adenoidectomy, Children operated for ventilation tube placement with adenoidectomy presented a significantly smaller number of otorrhea episodes (P=0.02)[20]. Hao et al in his study found that adenoidectomy was a preventive factor for upper respiratory tract infection[25]. In the Meta- analysis by Samantha and Matthew, Ten studies (n = 71 353) reported that primary adenoidectomy with tympanostomy tube insertion decreased the risk of recurrent acute otitis media or otorrhea compared with only tympanostomy tube insertion, while Four studies (n = 538) reported no such a difference[26].

Conclusions

There are considerable complications associated with tympanostomy tube insertion, which are nearly similar to what are reported in other centers worldwide.

Complication rates are less when adenoidectomy done in addition to tympanostomy tube insertion. Physicians should explain the possible post-operative complications to patient`s parents.

Conflict of interests

The authors recorded no conflict of interests.

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