Follow-up of 366 ears after tympanostomy tube insertion: Why is it draining?

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OBJECTIVE: **Tympanostomy tube insertion is one of the most frequently performed procedures in otolaryngology. Complications, such as otorrhea, tympanosclerosis, and cholesteatoma, have been reported in the literature after its application.**

STUDY DESIGN: **This study reports the complications encountered with 239 children (439 ears) with a follow-up of 7 to 73 months (median, 29 months) after tympanostomy tube insertion. Hearing results and middle ear pressures were compared and complications were noted in 366 ears that were available for the study.**

RESULTS: **Otorrhea developed in 3 (0.8%) cases. Tympanosclerosis was seen in 74 (20.2%) cases. Tympanic membrane perforation, retraction pocket, granulation tissue, and atelectasis were seen in 4.6%, 5.2%, 1.1%, and 6%, respectively. No patients developed cholesteatoma after tube insertion. Hearing results were improved postoperatively in 93.4% of patients (median, 14.2 dB) and worse in 6.6% of patients (median, 8.3 dB). The average extrusion time was 7.3 months for grommet and 16.3 months for T-tubes.**

CONCLUSION: **Multifactor etiologies show some unsolved or misunderstood underlying pathology, or unmentioned environmental factor such as atopy due to rich flora and humidity might exist to consider in the pathophysiology of the otorrhea.**

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Since the introduction of the ventilation tube for the treatment of persistent middle ear effusions by Armstrong,[1] tympanostomy tubes have become an effective treatment modality for otitis media with effusion. Persistent otitis media with effusion, recurrent acute suppurative otitis media, and chronic hypoventilation of the middle ear are the usual indications for ventilation tube insertion (TTI).[2]

The complications following TTI include otorrhea, tympanosclerosis, tympanic membrane perforation, atelectasis, granulation tissue, retraction pockets, hearing loss, ossicular erosion, and cholesteatoma.[2-4] The relatively high rate of otorrhea in the English-language literature drew our attention to complications of TTI procedures in our patients, particularly in regard to otorrhea. The purpose of this study was to evaluate complications, especially otorrhea, in our series.

PATIENTS AND METHODS

From January 1996 to September 2001, 239 children (439 ears) undergoing myringotomy with TTI at the Inonu University Medical Faculty, Department of Otorhinolaryngology, Turkey, were included in this study. The mean age was 5.8 years (range, 10 months to 12 years). One hundred thirty-nine children were boys and 100 were girls. Indication for tympanostomy tube application was chronic otitis media with effusion after failure of 2 or more courses of antibiotic therapy. Preoperative pure-tone audiograms were obtained for all of the patients who could adapt to the test. Tympanograms were obtained from all of the patients preoperatively. Otoscopic and tympanometric findings were consistent with the diagnosis of chronic otitis media with effusion in all cases.

Operations were carried out under general anesthesia. Preoperative antibiotics (sulbactam plus ampicillin) were used. The outer ear canal was prepared with povidone-iodine solution. The patients were operated under a microscope under sterile conditions. Cerumen was cleared by suction and cerumen curettes. The myringotomy incision was placed mostly in the anteroinferior quadrant. Middle ear fluid was aspirated. Shepard grommet tympanostomy tubes were inserted in 409 and T-tubes were inserted in 30 cases. Adenoidectomy was performed in 162 and tonsillectomy in 59 children. Postoperative antibiotic therapy was used for 1 week after surgery. No topical antimi-

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Table 1. Type of tubes used and complications

Type of tube	No. of ears	Perforation		Retraction pocket	
		n	%	n	%
Shepard	343	15	4.4	18	5.2
T-tube	23	2	8.7	1	4.3
Total	366	17	4.6	19	5.2

crobial prophylaxis or saline irrigation was used. The parents were recommended to protect the child's ears from water with an earplug during swimming or bathing.

All cases were examined postoperatively at 1 week, at 1, 3, and 6 months, and (most of the subjects) at 12, 24, 36, and 48 months after surgery. Follow-up periods were 7 to 73 months (median, 29 months). When this study was planned, all of the children were called for final examination and audiometric and tympanometric evaluation. Otoscopic examination was conducted carefully, and the presence of otorrhea, tube patency, perforation, tympanosclerosis, cholesteatoma, retraction pocket, and atelectasis was checked. Purulant or mucupurulant discharge from the middle ear in an early or a late period after TTI was accepted as otorrhea in this study. Tympanometric and audiometric evaluations were obtained after the tympanostomy tube was rejected and compared with preoperative audiologic findings.

RESULTS

Follow-up details were incomplete in 73 of 439 tube insertions; thus, 366 were available for the study. Three hundred forty-three of 366 tubes were grommet and 23 were T-tubes in the study group. The types of tube used and complications are shown in Table 1. Three patients developed posttympanostomy otorrhea. Two of them were observed at 2 weeks after insertion, and one of them was developed 3 months after tube insertion.

Tympanostomy tubes were found in the middle ear in 4 (1.1%) of the patients and were removed under general anesthesia.

Recurrent TTI was performed twice in 18 patients and three times in 6 patients. Three of these 6 patients had Crouzon syndrome, and 1 had cleft palate.

Audiometric evaluations were available for 212 children preoperatively and postoperatively after the tubes were removed. The postoperative hearing results were better than the preoperative level in 198 of 212 ears (93.4%) (median, 14.2 dB; range, 3 to 31 dB) and worse in 14 ears (6.6%) (median, 8.3 dB; range, 1 to 28 dB).

Tympanometries were performed in all of the ears preoperatively and postoperatively after the extrusion of the tubes, except in 17 ears with residual tympanic membrane perforation. Preoperative tympanograms were B type for all ears. Postoperative results were same in 33 patients (9.0%), whereas 333 (91.0%) were better.

The extrusion times for the tubes are shown in Figure 1.

DISCUSSION

TTI is the most frequently performed otolaryngologic procedure,[5] and it is an effective treatment modality for chronic otitis media with effusion. The usual benefit from the procedure is the restoration of ventilation of the middle ear, as well as an immediate gain in hearing.[2] It is possible, however, to have complications because of the operative procedure.

One of the most common complications after TTI is otorrhea.[3,5,6] Gross et al[7] reported that 10% to 29% of tubes will sometimes drain after they have been placed, whereas Kinsella et al[5] reported a rate of 1.67%, and Derkay et al[4] reported a 7.8% rate of otorrhea. However, otorrhea is not serious in most cases; almost all patients experience some degree of hearing loss and discomfort.[6] In this series, only 3 of the patients (0.8%) had otorrhea. This rate is significantly lower than that in the literature. In this study, 2 of 3 cases of otorrhea occurred early, within the first 2 weeks, and the third occurred in late stage.

Several factors were blamed in the literature for the occurrence of otorrhea, such as the lack of instituition of antimicrobial therapy, patients' younger age, contamination from the external au-

Table 1. Type of tubes used and complications

Granulation		Atelectasis		Otorrhea		Tympanosclerosis		Colesteatoma	
n	%	n	%	n	%	n	%	n	%
1	0.3	20	5.8	3	0.9	67	19.5	0	0
3	13.0	2	8.7	0	0	7	30.4	0	0
4	1.1	22	6.0	3	0.8	74	20.2	0	0

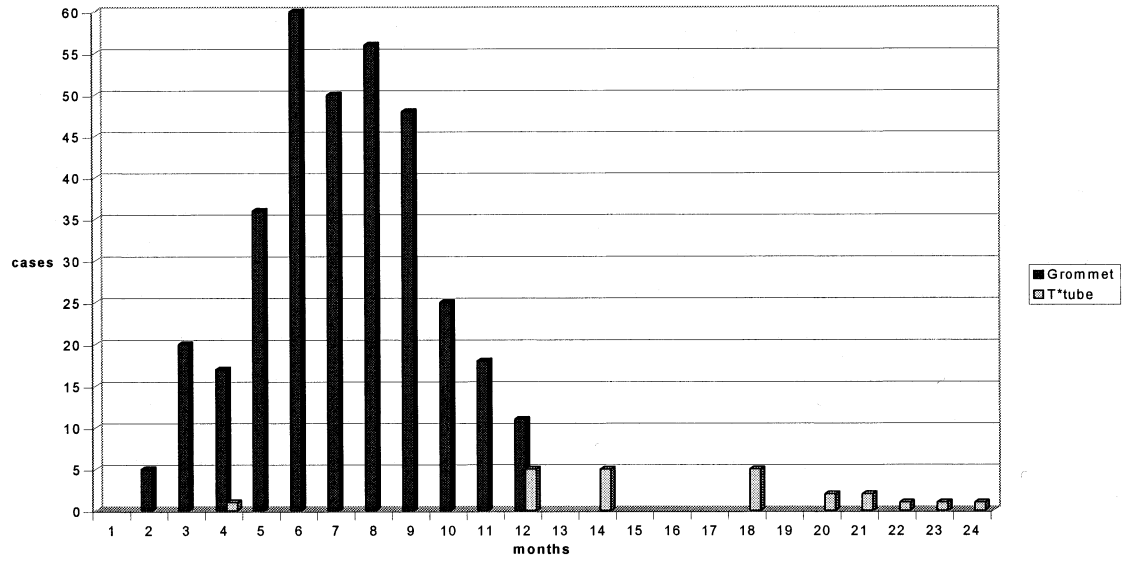

Fig 1. Extrusion times for the tubes.

ditory canal during surgery, upper respiratory tract infection, bleeding at the myringotomy site,[6] mucoid or purulent middle ear effusions,[8] and edematous or granular middle ear mucosa.[9] Some authors reported a tendency for otorrhea to occur in younger patients.[10-12] Because of an immature immune function, young age can be a possible risk factor for otorrhea.[3] Middle ear effusion in young children is more often associated with clinical signs of inflammation than it is in older children.[3]

Contamination from the external auditory canal was suggested as a cause of drainage occurring within the early period of TTI.[5] Cleaning of the external auditory canal preoperatively with 70% alcohol[13] or povidone-iodine solution[3] has decreased the incidence of otorrhea to 50%. Although this is without statistical significance,[14] it is supported by the fact that wider-rim tubes such as Paparalla type 2 carry a higher risk of otorrhea.[15,16] However, Myer,[6] Giebink et al,[11] and Scott et al,[17] do not believe that sterilization of the external auditory canal would result in benefit before placement of a ventilation tube. In other studies, intratympanic saline irrigation during surgery was suggested to be a factor in significantly reducing postoperative otorrhea rates.[7,10] Several authors have found topical prophylaxis to be effective in reducing otorrhea[3,10,12,18,19] and have recommended the routine use of various topical antibiotic drops at the time of surgery and postoperatively to decrease the incidence of early postoperative otorrhea.[12] However, others have found this topical prophylaxis to be ineffective.[3,14] In Scott's study,[8] the presence of mucoid effusion was found to be strongly associated with postoperative otorrhea, and he stated that postoperative topical medication could be justified only in mucoid effusion TTI patients.

Some studies have compared the incidence of otorrhea with different types of tubes.[15,20] Slack et

al[15] reported a higher rate of otorrhea for Paparella type 2 tubes (40%). Although the rate of otorrhea with Shepard tubes was 5.7% at the same study, Charnock[1] reported an 8.4% otorrhea rate after standard fashion using collar button tubes or Silastic T-tubes. In our series, Shepard tubes or T-tubes were used, and otorrhea was seen in 0.9% and 0% of the children, respectively.

The external auditory canals were cleaned with povidine-iodine solution in all patients before myringotomy in this study group. Perioperatively and postoperatively, antibiotics were used to protect the children from infection. No eardrops were used for fear that the eardrops might carry the bacterial flora of internal ear canal to the middle ear via the tympanostomy tube and thus cause otorrhea. However, Gates et al[3] and Balkany et al[10] reported no difference in otorrhea rates when postoperative antimicrobial agents were used or were not used.

It is difficult to obtain conclusive data from the literature, because of conflicting results reported, or from this study. The low incidence of otorrhea in this study could result from the use of antiseptics in cleaning the ear canal, preoperative and postoperative parenteral or oral antibiotics use, strict water precautions after tympanostomy, and older patient age than in the literature in which high otorrhea rates were reported. Otorrhea may also be related to other unmentioned factors such as a high atopic population resulting from the rich allergic flora and humid environment in the United States.

Tympanic membrane perforation is the other complication has been reported in a range of 4% to 32.6% of cases in the literature.[4,21-23] The perforation rate was 4.6% in this series (4.4% and 8.7% for Shepard and T-tubes, respectively). This complication might have occurred because of the longer duration of the tubes.[21,22] The longer the tubes remained in place, the higher was the incidence of persistent perforation after tube removal.[23] Iwaki et al[24] reported that long-term tubes (ie, Goode T-tubes) showed significantly high perforation rates compared with the Shepard grommet. The perforation rate was higher in the spontaneous extrusion group than in the intentional removal group after T-tube treatment in the study of Saito et al.[23] They reported the perforation rates for grommet and T-tubes as 4% and 14.3%, respectively. In the current study, the tubes extruded spontaneously. In the most of the perforated cases, tubes extruded 9 or more months after the insertion. It was thought that longer duration time can be a factor in perforation development.

Retraction pockets, atelectasis,[4] and cholesteatoma[2,4] were reported after TTI. In this study, these complication rates were 5.2%, 6%, and 0%, respectively. Granulation tissue was seen in 1.1% of the cases; the rate was 13% for the T-tubes and 0.3% for Shepard grommet tubes. Derkay et al[4] and Valtonen et al[25] reported this complication rate as 2.2% and 5%, respectively. Longer duration of inserted tube may be a factor.

The presence of ventilation tubes in a tympanic membrane is associated with the development of tympanosclerosis.[26] This is a progressive phenomenon and the incidence increases with time. Slack et al[26] reported that 70% of cases had tympanosclerosis 21 months later than those with the grommet insertion, while 1 year later than the insertion, 39% of cases had this complication. Mangat et al[22] reported the tympanosclerosis rate as 23.6% for T-tubes in their study. In the current study, tympanosclerosis was seen in 74 of 366 ears (20.2%). It was higher for T-tubes than for grommet tubes (30.4% and 19.5%, respectively). According to MacKinnon,[27] the development of tympanosclerosis might be due to the middle ear disease rather than to the tubes. However, some authors[28,29] reported that tympanosclerosis develops more frequently in ears with a tube than in those without a tube. In the current study, we did not have any chance to compare the ears with and without TTI. This complication was found predominantly (82.7%) in the tympanic membrane quadrant in which the ventilation tube was inserted (anteroinferior) in the current study with little effect on hearing.[30]

The extrusion time of ventilation tubes depends on its type.[25] Grommets tend to be extruded earlier, whereas Goode T-tubes tend to remain longer.[24] The mean intubation periods were reported as around 5.9 and 10.7 months, respectively, in the literature.[24,31] Valtonen et al[25] reported ventilation time as 31.7 months for Goode-T-tubes. In the current study, the average extrusion time was 7.3 months for grommet and 16.3 months for T-tubes.

In conclusion, male gender, white race, winter months,[17] summer months,[32] thick fluid, younger age, presence of the blood at myringotomy site,[3,14] underlying disease activity,[33] and large-bore tympanostomy tubes have been held responsible for postoperative otorrhea.

It may be better if external auditory canals are cleaned with povidine-iodine solution. Perioperatively and postoperatively, antibiotic therapy can cause a lower otorrhea rate. During the procedure of TTI, after myringotomy or postoperatively, the use of any eardrops can carry the resistant bacteria to the middle ear and possibly cause otorrhea. Protection of the ears with tympanostomy tubes from water during swimming or bathing might be benificial.

All of these factors show some unsolved or misunderstood underlying pathology. Unrecognized environmental factors such as atopy and rich herbal flora and humidity might be contributing in the pathophysiology of the otorrhea in those studies in which otorrhea is much more prevalent.

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