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CLINICAL RECORD

Complications of long-term ventilation tubes

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Abstract

Objective: To demonstrate that ventilation tubes can remain in situ much longer than expected, and that the materials used in the manufacturing of these tubes can degrade and cause complications. Long-term follow up and replacement of the tube is recommended.

Method: Case report and review of the literature concerning the use of long-term ventilation tubes.

Results: In the case reported, the ventilation tube was in place for 19 years, which resulted in chronic ear discharge. When it was removed, it was noted that the tube itself had degraded and had caused a chronic inflammatory reaction.

Conclusion: We recommend that the long-term use of ventilation tubes is followed up and that the tube is replaced before material degradation takes place.

Key words: Ventilation; Middle Ear; Tympanostomy; Grommet Insertion; Otitis Media; Complications

Introduction

Otitis media with effusion (OME) is common in children. The incidence is even higher in children with cleft palate or Down's syndrome. An intervention is recommended if the condition persists for more than three months. One of the modalities of intervention is the insertion of a ventilation tube.[1] Up to 25 per cent of children with OME may need this procedure to be repeated at least once.[1] Some of these children will continue to suffer from OME even after the second or third tube reinsertion. Long-term ventilation tubes offer a solution to this problem. The current practice at our institution is to offer long-term ventilation tubes on the third reinsertion. However, the use of long-term ventilation tubes can result in residual perforation in 32.6 per cent of cases and recurrent otorrhoea in 21 per cent of cases.[2]

The Shah Permavent tube was designed to reduce the incidence of complications associated with long-term ventilation tubes. Shah, the developer of the Permavent tube, recommended tube insertion under general anaesthesia. He also highlighted the importance of post-operative care, including the intermittent use of antibiotics and steroids drops, regular out-patient visits, and tube removal at the appropriate time. The average time of Permavent tube extrusion has been reported to be 3 years, with an otorrhoea rate of 18.5 per cent.[3]

Some authors have suggested trimming the base of the tube to facilitate insertion,[4,5] which can expose the mesh. The trimming of the Permavent tube is associated with earlier extrusion, with the average length of stay being 12.5 months.[4]

Case report

A 38-year-old female presented with a one-year history of intermittent, purulent left-sided otorrhoea. Her medical history included recurrent middle-ear effusions between four and nine years of age. She had a submucous cleft palate, an aortic arch abnormality and a small ventricular septal defect. The patient underwent her first grommet insertion and palatoplasty at the age of nine years. She had a second set of grommets inserted during childhood. At the age of 19 years she received a Shah Permavent tube in the left ear. Around the same period, she underwent a pharyngoplasty to improve the quality of her speech by preventing nasal air escape, a problem which had persisted following her palatoplasty.

The patient had complained of recurrent discharge from her left ear when she was 30 years old. The Permavent tube was still in situ at this time. The infection settled with the use of antibiotic ear drops. However, the recurrent left ear discharge once again became problematic when she was 37 years old. This time there was only a temporary response to the antibiotic and corticosteroid drops. Clinical examination showed the presence of granulation tissue around the Permavent tube. The tube was removed under general anaesthesia together with the abundant granulation tissue. The tympanic membrane defect was left to heal by secondary intention.

On close inspection, it was observed that the Permavent tube had been inserted without any trimming or modification. It was also apparent that the silicone cover had degraded along the disc edges, with exposure of the mesh fibres (Figure 1).

The patient was reviewed in clinic six weeks later, at which point she was found to have a small, dry central perforation. The perforation was left alone because it was asymptomatic and it provided middle-ear ventilation.

Discussion

As the name indicates, long-term ventilation tubes are designed to stay in situ for long periods of time. Several makes of product are available. We currently use a variety of tubes: the T-Tube (Medtronic Xomed, Inc.; Jacksonville; Florida; USA), Triune tube (Grace Medical; Memphis; Tennessee; USA) and Permavent Shah tube (Exmoor Plastics Ltd.; Somerset; UK). Shah, the developer

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FIG. 1
The Permavent grommet removed from the patient showing the exposed mesh.

of the Permavent tube, suggested close follow up to identify and treat any infections. As a consequence of increasing pressure in terms of delivering services, follow up for patients with ventilation tubes has in general been reduced or has been delegated to primary care. The current case highlights the fact that long-term ventilation tubes can be used for a much longer period of time than they were originally designed for. Degradation of the tube material can occur, with undesirable complications. A PubMed search of the literature using the word Permavent returned only three results; none of these articles related to the focus of this case study.

In the case reported here, the ventilation tube did not seem to have been modified. Trimming the tube – especially at the base – in order to allow easier insertion or earlier extrusion (as suggested by some authors),[4,5] may alter the tube structure. The inner mesh may become exposed, which can induce a local inflammatory reaction. This can increase the risk of otorrhoea. However, in the study reported by Abdullah *et al.*, none of the children with a trimmed tube reported discharge over the study period of 29 months.[4] In the current case, the irregularity in the disc surface associated with the decay of the tube may have been the cause of the persistent infections. The presence of such surface irregularities can enable bacteria to become trapped, resulting in increased biofilm formation.[6,7] The exposure of the mesh will only add to this problem.

- **Permavent tubes last for approximately three years**
- **This paper reports a case of a Permavent tube that remained in situ for 19 years**
- **Examination of the tube revealed degradation of the silicone**
- **Exposure of the Permavent tube's inner mesh can cause otorrhoea**

The biodegradation of medical grade silicone has been reported in voice prostheses. Yeasts were blamed for their degeneration and for biofilm formation. The degradation resulted in the failure of the prostheses.[8] The ionising of silicone ventilation tubes, which is achieved by bombarding the tubes with ions thereby making their surface non-adherent,[9] has been found to reduce biofilm formation with a consequent reduction in the incidence of otorrhoea.[10]

By contacting the companies that supply the Permavent grommets, we established that there are two Permavent designs made by two different companies. One design is moulded in one piece and does not contain inner mesh (Exmoor Plastics Ltd.; Somerset; UK). The other design is made from two pieces (a disc and a tube) welded together and does contain mesh (Richard's Medical Equipment; Wheeling; Illinois; USA). Both tubes are made from medical grade silicone except for the mesh. Our efforts to establish the type of mesh material used in the latter design were unsuccessful; we were unable to contact the manufacturer despite several attempts. However, on close inspection of the ventilation tube removed from our patient, it was apparent that the mesh material was made of woven strings and was unlikely to be a high grade silicone. We successfully contacted the company which produces the Permavent tube without the mesh, but no explanation was provided of why the mesh was not used in their design or if avoidance of the mesh was considered to reduce complications.

Conclusion

Long-term (Permavent) ventilation tubes can remain in situ long beyond the estimated period of extrusion. The tube material can decay and expose the disc's inner mesh, which can induce chronic infection. We recommend that no modifications of the tube are carried out. If modifications are performed, care should be taken not to expose the inner mesh. Long-term follow up should be maintained, and the tube should be replaced if indicated or after a reasonable period of time.

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