Clin. Otolaryngol. 2004, **29**, 598–601

The use of perioperative Sofradex® eardrops in preventing tympanostomy tube blockage: a prospective double-blinded randomized-controlled trial

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Accepted for publication 10 December 2003

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(2004) *Clin. Otolaryngol.* **29**, 598–601

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Around 11–12% of tympanostomy tubes are reported to become blocked by middle ear secretions or blood immediately following surgery, and so no longer function. Many otologists routinely instil an antibiotic and steroid-containing solution at the time of surgery in the belief that this may reduce this complication. The aim of the study was to investigate the efficacy of instilling the antibiotic and steroid-containing solution Sofradex® at the time of grommet insertion in preventing grommet blockage. Double-blind randomized-controlled trial, comparing rates of grommet blockage in ears treated with Sofradex® drops against control (no drops) in patients undergoing bilateral grommet insertion. Sixty-one pairs of results were obtained. There was a significant difference between the rates of grommet blockage in the two groups. Grommets with Sofradex® drops instilled perioperatively were nine times less likely to be blocked than controls [1.6% *versus* 13.1%, odds ratio (Sofradex®/control) = 9.06, 95% confidence interval (CI): 1.04–78.82, $P = 0.05$]. There was no association between grommet blockage and perioperative bleeding or the nature and presence of middle ear secretions. Sofradex® eardrops are effective in reducing the rate of grommet blockage when instilled perioperatively.

Keywords *clinical trial* *perioperative* *tympanostomy tubes*

Tympanostomy tube insertion is amongst the commonest operations performed by ENT surgeons in the UK, with 42 000 being performed last year.[1] Revision surgery is sometimes required because of premature tube blockage. Factors believed to cause grommet blockage include perioperative bleeding and secretions present at the time of operation, or developing later.[2] Rates of grommet blockage have been previously quoted as being between 11% and 12%.[3] Many otologists routinely place a single dose of antibiotic and steroid-containing eardrops into the external auditory canal after grommet insertion when tenacious middle ear secretions or bleeding are encountered, in the belief that this may prevent occlusion of the lumen of the grommet. A reduction in grommet blockage rate should reduce the need for grommets to be reinserted, and improve functional outcomes.

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Method and patients

Local Research and Ethics Committee approval and informed parental consent was always obtained.

All patients entered into the study had previously and independently been listed for bilateral grommet insertion on the basis of persistent bilateral middle ear effusions. These were diagnosed by clinical assessment, preoperative audiogram and tympanogram. There was no age restriction in patient recruitment. Patients with co-morbid factors such as Down's syndrome or cleft palate were included in the study. Exclusion criteria were known allergy to Sofradex® (Patheon UK, Swindon, Wilts, UK) or its constituents, unilateral grommet insertion or the placement of other than standard Shah grommets. Sofradex® was chosen because of its widespread use by otologists in the prevention of grommet blockage.[4] Informed consent was always obtained.

Standard Shah grommets were inserted bilaterally under general anaesthesia. At operation a record was made of the

nature of any middle ear effusion, of the site of any bleeding, of whether the surgeon would have normally placed drops in the ear and of other operative procedures performed. Grade of surgeon varied from senior house officer to consultant.

The left or right ear of patients was selected at random to have one dose of topical antibiotic and steroid-containing eardrops (Sofradex®) instilled following grommet insertion whilst the patient was still in the operating theatre. Sofradex® contains dexamethasone 0.05%, framycetin 0.5% and gramicidin 0.005%. Cotton wool was then placed in both ears. The opposite ear had no drops instilled and acted as the control ear. The treated side was double blinded to both patient and surgeon at follow-up. Identical sealed envelopes indicating which ear was to be selected for Sofradex® treatment were available in theatre and opened in consecutive order by a member of the theatre staff who instructed the surgeon as to which ear to treat. Records of the side selected were kept separate from the hospital records and were not revealed until the end of the study.

Patients were seen at 6 weeks postoperatively when a history of otorrhoea was sought, ventilation tube patency assessed on the basis of tympanometry and clinical examination, and pure tone audiometry repeated.

Results were collated and subjected to statistical analysis (univariate logistic regression, using SPSS for Windows, version 11; SPSS Inc., Chicago, IL, USA). The help of a professional statistician was employed.

Results

A total of 75 patients undergoing bilateral grommet insertion were recruited into this prospective study.

Accurate assessment was made of 122 (83%) ears at follow-up. Reasons for incompleteness were patients who were lost to follow-up (12 patients) and two grommets that had extruded before 6 weeks follow-up.

Thirty patients were boys and 31 were girls. The median patient age was 5 years [inter-quartile range (IQR): 4–7, $n = 61$].

Univariate logistic regression models were used to test for associations between the outcome variables grommet blockage with and without effusion and the use of Sofradex®. As there were two records per patient (one per ear), the observations could not be assumed to be independent. The standard errors were therefore adjusted to allow for the interdependence between responses from the same patient.

Nine of the 122 grommets were blocked at 6 weeks (one Sofradex® ear and eight control ears).

The odds of an ear being clear at 6 weeks were over nine times greater for ears treated with Sofradex® compared with control ears [odds ratio (OR) (Sofradex®/control) = 9.06, 95% confidence interval (CI): 1.04–78.82, $P = 0.05$].

Otorrhoea occurred in 12 of the 122 ears (four Sofradex® ears and eight control ears).

There was no statistically significant association between the use of Sofradex® and the development of otorrhoea [OR (Sofradex®/control) = 0.46, 95% CI: 0.15–1.37, $P = 0.16$].

Tonsillectomy was performed simultaneously in three patients (4.8%), adenoidectomy in 14 patients (22.6%) and adenotonsillectomy in four patients (6.5%). One patient with adenoidectomy and one patient with adenotonsillectomy performed simultaneously had proven blockage of the control grommet at follow-up.

Intra-operative bleeding was encountered in 21 ears (33.9%) with Sofradex® instilled and 19 control ears (30.6%). On one occasion bleeding from the ear canal was associated with grommet blockage and this was from a control ear. On one occasion bleeding from the drum was associated with grommet blockage and this was from a Sofradex® ear. The numbers are too small to make robust statistical inferences.

At myringotomy the surgeon observed the nature of any effusion. Samples were not subject to laboratory analysis. The nature of the effusion is depicted in Table 1. Of the Sofradex® group, the only grommet that was blocked had a seromucinous effusion (as well as a canal bleed) and of the control group, four grommets were blocked which had a seromucinous effusion. Three of these four patients were also noted to have a seromucinous effusion on the other side in which Sofradex® had been instilled. These were subsequently proved to be patent at follow-up. Two of the grommets (both from the control group) that were blocked at follow-up had dry middle ears at myringotomy. One grommet from the control group was blocked at follow-up that had a serous effusion at myringotomy.

Surgeons would have used Sofradex® drops in 14 control ears if the trial had not been running. Two of these were subsequently blocked, giving an accuracy rate of 14.3%. This was not different from chance as eight of 61 (13.1%) of the control ears were blocked.

Audiological improvement as demonstrated by pure tone audiography is shown in Fig. 1. Similar mean results were obtained between both groups, as might be expected with only small numbers of grommets being blocked.

Table 1. Nature of effusion with patient groups

	Nature of effusion (dry indicates no effusion)		
	Dry	Serous	Seromucinous
Sofradex	18	13	30
Control	24	12	26

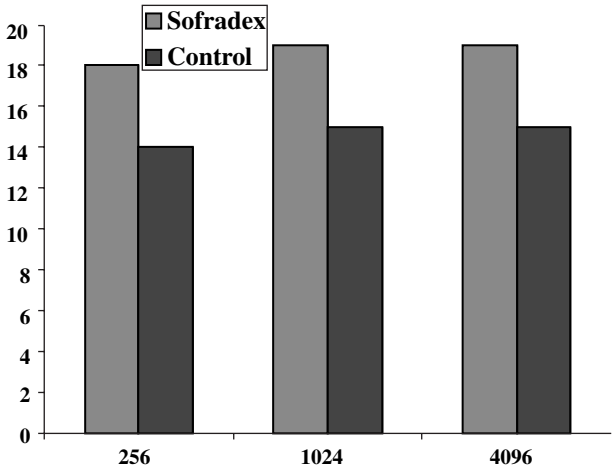

Figure 1. Showing postoperative audiological improvement (all results).

Discussion

In this study the use of perioperative Sofradex® eardrops lead to a significant reduction in the rate of grommet blockage from 13.1% to 1.6%.

Although it is logical to assume an association between perioperative bleeding, middle ear secretions and grommet blockage, our study could not or did not investigate this as grommet blockage was too infrequent to allow accurate subset analysis.

Previous studies have addressed the problem of postoperative grommet blockage. The use of tympanostomy tubes coated with antibiotic ointment did not result in a reduction in grommet obstruction.[5] Xylometazoline hydrochloride (Otrivine nasal drops 0.1%) instilled into the ear perioperatively produced a reduction of 10.5% in blockage rate when reviewed 3 months postoperatively.[3] Sodium bicarbonate and hydrogen peroxide drops have been independently found to be highly effective in unblocking blocked grommets found to be obstructed at outpatient follow-up, reducing the rate of reinsertion by 5%.[6]

There is evidence contradicting the use of antibiotic-containing drops in the presence of a tympanostomy tube, because of inner ear ototoxicity and middle ear inflammation.[7] A single dose of antibiotic-containing drops may not have such an adverse effect as other studies have shown ototoxicity only occurs with prolonged usage.[8] A study looking at all cases of possible related ototoxicity between 1953 and 1995 found only two of 134 patients to have a sensorineural hearing loss attributable to the use of antibiotic-containing eardrops in the presence of a tympanic membrane perforation.[9] Placebo controlled trials of polymyxin B/neomycin solutions have demonstrated no evidence of ototoxicity when used with tympanostomy tubes.[10,11]

There are a number of reasons why Sofradex® may be effective in preventing tympanostomy tube blockage. Sofradex® drops pass through tympanostomy tubes with relative ease when compared with other topical antibiotic preparations.[12] It may be that this property led to such a significant reduction in the rate of postoperative grommet blockage. It may be the presence of a solution in the lumen discourages clot formation as well as preventing secretions from drying. The contribution of each constituent of the drops has not been subject to separate analysis in this study.

As we are unable to conclude which component of the Sofradex® drops is responsible for the marked reduction in postinsertion blockage, further studies are needed. The ineffectiveness of the antibiotic coated tubes suggests the antibiotic component may not be required. Using drops without an aminoglycoside would be attractive. Hence studies looking at only instilling saline, or steroid would be of interest. The role of sodium bicarbonate drops might also be considered. In the meantime we conclude that Sofradex® significantly reduces the occurrence of tympanostomy tube blockage when used perioperatively.

Acknowledgements

The authors acknowledge the help of Miss Kate Parry from the North Bristol NHS Trust Research and Development Support Unit (RDSU) for her help in the statistical analysis of this paper. We also acknowledge the help of Mr Desmond A. Nunez (Consultant Otolaryngologist and Senior Clinical Lecturer, North Bristol NHS Trust) for his help in proof reading the paper.

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