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Main Article

Is phenol a safe local anaesthetic for grommet insertion?

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Abstract

Two studies were performed to determine whether topical phenol is a safe and well tolerated local anaesthetic for grommet insertion. Study 1 was a retrospective examination of audiological outcomes and complications. Data were obtained regarding 71 procedures in 57 patients. One late infection and nine early extrusions were noted. No statistically significant changes between pre- and post-operative bone conduction thresholds were found. Study 2 was a prospective analysis of patients' perceptions of the procedure. Data from 17 patient questionnaires were analysed as follows: pain rating – not painful, three patients; slightly painful, 14 patients. Overall experience rating – pleasant, four patients; slightly unpleasant, 10; unpleasant, three. All patients stated that they would undergo the procedure again. In conclusion, we found no evidence of phenol-induced hearing loss. The complication rate was within normal limits and patients were satisfied with the procedure. Grommet insertion using phenol as a local anaesthetic is safe and acceptable to patients.

Key words: Phenol; Middle Ear Ventilation; Otitis Media with Effusion; Anaesthetics; Local Anaesthesia; Local

Introduction

Grommet insertion in adults is frequently carried out under local anaesthesia. Lignocaine injection and the application of topical preparations are the two main methods of anaesthetizing the tympanic membrane. However, both these methods have significant drawbacks. The injection of lignocaine into the external auditory canal produces consistent and complete anaesthesia of the tympanic membrane. Once injected, it is necessary to wait in the region of 10 minutes for the lignocaine to take effect. The main disadvantage of this method is the discomfort the injection causes: the periosteum and perichondrium of the canal are closely applied to the external auditory canal skin and injection into this area stretches the skin from the underlying tissue, resulting in significant pain. The pain caused by injection can be worse than the discomfort produced by a myringotomy on an unanaesthetized tympanic membrane. Topical preparations used to anaesthetize the tympanic membrane include lignocaine cream (EMLA)[1] and tetracaine gel (Ametop).[2] The application of such preparations requires the canal to be cleansed before the cream can be syringed into it. Care must be taken not to leave a bubble of air over the tympanic membrane because this area will not be anaesthetized. The EMLA cream is left in place for 40 minutes and tetracaine gel for 30 minutes in order to anaesthetize the drum, and must then be removed with suction. The use of topical agents is therefore a rather cumbersome and time-consuming method.

An alternative method is to use phenol to anaesthetize a portion of the drum. The benefit of this technique is that the anaesthesia is much more rapid. Phenol has been used as an anaesthetic for the tympanic membrane for many years. Bonain[3] first described the used of phenol to anaesthetize the tympanic membrane in 1907: he described a solution containing equal parts of phenol, cocaine and menthol that could be poured into the ear canal to produce local anaesthesia. Storrs[4] introduced the use of concentrated phenol for grommet insertion in 1956. He later claimed to have had no complications in 5000 cases over a 10-year period,[4] although he did not support his claim with any figures. However, this technique has fallen out of fashion in the United Kingdom because of concerns about long-term damage to the tympanic membrane and cochlea. Phenol is indeed neurotoxic and could potentially cause sensorineural hearing loss. The Otolaryngology Department of Glan Clwyd Hospital

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has resisted the national trend and has continued to use phenol as a local anaesthetic for grommet insertion. This department has over 10 years of experience with using phenol and has found it to be safe and effective. We set out to determine whether we could substantiate this anecdotal evidence scientifically. Our objective was to determine whether grommet insertion using phenol is a safe procedure, and whether it is acceptable to the patient.

Materials and methods

Two studies were performed: a retrospective examination of audiological outcomes and complications, and a prospective analysis of patients' perceptions of the procedure.

Surgical technique

A piece of cotton wool wrapped tightly around a thin wire is dabbed into a solution of 88 per cent phenol. The tip of the probe is then carefully applied to the anteroinferior part of the tympanic membrane, carefully avoiding contact with the ear canal and the rest of the tympanic membrane. The phenol immediately denatures the proteins of the desired portion of the tympanic membrane, including the sensory nerve endings, resulting in almost instantaneous anaesthesia. Any residual trace of phenol is then removed with a fine suction before making a standard myringotomy and inserting a grommet.

Study 1 (retrospective)

Patients who had undergone grommet insertion using the standard phenol technique in Glan Clwyd Hospital between 2001 and 2003 were identified from day surgery department logbooks. Patients with complete pre- and post-operative audiological data were included in the study and those without were excluded. Case notes were studied and the following data recorded: audiological bone thresholds pre- and post-operation, post-operative tympanic membrane perforations, late aural infections (later than two weeks post-insertion), early aural infections (within two weeks of insertion) and early grommet extrusion (less than six months post-insertion). The pre- and post-operative bone thresholds were analysed for a statistical difference using the paired Student's *t*-test.

Study 2 (prospective)

All patients undergoing phenol grommet insertion in Glan Clwyd Hospital between February and September 2004 were asked to fill in a confidential questionnaire that assessed pain and discomfort (Appendix 1). The time taken to perform the procedure, from the application of phenol to completion of grommet insertion, was noted by the assisting nurse and recorded to the nearest minute.

Results

Study 1

Eighty-two patients were found to have had phenol grommet insertion during the study period; 57 had complete follow-up data and were included in the study. There were 14 patients who had had bilateral grommets inserted and 43 who had had unilateral grommets inserted, making 71 insertions in total. The mean age of the patients was 57 years (range 24–80). No early infections were noted. One late infection was noted and was successfully treated with topical antibiotics. In nine cases the grommet extruded before six months. There were no tympanic membrane perforations noted.

The mean pre- and post-operative bone thresholds are summarized in Table I. The mean length of follow up from operation to final audiogram was eight months. Overall there was a slight increase in thresholds post-operatively, but none of the differences in pre- and post-operative bone thresholds was significant ($p < 0.05$). Figure 1 illustrates the distribution of changes between pre- and post-operative bone thresholds. In seven readings there was a 20 or 25 dB increase in thresholds, and in 10 cases there was a 20, 25 or 30 dB drop in thresholds. The seven readings that showed a large increase in thresholds were studied further, and it was found that in each case the individual frequency reading was an isolated one.

Study 2

Over a six-month period 17 patients filled in the questionnaire; three rated the procedure as not

TABLE I

MEAN BONE CONDUCTION THRESHOLDS IN dB(SPL)

	Average	500 Hz	1 kHz	2 kHz	4 kHz
Pre-op	29	23	21	38	32
Post-op	30	27	22	35	35

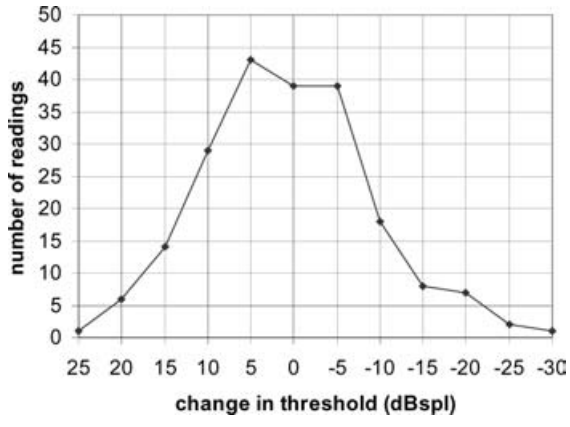

FIG. 1

Distribution of changes between pre- and post-operative bone conduction thresholds.

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painful at all, 14 rated it as slightly painful, and none rated it as either painful or very painful. Four patients rated the overall experience as pleasant, 10 as slightly unpleasant, three as unpleasant, and none as very unpleasant. All patients stated that they would be prepared to undergo the procedure again. The mean time taken to insert a grommet was four and a half minutes (range 2–12 minutes).

Discussion

Phenol (carbolic acid, benzenol) is a member of the benzene group of aromatic hydrocarbons. It is produced in the gastrointestinal tract and in decomposing organic matter by the breakdown of amino acids. It is a weak acid and is combustible. Phenol is highly toxic on ingestion and causes a chemical burn on contact with the dermis. Surprisingly for such a toxic chemical, phenol has a wide range of medical uses: cosmetic practitioners use it to chemically peel facial skin; it is used to destroy neurons in lumbar sympathectomy; and for the alleviation of neuropathic pain in patients with terminal cancer. Perhaps its most common use today is for nailbed ablation following avulsion of an ingrowing toenail.

Previous studies into the effects of phenol on the tympanic membrane have shown conflicting results. Schmidt *et al.*[5] performed several experiments looking at the effect of phenol on the rat tympanic membrane. Their earliest study found that phenol, xylocaine and Bonain's solution caused a similar local inflammatory response on the tympanic membrane.[5] However, in a later paper the same team found that phenol had a negligible effect on an already infected tympanic membrane.[6] A further study by the same authors compared the long-term effects of phenol, Bonain's liquid and xylocaine on the tympanic membrane[7] and found that all three agents caused an inflammatory response, which persisted at five months; however, the response to phenol was more localized and less severe than with the other two agents. It would seem that phenol does have some detrimental effect on the structure of the tympanic membrane, but its extent and significance are debatable, for if significant damage had been caused to the drum then the ability to heal the myringotomy incision should be impaired. In our series we found no tympanic membrane perforations, suggesting that the damage to its structure is not significant. Nor did we find a higher than expected early extrusion rate,[8] which would also suggest that tympanic membrane integrity is not compromised. The infection rate of the grommets was also within expected limits.[8]

We did not find any significant hearing loss in our series. The changes in bone conduction between pre- and post-operative audiograms have a normal distribution (Figure 1). If phenol exposure were causing ototoxicity, one would expect to find much more of a trend to higher bone conduction thresholds. Overall, the mean bone conduction threshold was 1 dB higher in the post-operative audiograms. We feel that this small and statistically insignificant increase can be explained by the advance of presbyacusis between the pre- and post-operative audiograms. The mean time between the surgery and the post-operative audiogram was eight months. The pre-operative audiogram is usually carried out a month before the procedure, making the gap between the two audiograms nine months on average. The mean age of our patients was 57 years. In such a population a slight increase in thresholds over a nine-month period would be expected. Our statistical analysis did not demonstrate a significant change in bone thresholds; however, if phenol only causes hearing loss in a small number of cases our statistical analysis would miss those cases. We therefore examined all the readings at the extreme ends of the distribution graph and found no individual who had sustained a 20 dB or greater increase in threshold in more than one frequency. We can therefore conclude from our series that there was no evidence of an individual patient sustaining significant sensorineural hearing loss.

Our prospective study found that the patients tolerated the procedure well. None found it very unpleasant and, rather strangely, four thought that having a grommet inserted under local anaesthetic was a pleasant experience. However, we would not attribute this finding to any antidepressant effects of phenol, but rather to the caring and friendly nature of the nurses. Most patients found the procedure to be slightly painful. We do not believe that this represents an incomplete anaesthesia during the procedure because examination of an ear with a speculum and microscope is inevitably slightly uncomfortable.

The mean time to insert the grommet in our series (four and a half minutes) was faster than the onset of action of any other local anaesthetic. Operating times are not the most important factor in determining which procedure is superior, and we certainly would not countenance undue haste in ventilation tube insertion. However, if several alternative methods are available and have similar efficacy and safety, then the method that makes the best use of operating time and resources should be preferred.

We feel that we carried out our studies as well as we could, but we must concede that they have certain inadequacies. In our retrospective study we went back as far as we had records, but in spite of this our numbers are not large. If phenol causes hearing loss in a small percentage of patients we may not have enough patients to find an episode of this.

Conclusion

We found no evidence of phenol-induced hearing loss, and the complication rate was within normal limits. Patients were satisfied with the procedure. We therefore concluded that grommet insertion using phenol as a local anaesthetic is safe and acceptable to patients.

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- **Middle-ear ventilation tubes can be readily inserted in adults under local anaesthetic**
- **Phenol is a toxic chemical with widespread medical uses**
- **Concentrated phenol has been used as a topical anaesthetic for the tympanic membrane for many decades**
- **All topical anaesthetics cause damage to the tympanic membrane to some extent; it is not clear whether phenol is any worse or better than other agents in this respect**
- **A retrospective analysis of patients who underwent ventilation tube insertion using phenol found no evidence of increased complications or sensorineural hearing loss**
- **A prospective study of patients undergoing ventilation tube insertion using phenol found that the procedure was well tolerated by the patients**

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Appendix 1 Patient questionnaire

1. How painful did you find the procedure? (please tick a box)
   not painful at all ☐
   slightly painful ☐
   painful ☐
   very painful ☐
2. Overall, how did you find the procedure? (please tick a box)
   pleasant ☐
   slightly unpleasant ☐
   unpleasant ☐
   very unpleasant ☐
3. Would you be prepared to undergo the procedure again if necessary?

   yes/no

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