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Thermal myringotomy
(An alternative to grommet insertion in childhood secretory otitis media?)

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Abstract

Thirty-six children with bilateral secretory otitis media were treated by thermal myringotomy and middle ear aspiration in one ear, and conventional myringotomy, middle ear aspiration and Shepard grommet insertion in the other ear. All children underwent adenoidectomy. Comparing the effectiveness of the two different procedures over a three-month review period, our main findings are as follows. All thermal perforations were closed by 42 days. Elimination of middle ear fluid was achieved in 81 per cent of the thermal myringotomy group, and in 100 per cent of the grommet group. While there was no significant difference in the hearing improvement between the procedures, conventional myringotomy and grommet insertion provided significantly better sustained middle ear ventilation.

Introduction

Myringotomy, aspiration of middle ear fluid and insertion of a ventilation tube (grommet) is an established method of management of children with secretory otitis media. The function of the grommet is to prevent the myringotomy incision from closing, thus establishing aeration of the middle ear cleft. A myringotomy incision heals within twenty-four to forty-eight hours and because of this rapid healing, simple myringotomy and aspiration of fluid alone is often ineffective, since adequate ventilation is not achieved.

It has been known for many years that perforations of the tympanic membrane resulting from thermal injury have a tendency not to heal spontaneously (Schein, 1955; Pappas, 1974). There is now commercially available a battery powered device which will produce a bloodless thermal myringotomy 2–3 mm. across. It consists of a handpiece into which a disposable probe can be plugged. The probe is insulated except for the tip which consists of a wire loop which extends 2 mm. beyond the insulation. The handpiece houses a rechargeable battery and an on-off switch which will give a timed power pulse of approximately three seconds when pressed. The unit fits into a charging stand which can be powered from a standard 240 volts mains socket (Figs. 1 and 2). Previous reports (Saito *et al.*, 1978; Goode, 1982; Lau *et al.*, 1985) have shown that a thermal myringotomy remains patent for approximately two to six weeks.

We have investigated the efficacy of thermal myringotomy using this device in children with bilateral secretory otitis media. Using each child as his own control we have compared standard myringotomy and grommet insertion performed on one ear, with thermal myringotomy without grommet insertion performed on the other ear. In addition every child in the trial had an adenoidectomy.

Method

Forty children, twenty-three male and seventeen female, with a mean age of 5 years 10 months (range 4–9 years) with bilateral secretory otitis media were operated on after informed parental consent. Only children presenting with secretory otitis media for the first time were entered into the study. The names of children diagnosed as having bilateral serous otitis media in the clinic and which had been placed on the operating list for

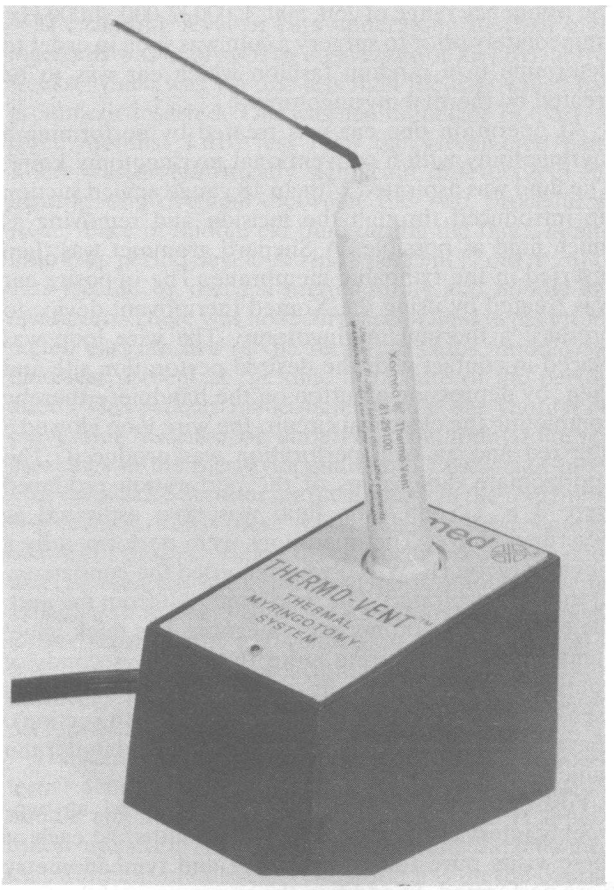


Fig. 1
Thermal Myringotomy device.

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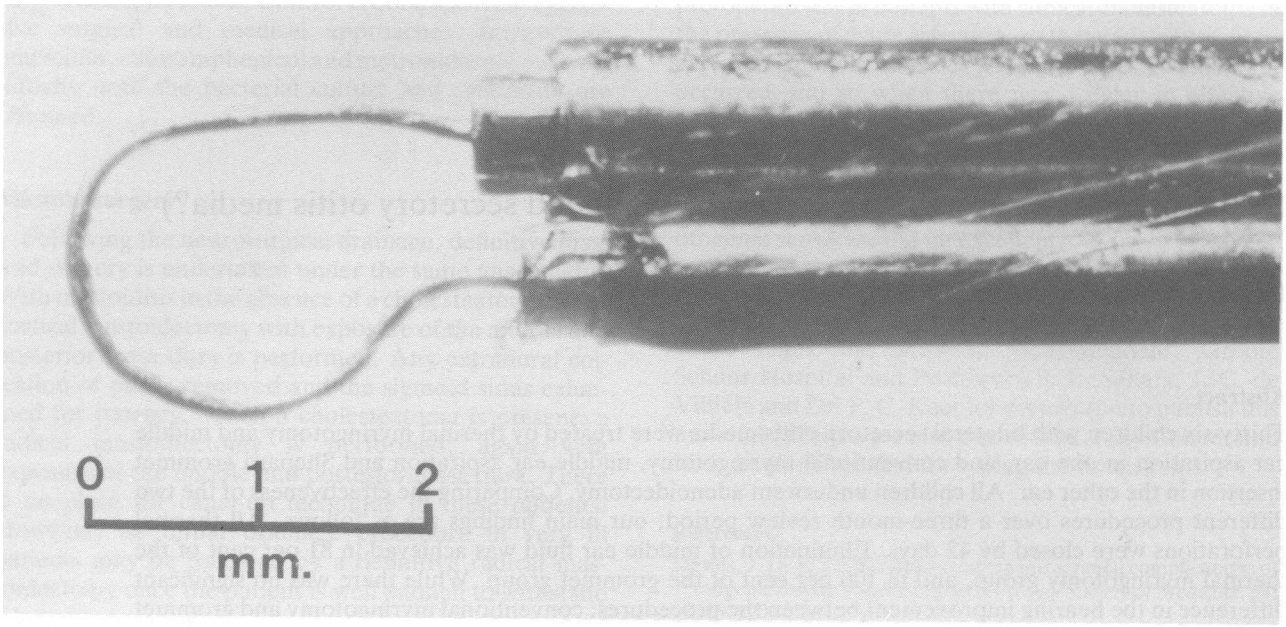


FIG. 2
Wire tip of myringotomy device.

myringotomy were taken in chronological order to eliminate any prejudicial selection. At the time of admission for surgery all these children had had bilateral serous otitis media for three months or longer and the persistence of the condition was confirmed by pure tone audiometry, tympanometry and otoscopy. The air conduction and bone conduction results were averaged over the frequency range of 250, 500, 1,000, 2,000, 4,000 Hz. Immediately prior to surgery a coin was spun in order to determine in a random fashion which ear was to be treated by thermal myringotomy.

At operation one ear was treated by performing a myringotomy with a conventional myringotomy knife. The fluid was aspirated with an 18 gauge angled suction tip introduced through the incision and removing as much fluid as possible. A Shepard grommet was then inserted in the tympanic membrane. The opposite ear was treated by using the Xomed thermovent device to produce a thermal myringotomy. The wire loop was placed in contact with the desired perforation site and then, by depressing a button on the handpiece thereby completing the electrical circuit, the wire loop glowed a dull red and an oval perforation was produced. The approximate dimensions of the perforation produced were 3 × 1.5 mm. The fluid was then aspirated as described above. The operations were performed by a single surgeon (R.W.R.) who recorded the consistency of the fluid aspirated. The fluid aspirated from the middle ear at myringotomy was categorised as thick 'glue' (tenacious and requiring more than a few seconds of continuous suction for its evacuation) or thin fluid (serous fluid which was easy to aspirate with suction). Each child had an adenoidectomy performed under the same anaesthetic.

Post-operatively each child was reviewed at two-weekly intervals for a total of three months. At each of these visits pure tone audiometry and tympanometry were performed. In addition the appearance of the tympanic membranes was recorded. The patency of the grommet and the thermal perforation were assessed by Siegle examination and tympanometry. Any otological symptoms experienced by the child during the post-operative period were recorded. The air conduction and bone conduction thresholds recorded throughout the study were used to calculate the average air-bone gap with each ear. The results are expressed as means and standard deviations for both the thermal myringotomy group of ears and the standard myringotomy and grommet group. Differences between the response rates with the two treatments were analysed using McNemar's test for paired alternatives.

Results

Of the 40 children who entered the study complete results were obtained in 36. Four children failed to attend for regular post-operative review and were not included in the final results.

The thermal perforation remained open for an average of twenty-six days (SD 8 days). Eight (22 per cent) out of the thirty-six thermal perforations were closed at two weeks, a further twenty-four (67 per cent) were closed at four weeks, and four (11 per cent) were not closed until six weeks had elapsed. None of the thermal myringotomies produced a permanent perforation, and all thirty-six were closed by six weeks. At the three-month review it was difficult to identify the myringotomy site. No tympanosclerosis was identified.

Of the thirty-six grommeted ears, all grommets remained in place at the three-month review, although two were found to be blocked. There was no evidence of associated tympanosclerosis.

Recurrence of middle ear fluid was diagnosed by the appearance of the tympanic membrane, together with a conductive hearing loss on pure tone audiometry, a flat tympanogram, and it was confirmed later by myringotomy. Recurrence of middle ear fluid developed after closure of the thermal perforation in 7 ears (19 per cent)

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during the three-month review period. The grommeted ears of each of these 7 children remained free of recurrent fluid. In four of these seven cases the thermal myringotomy was found to be closed at two weeks and recurrent middle ear fluid was evident at this time. In the remaining three ears, the thermal myringotomy was closed at four weeks; recurrent fluid was evident in one at this stage but did not occur for a further four weeks in the remaining two, and in one of these fluid recurred following an episode of acute otitis media (Fig. 3). The original fluid type in these seven children was bilateral thick 'glue' in 6 cases, and thin serous fluid in the remaining case. These seven children underwent further myringotomy, middle ear fluid (thick 'glue') was confirmed in all of them and Shepard grommets were inserted.

Bilateral 'glue' was found in 25 children (69 per cent) and bilateral thin fluid in 11 children (31 per cent). Recurrence of middle ear fluid ('glue') occurred in 6 of the children who originally had middle ear glue and one child who originally had thin middle ear fluid.

In the thermal myringotomy group, the pre-operative hearing loss measured as the mean air-bone gap for the frequencies 250, 500, 1000, 2000, 4000 Hz was 21.0 dB. (SD 6.6). Two weeks after thermal myringotomy, excluding the cases with recurrent middle ear fluid, this value was 7.9 dB. (SD 4.3) and at three months was 7.4 dB. (SD 3.2). The children treated by myringotomy and grommet insertion had a pre-operative mean air-bone gap of 21.4 dB (SD 6.5) which at two-week followed up was 6.8 dB (SD 3.3) and at three months was 6.9 dB. (SD 4.6).

In the thermal myringotomy group at the three-month review 17 out of the 29 ears (59 per cent) gave a negative peak on tympanometry (middle ear pressure lower than minus 100 mm. of water), while the remaining 12 (41 per cent) had normal tympanograms.

Complications were few. One child complained of mild otalgia on the side of the thermal myringotomy two weeks after surgery while the perforation was open. On examination there was no evidence of infection, the perforation was dry, and the tympanic membrane was otherwise normal. One child (2.7 per cent) developed unilateral acute otitis media on the side of the thermal myringotomy two weeks after closure of the perforation.

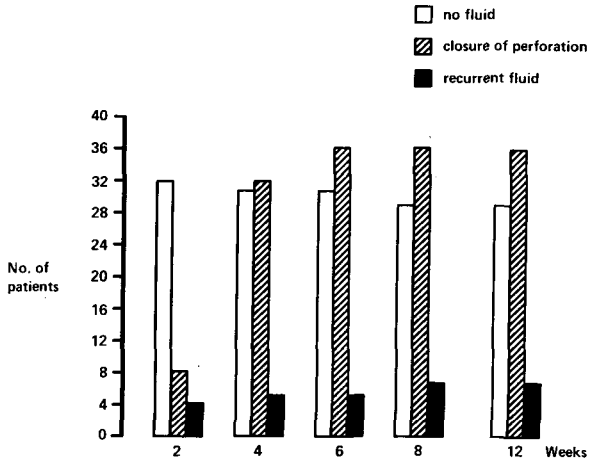


FIG. 3

Outcome of thermal myringotomy group during three-month follow-up period.

This responded promptly to oral antibiotics but the child later developed recurrent middle ear fluid.

The significance of the results of treating secretory otitis media by these two different surgical methods was tested by McNemar's test for paired alternatives. At three months, treatment by standard myringotomy and grommet insertion was significantly more successful than thermal myringotomy alone. ($0.05>P>0.01$).

Conclusion

Recently thermal myringotomy (Goode, 1982; Lau *et al.* 1985) has been recommended for the treatment of secretory otitis media. In particular, emphasis has been placed on potential cost savings when thermal myringotomy is performed using local iontophoretic anaesthesia. We have studied the effectiveness of this treatment by comparing it with grommet insertion in the opposite ear of children with bilateral serous otitis media during a 3-month follow-up period, each child acting as his own control.

Thermal myringotomies patent for an average of 26 days and all had healed by 42 days. Complications were minimal. Mild unexplained otalgia occurred in 1 case (2.7 per cent) and Richards *et al.* (1971) have noted that pain is a more frequent symptom in ears managed by simple myringotomy than by myringotomy and grommet insertion. One child had an episode of acute otitis media following thermal myringotomy after the perforation had closed. This probably does not relate to treatment but likely would not have occurred had a grommet been placed (Myerhoff, 1981).

The hearing level in ears undergoing thermal myringotomy was improved by an average of 13.1 dB. at two weeks, which was 1.5 dB. less than the ears which had grommetic inserted. This was maintained at 13.6 dB. at three months, 1 dB. less than the grommeted ears. There was no statistically significant difference in the hearing improvement between the two procedures. Recurrence of middle ear fluid during the three-month follow-up period developed in 19 per cent (7 out of 36) of ears treated by thermal myringotomy and middle ear aspiration. There was no recurrence of fluid in the grommeted ears. In five of the recurrent cases, middle ear fluid was present at the time of closure of the perforation. This reflects inadequate middle ear ventilation preventing reversal of underlying pathophysiological processes in the mesotympanum and Eustachian tube. This would also account for the findings in the remaining two cases in which there was a delay of 4 weeks after healing of the perforation before recurrence of the middle ear fluid. A larger thermal perforation might be expected to remain patent for longer and, by achieving longer term middle ear ventilation, might result in a lower incidence of the recurrent effusion. There would, however, be a danger of producing a permanent perforation.

Transient middle ear ventilation, by thermal myringotomy, achieved a satisfactory response in eliminating middle ear fluid in 81 per cent of the ears. A longer follow-up period is necessary to determine the influence that transient middle ear ventilation has on the overall recurrence rate of secretory otitis media. Kilby *et al.* (1972), in a similar study to our own, found a recurrence

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rate of 28 per cent in the two years following conventional myringotomy and middle ear aspiration, while recurrence occurred during the same period in 31 per cent following grommet insertion. Our study shows that, during the three-month follow-up period, sustained ventilation achieved by grommet insertion resulted in an overall significantly better result in the treatment of secretory otitis media than thermal myringotomy and middle ear aspiration alone.

Secretory otitis media follows a variable and unpredictable course. In some children it runs a relapsing course over several months with eventual spontaneous resolution; in others it may persist and progress to permanent middle ear damage (Editorial, Lancet, 1975). Transient middle ear ventilation in the former situation could be expected to hasten resolution, while such treatment in the latter would be inadequate. Unfortunately, there is no means of predicting which child, or ear, will behave in which way. If secretory otitis media is treated initially by a heat myringotomy our study indicates that an initial success rate of around 80 per cent may be anticipated. This implies a 20 per cent failure rate and therefore one child in five would require a further procedure under general anaesthesia to achieve adequate middle ear ventilation. Our experience indicates that young children do not tolerate myringotomies using iontophoretic anaesthesia or infiltration local anaesthesia even when oral premedication is used.

It seems to us, therefore, that there is currently little place for the use of heat myringotomy in the treatment of serous otitis media in children.

Acknowledgement

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