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Raised ABR threshold after suction aspiration of glue from the middle ear: three case studies

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Abstract

Between 1991 and 1993, 13 children (25 hearing ears) underwent recordings of the auditory brain stem response (ABR) under a general anaesthetic. The anaesthetic technique was similar for each child. Fourteen of these ears had fluid aspirated after myringotomy with insertion of grommets prior to the auditory brain stem response investigation. On subsequent hearing assessment six of these 14 ears (43 per cent) showed clear evidence of a threshold shift of 15 dB or greater. Eleven ears had either dry myringotomies or did not have a myringotomy prior to ABR and none of these showed evidence of a temporary threshold shift. Using Fisher's Exact probability test this difference is significant ($p = 0.034$). We feel it is important to report these observations so that unexpected high ABR thresholds following aspiration of glue are interpreted with caution.

Key words: Otitis media with effusion; Evoked potentials, auditory, brain stem

Introduction

The auditory brain stem response is a valuable investigation for assessing hearing thresholds in young patients who are unable to cooperate with behavioural audiometry or a subjective audiogram. In young children, it may be necessary to employ sedation such as vallergan or droperidol. Occasionally sedation is inadequate and a general anaesthetic is required to allow the test to proceed. Children who have middle ear effusions require removal of the fluid or glue so that hearing thresholds can be measured without the influence of a conductive loss. To optimize the efficiency of both patient and staff time the ABR is sometimes performed immediately after myringotomies, aspiration of glue and insertion of grommets.

Wetmore *et al.* (1993) measured sucker noise intensity during aspiration of fluid from the middle ear and 50 per cent of these recordings had median intensities greater than 86 dB. They suggested that this level of noise intensity must be considered to pose a potential risk to hearing including at least the possibility of a temporary threshold shift. We had become concerned that some aspect of the procedure in theatre particularly during the aspiration of sero-mucinous middle ear effusions appeared to cause a temporary increase in the threshold of the ABR. To see whether our concern was justified we carried out a retrospective analysis of 13 children where the ABR was recorded under general anaesthetic between 1991 and 1993.

Method and materials

The ABR was recorded with a standard test procedure (Mason, 1993) using click and 1 kHz tone-pip stimuli. The intensity of these stimuli is expressed in decibels relative to normal hearing threshold in young adult subjects (dBnHL). Every ABR performed under a general anaesthetic on children under the age of 16 years was looked at between April 1991 and August 1993. This examination of data gave 13 cases (25 hearing ears) for analysis. Hospital notes were inspected and patient details relating to sex, age at time of ABR, underlying diagnosis, operative intervention, whether glue was aspirated from middle ear and type of anaesthetic were noted.

The thresholds of the ABR recorded in the operating room under a general anaesthetic were compared with the other tests of hearing including behavioural and subjective audiometry, and repeat ABR assessments.

Results

The anaesthetic procedure was similar in most children and was performed with the patient breathing spontaneously using nitrous oxide, oxygen and either halothane or enflourane. Information regarding the anaesthetic was not available on one child.

A summary of the details of 25 hearing ears in 13 children is given in Table I. Fourteen out of 25 ears (56 per cent) had fluid aspirated after myringotomy

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TABLE I
DETAILS OF 25 HEARING EARS WHICH UNDERWENT ABR UNDER GENERAL ANAESTHESIA BETWEEN 1991 AND 1993

	Glue aspirated	No glue aspirated
Number	14	11
Mean age in years (range)	1.86 (0.75–5)	5.62 (0.92–15)
Male	5	4
Female	9	7
Raised ABR threshold implied	6	0
Accurate ABR threshold	8	11

with insertion of grommets immediately prior to the auditory brain stem response investigation. On subsequent hearing assessment six of these 14 aspirated ears (43 per cent) showed clear evidence of a threshold shift of 15 dB or more. This compares with the other 11 ears where the middle ear was dry or a myringotomy was not performed and none of these showed evidence of a temporary threshold shift, using Fisher's Exact test this difference is significant ($p = 0.034$). The cases of the three children who showed clear evidence of a temporary threshold shift are reported below.

Case reports

Case 1

A 16-month-old girl was seen in our clinic with obvious middle ear effusions, and clinically reduced hearing that was more marked on the right. The infant underwent bilateral myringotomies with grommet insertion and thick glue was aspirated on both sides. Thresholds of the ABR were measured immediately afterwards in the operating room. Subsequently ABR thresholds were also recorded one month later under sedation. At that time both grommets were intact and patent. Results are presented in Table II.

TABLE II
CASE 1 RESULTS

Immediately after grommets	Right ear	Left ear
Click threshold	85 dBnHL	55 dBnHL
1 kHz tone-pip theshold	90 dBnHL	75 dBnHL
One month later		
Click threshold	35 dBnHL	30 dBnHL
1 kHz tone-pip threshold	30 dBnHL	25 dBnHL

Case 2

A five-month-old boy was reviewed in our clinic, with obvious middle ear effusions, and a family history of sensorineural deafness. The ABR was measured under sedation and indicated a moderate conductive loss. These middle ear effusions did not resolve and the ABRs were repeated when the child was aged nine months under a general anaesthetic following myringotomies, aspiration of glue and insertion of grommets. Thresholds were raised despite the removal of middle ear fluid. However subsequent behavioural assessment showed that the child's hearing had improved to near normal levels dispelling any fears that the baby had a rapidly progressive sensorineural hearing loss. Results are presented in Table III.

TABLE III
CASE 2 RESULTS

Before grommets	Right ear	Left ear
Click threshold	35 dBnHL	40 dBnHL
1 kHz tone-pip theshold	90 dBnHL	55 dBnHL
Immediately after grommets		
Click threshold	70 dBnHL*	55 dBnHL
1 kHz tone-pip threshold	85 dBnHL	70 dBnHL

*Click threshold on the right ear was the first measurement after grommets. A repeat measurement at the end of the test session (30 minutes later) revealed that the threshold had improved to 55 dBnHL.

Case 3

A 14-month-old girl with developmental delay and a collagen disorder related to a chromosomal translocation on No. 9 was referred to the Children's Hearing Assessment Centre in Nottingham. The infant was difficult to assess and had obvious middle ear effusions. ABRs were performed under a general anaesthetic after myringotomies, aspiration of middle ear fluid and grommet insertion. The ABR was repeated three months later while the grommets were still in position and patent. The results are shown in Table IV.

TABLE IV
CASE 3 RESULTS

Immediately after grommets	Right ear	Left ear
Click threshold	55 dBnHL	55 dBnHL
1 kHz tone-pip threshold	70 dBnHL	60 dBnHL
Three months later		
Click threshold	20 dBnHL	35 dBnHL
1 kHz tone-pip threshold	30 dBnHL	55 dBnHL

Discussion

Application of the ABR for assessment of hearing at the time of insertion of grommets is an efficient test protocol. There is however very little information in the literature regarding the effects of this procedure on the response waveforms. Fria and Sabo (1980) measured latency components of the ABR at the time of myringotomy and tympanostomy tube insertion and showed that this technique was promising as a predictor of the presence or absence of otitis media with effusion. Similar measurements were carried out by Owen *et al.* (1993). Both these studies employed the wave V latency input/output function to predict the threshold rather than using the actual response threshold. The use of latency measurement to predict threshold must be used with

caution in children with possible mixed hearing loss since a cochlear hearing loss will have a very different effect on the input/output functions of the ABR when compared to conductive pathology. Temporary threshold shifts were not reported in either of these studies. Chambers *et al.* (1989) showed that in children with tympanostomy tubes *in situ* for persistent long-term otitis media with effusion there was a relative increase in latency of waves III and V relative to wave I but no increase in response threshold. These ABR measurements were performed under sedation, and confirm that the temporary raised thresholds we have noted are related to an effect of the procedure rather than the underlying condition.

It is well known that intense noise can introduce a temporary shift in hearing threshold. The use of the sucker for aspiration of fluid and glue is likely to introduce sufficiently high levels of noise to cause this effect as shown by Wetmore *et al.* (1993). There may be other factors contributing to the temporary threshold shift such as pressure changes at the round window due to sudden removal of middle ear fluid.

In this retrospective review eight of the 14 ears that had been exposed to aspiration of glue did not show any evidence of temporary threshold shift. This may be because these ears were not susceptible to noise exposure, or were exposed to insufficient noise to have any effect. The absence of the effect in all 11 of the ears in our study where the middle ear was dry or a myringotomy was not carried out supports the suggestion that aspiration of fluid may temporarily increase hearing thresholds. Further prospective studies are required to relate the intensity of sucker noise to the ABR threshold.

In those ears where a threshold shift was apparent there was a slight difference in changes for the two types of stimulus used. Click thresholds showed a mean shift of 30 dB (range 15–50 dB), and the 1 KHz tone-pip threshold showed a mean shift of 35 dB (range 15–60 dB). It would have been anticipated that the click thresholds should have been more sensitive to noise exposure, because noise generally affects hearing thresholds at high frequencies (typically above 2 KHz). The detection of the wave V and the SN10 components of the ABR is generally easier for the click evoked response than the 1 KHz tone-pip and this is one possible explanation as to why the click threshold has not been differentially affected. Equally we cannot be sure that other factors, such as sudden pressure changes at the round window, have not introduced a genuine temporary loss in hearing at 1 KHz.

Despite the limitations of this retrospective review we would wish other professionals to exercise caution in the interpretation of ABRs that are performed after aspiration of glue. Thresholds of the ABR may be unexpectedly raised, and in this situation advise that repeat measurements are carried out after an interval of two to three weeks.

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