The Auditory Brainstem Response – Are South African ENT's Missing the Point?

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ABSTRACT

The use and misuse of the auditory brainstem response (ABR) test by hearing professionals is often related to the extent and nature of the training they have received. This study used a postal survey based questionnaire to investigate the levels of training in, knowledge about, and appropriateness of referral for, ABR testing in Ear, Nose and Throat (ENT) surgeons and registrars in Gauteng, South Africa. Thirty-seven actively practising ENT specialists and registrars were sampled using a convenience sampling technique. Overall, a poor level of training and knowledge in ABR and its related areas of audiology was identified. This was mirrored by a high demand for further education. Considering the prevalence of auditory disorders in South Africa, and the push towards primary care and early intervention, this study's results highlight the need for improved training in ABR for ENT surgeons and registrars.

OPSOMMING

Die gebruik en misbruik van die ouditiewe breinstamrespons (OBR) toets deur professionele individue gemoeid met gehoor, hang dikwels af van die aard en omvang van die opleiding wat hulle ontvang het. Hierdie studie het deur middel van 'n posvraelys, die vlakke van opleiding, kennis, en toepaslikheid van verwysings vir OBR-toetsing deur 'n groep Oor-, Neus- en Keelartse (ONK) in Gauteng, Suid-Afrika, ondersoek. Sewe en dertig praktiserende ONK -artse en kliniese assistente is deur middel van 'n gerieflikheidssteekproeftegniek geselekteer. 'n Algemene gebrek aan opleiding en 'n lae vlak van kennis oor OBR en verwante terreine van oudiologie is geïdentifiseer. Terselfdertyd is daar 'n uitgesproke behoefte aan verdere opleiding. In die lig van die hoë voorkoms van gehoorprobleme in Suid-Afrika en die voorkoming en vroeë intervensie, dui die resultate van hierdie studie op 'n besliste behoefte aan verbeterde opleiding oor OBR onder Oor-, Neus-, en Keelartse.

KEYWORDS: auditory brainstem response, Ear Nose and Throat Surgeons and Registrars, training, knowledge.

INTRODUCTION

The auditory brainstem response (ABR) has been the mainstay of the advanced audiological and ENT neuro-otological test battery since its clinical introduction in the late 1970's (Hall, 1992; Ferraro & Durrant, 1994). It is a far-field, differentially averaged, electrophysiologically recorded signal that represents the summed and averaged responses to repeated acoustic stimulation, of thousands of nerve fibres in the VIIIth cranial nerve, and the auditory brainstem, thalamus and thalamocortical radiations (Hall, 1992).

Clinical advantages of ABR include the fact that it is relatively easy to record, objective, non-invasive, is independent of state of subject arousal, is generally drug resistant, and provides ear-specific information (Hall, 1992; Musiek, Borenstein, Hall & Schwaber, 1994). Furthermore, ABR results provide reproducible, sensitive and quantitative clinical information that can localise lesions within the auditory pathway even when the patient's history and physical examination are normal (Chiappa & Young, 1985).

As a result of its many advantages, the ABR is now established as the best audiological and oto-neurological test of the functional integrity of eighth cranial nerve and auditory brainstem (the so called "site of lesion" or "diagnostic" ABR). In this application, the ABR has proven to be more sensitive in detecting mass lesions than a computerised tomography scan (but less sensitive than an magnetic resonance imaging scan), and more sensitive than any test in detecting functional lesions of the VIIIth CN and auditory brainstem (Hall, 1992; Stanton & Cashman, 1997).

As the ABR is an accepted test of VIIIth CN and auditory brainstem function, it has also been widely and successfully used as estimator of hearing thresholds (the so called "threshold" ABR). In this role the ABR is used to estimate hearing thresholds in difficult to test subjects such as high risk newborn infants, the mentally and physically handicapped and psychogenic hearing losses (Hall, 1992).

The ABR is not without significant limitations however. Of primary concern is the fact that the ABR is NOT a test of hearing. The perceptual act of hearing requires, at the very least, neural activity to occur in the cortex. As the ABR is a test of the VIIIth CN and auditory brainstem only, it cannot be used to comment on cortical function. The ABR cannot, therefore, be seen to reflect the conscious act of hearing (Hall, 1992; Roush & Matkin, 1994).

Other ABR limitations include the need for sufficient peripheral hearing to enable accurate VIIIth CN and audi-

tory brainstem site of lesion evaluation (Hall, 1992), and the high frequency emphasis of the click stimulus and less than ideal error margin (± 20 dB) when using ABR to estimate hearing thresholds (Eggermont, 1984; Bachmann & Hall, 1997).

Whilst there is no doubt the ABR is a powerful component of the advanced audiological and otoneurological test battery, poor knowledge of the ABR's advantages and disadvantages have lead to its serious misuse in many clinical settings by both audiologists and medical doctors (Ferraro & Durrant, 1994). In a retrospective record review study, Holland (1996) and Downs (1996) showed 13/15 Southern African hearing impaired children from 15 to 74 months old to have been successfully assessed using behavioural audiometry after being initially assessed using ABR. They concluded the initial ABR assessment to have been unnecessary and to have delayed the initiation of appropriate aural rehabilitation in all 13 cases.

Such misuse of ABR is often related to the extent and nature of professional training in auditory evoked potentials. As Ear, Nose and Throat (ENT) specialists are often the first medical professional to be consulted about an auditory pathology, and the most likely to refer a patient for ABR testing, they are the medical professionals in the most need of up-to-date and accurate ABR training. In view of the under-utilisation of ABR technology in South Africa to date, and the fact that a substantial number of ENT specialists presently practising in South Africa were trained before the peak era of ABR technology, there is a likely demand for continued ABR education of South African ENTs. Without adequate training, underutilisation and inappropriate utilisation of ABR technology will continue (Donohoe, 1988).

By the year 2000, South Africa's population is projected to reach 47 million, the health of whom is expected to be managed within a primary health care framework (African National Congress, 1994). In view of the potential of ABR for early identification of auditory pathologies and hearing loss both as a screening tool and a diagnostic tool, and the emphasis in the White Paper for the Transformation of the Health System in South Africa (1997) on the appropriate use of health technology, the current knowledge and training of South African ENTs on ABR needs to be evaluated.

METHODS

AIM

This study used a postal survey based questionnaire to investigate ENT surgeon's and registrar's levels of training in; knowledge about; and appropriateness of referral for; auditory brainstem response testing specifically, and its place within audiological site of lesion and threshold testing generally, in Gauteng, South Africa. Specifically this study aimed to:

1 Determine the extent and nature of training received by ENTs in, and;
2 Explore ENTs' perceptions regarding the adequacy of their training in;
ABR testing specifically, and audiological site of lesion and threshold testing generally, and to;
3 Evaluate the referral criteria employed by ENTs for, and;
4 Determine ENTs' views with regard to their need for further training in;
ABR testing specifically.

TABLE 1: Description of respondents (n=37)

Demographic Factor	Sample	Total	Percentage
1. Level of Training	Registrar	7	19%
	Consultant	30	81%
2. University of Graduation	Cape Town	1	3%
	Medunsa	2	5%
	Bloemfontein	1	3%
	Pretoria	10	27%
	Stellenbosch	2	5%
	Witwatersrand	20	54%
	Other	1	3%
3. Years of Practice	Less than 1 year	3	8%
	1-3 years	3	8%
	4-6 years	9	24%
	7-10 years	7	19%
	10 or more years	15	41%
4. Place of Employment (n=51)*	Government Hospital	27	73%
	Private Practice	16	43%
	University	8	21%
5. Predominant Patient Population (n=139)*	Infants (0-18 months)	34	92%
	Paediatrics (19 months - 11 years)	34	92%
	Adolescents (12-17 years)	35	95%
	Adults (18 years+)	36	97%

* n ≠ 37 as respondents could reply in more than one category.

PROCEDURE

Subject sampling procedure and selection criteria

Subjects were sampled using a convenience sampling technique from the names of 90 ENTs and ENT Registrars listed as members of the South African Society of Otorhinolaryngology, Head and Neck Surgery.

In order to be eligible for inclusion in the survey, all subjects were required to be either actively practising as qualified ENT Specialists or be ENT Registrars completing their training. Due to time and resource restraints, only subjects practising in Gauteng Province, South Africa, were selected.

Description of subjects

Of the 90 subjects who received questionnaires, 37 responded yielding a response rate of 41%. Moser and Kalton (1971) report that a 20-30% response rate is acceptable as a baseline of replies to mailed questionnaires, and in general, a response rate below 50% is not unusual for postal surveys. A description of the respondents is provided in Table 1.

Questionnaire

The questionnaire comprised of 20 close ended multiple choice questions divided into five sections: demographic information (five questions); extent, nature and perceived adequacy of training in ABR and related audiological/otological tests (six questions); nature of current ABR referral practises (seven questions); need and desire for additional information in various areas of ABR (two questions); and an additional comments section that allowed for open ended comments to be made.

Data analysis

Questionnaire responses were analysed using descriptive statistics. Responses to multiple choice questions were assessed for percentages of respondents choosing each response. Responses to the open ended comment question were subjectively assessed for themes common across multiple respondents, or on individual comments considered to be of interest. General conclusions were then made.

RESULTS

The results are presented in accordance with the subaims formulated for the study:

UNDERGRADUATE AND PROFESSIONAL TRAINING

Respondent's training in the field of ABR

Of the 37 respondents, 19 (51%) had received formal training in the ABR. For these 19 respondents, 2 (11%) received the training during their undergraduate courses, 16 (84%) during their time as an ENT registrar, and 1 (5%) during their time as a qualified ENT surgeon. Three of the 19 (16%) had their training conducted by an audiologist and ENT, whilst the remaining 16 (84%) had their training conducted by an audiologist only. Many of the 19 respondents received their ABR training in multiple formats with 13 (68%) responses for formal lectures, 6 (31%) for workshops, 4 (21%) for conferences, 5 (26%) for journal clubs, and 10 (53%) for self-reading of the literature. This training was for more than 10 hours in 6 (32%) cases, between 5-10 hours in 4 (21%) cases, between 1-4 hours 8 (42%) cases, and was less than one hour in 1 (5%) case.

TABLE 2: Numbers and percentages of respondents who had received training in other audiological and/or electrophysiological tests (n=37).

Audiologic/Electrophysiological Test	Total	Percentage
Visual Reinforcement Audiometry	8	22%
Conditioned Orienting Response Audiometry	3	8%
Play Audiometry	7	19%
Tangible Reinforcement Operant Conditioning Audiometry	2	6%
Pure Tone Air and Bone Audiometry	33	92%
Speech Audiometry	28	78%
Site-of-Lesion Testing (e.g., Bekesy Audiometry)	10	28%
Otoacoustic Emissions	11	31%
Electrocochleography	6	17%
Auditory Middle Latency Response	4	11%
Auditory P300 Response	0	0%
Auditory 40 Hz Response	0	0%

Respondent's training in other audiological site of lesion and threshold tests

Percentages of the 37 respondents who had received training in other audiological and/or electrophysiological tests are shown in table 2.

PERCEIVED ADEQUACY OF TRAINING

The respondents average perceived adequacy of training in ABR anatomy and physiology, clinical applications, clinical limitations, interpretation, and referral criteria is shown in figure 1. Their perceived adequacy of training in audiology in general is shown in figure 2 with the five point scale from one-poor to five-excellent showing percentages of responses of 17% for one, 22% for two, 47% for three, 8% for four, and 6% for five.

RESPONDENT'S CURRENT LEVEL OF REFERRAL FOR ABR

Professional to whom respondents refer for ABR testing

Thirty-five (94%) respondents indicated they refer to an audiologist for ABR testing. Two (3%) indicated they refer to an audiologist and neurologist, whilst 2 (3%) indicated they refer to a medical technologist.

Reasons for ABR referral

Fourteen (37%) respondents indicated they refer for ABR testing for threshold estimation, 9 (26%) for threshold diagnosis (exact threshold identification), and 14 (37%) for site of lesion purposes.

Confidence in ABR results

The respondent's average confidence in the accuracy of ABR results for site of lesion purposes, for threshold estimation purposes, and for fitting of amplification, is shown in figure 3.

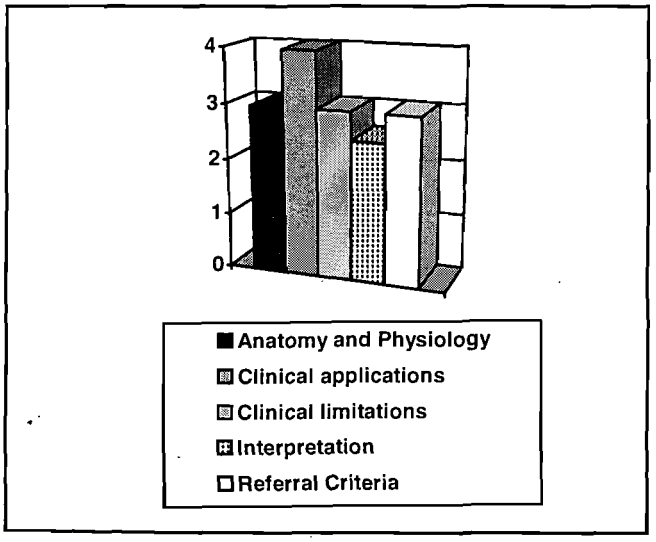

FIGURE 1: Average responses (0-very poor to 5-very good) for respondent's perceived adequacy of training in ABR (n=19).

Access to ABR resources

The respondent's level of access to ABR is shown in figure 4 with the five point scale from one-low to five-high showing percentages of responses of 6% for one, 6% for two, 11% for three, 25% for four, and 52% for five.

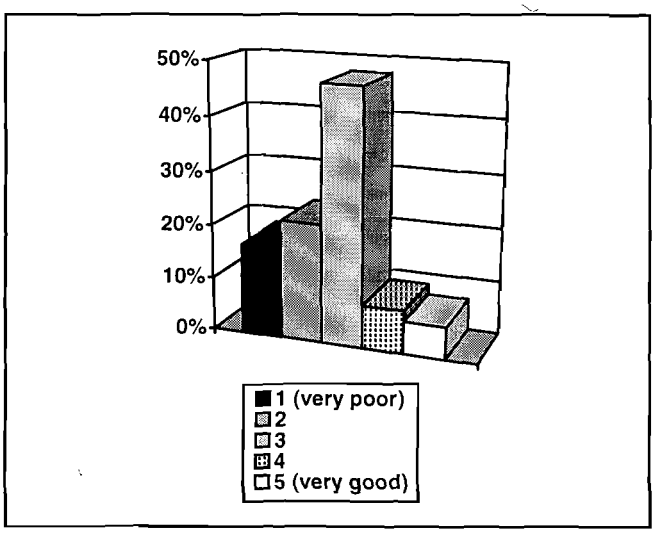

FIGURE 2: Percentage of respondents in each category for perceived adequacy of training in audiology in general (n=37).

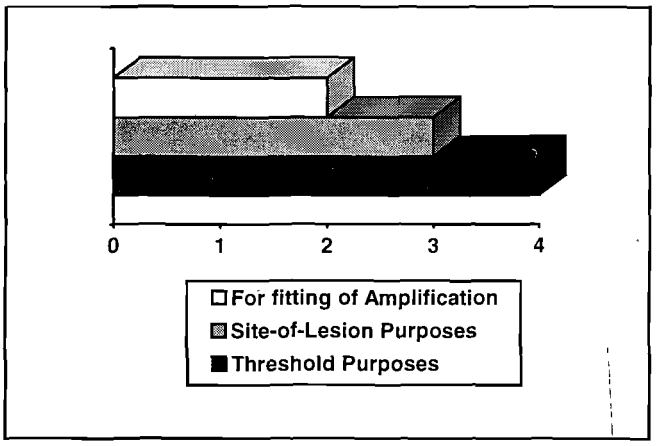

FIGURE 3: Average responses (0-low to 5-high) for respondent's confidence in ABR results (n=37).

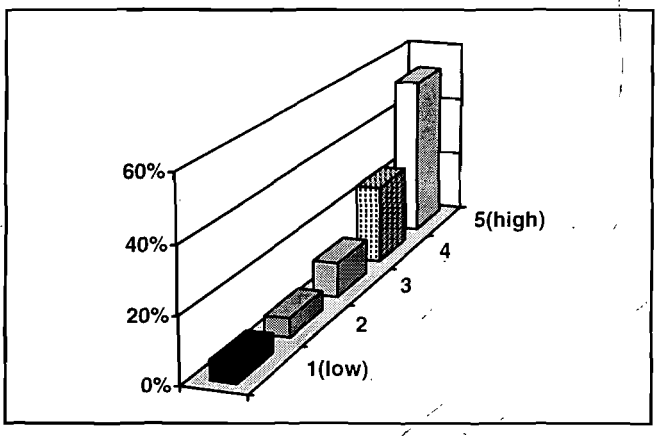

FIGURE 4: Percentage of respondents in each category (1-low to 5-high) for level of access to ABR (n=37).

Referral of paediatric and difficult-to-test patients for ABR threshold testing PRIOR to other audiological testing

Twenty-four (64%) respondents said they would refer neonates (0-3 months old), 26 (69%) infants (4-18 months old), 11 (31%) toddlers (19 months - 4 years old), 3 (8%) children (5-11 years old), 12 (33%) physically disabled patients, and 29 (78%) mentally retarded clients, prior to any other audiological testing.

Indication for ABR testing of various pathologies, signs and symptoms

Table 3 shows respondent's responses as to the indication for ABR testing of various pathologies, signs and symptoms.

NEED FOR ADDITIONAL ABR INFORMATION

Respondent's perceptions regarding the type of ABR information that is required

Six (16%) of the 37 respondents reported they did not, and 31 (84%) reported they did require further ABR training. Of the 31 respondents requesting further ABR training, 22 (70%) requested training on referral criteria for ABR, 28 (90%) on interpretation of ABR results, 25 (80%) on the clinical limitations of ABR, 30 (97%) on the clinical applications of ABR, and 21 (67%) on the anatomy and physiology of ABR. Twenty-three (73%) of these 31 respondents preferred this information to be presented in a workshop format, 4 (13%) preferred a conference format, and 11 (37%) preferred a lecture format. Twenty nine (94%) of these 31 respondents preferred this information to be presented by an audiologist, whilst 1 (3%) preferred a neurologist, and 1 (3%) a medical technologist.

ADDITIONAL COMMENTS

In the final item of the questionnaire, respondents were given the opportunity to express any further comments. This question was formulated as an open-ended item. The following are comments that were recorded verbatim:

"In all cases I will prefer otoacoustic emission testing prior to ABR if available."
"Unavailability of ABR in my region is the main reason for my low referral rate. For screening purposes, OAE's seem to be taking over."

TABLE 3: Respondent's responses (n=37) as to the indication for ABR of various pathologies, signs and symptoms (* indicates moderate and ** indicates major literature support for ABR use).

PATHOLOGY	Total	Percentage
Otosclerosis	2	6%
Ossicular Discontinuity	1	3%
Cochlear Pathologies *	18	50%
Presbycusis *	3	8%
Tinnitus, Vertigo, Hearing Loss **	30	83%
Recruitment *	16	44%
Poor Speech Discrimination **	21	58%
Tone Decay **	20	56%
Intra-axial Brainstem Lesions **	20	56%
Extra-axial Brainstem Lesions **	20	56%
Demyelinating Lesions of the Brainstem **	23	64%
Cerebral Vascular Disease in the Acute Stages	19	53%
Cerebral Vascular Disease in the Recovery Stages	9	25%
Hydrocephalus *	10	28%
Comatose Patients *	19	53%
Intra-Operative Monitoring of Neurological Status after Brain Injury *	16	44%
Intensive Care Unit Monitoring *	20	56%

"ABR is LESS important in ENT than in general and otoneurology. Developments in audiology and radiology are surpassing its diagnostic ability. The high costs of ABR will serve to limit its use in battery testing in a managed care environment."
"In my opinion, MRI scanning has replaced ABR for diagnosis of pathology regarding intra-cranial tumours, CV disease, comatose patients, M.S. ABR is suitable for threshold testing in small children and malingerers."
"Depending on costs and logistics a lot more patients could be referred for ABR."
"Education is very necessary for the ENT specialist."
"I have chosen an audiologist to now train me in ABR because I do not know how much information others have on ABR."

DISCUSSION

This study used a postal survey based questionnaire to investigate ENT surgeon's and registrar's levels of training in, knowledge about, and reasons for referral for, auditory brainstem response testing. Specifically the aims of the study were to; determine the extent and nature of training received by ENTs in, and explore ENT's perceptions regarding the adequacy of their training in, ABR testing specifically and audiological site of lesion and threshold testing generally; and evaluate the referral criteria employed by ENT's for, and to determine ENT's views with regard to their need for further training in, ABR testing specifically. Thirty-seven actively practising ENT Specialists and seven ENT Registrars from Gauteng Province, South Africa were sampled using a convenience sampling technique. Their questionnaire responses will now be discussed in the order of the study's aims.

UNDERGRADUATE AND PROFESSIONAL TRAINING

With only 51% of the respondents having received any formal training in ABR, the precedent for poor ENT ABR knowledge was immediately set. The finding that the majority (84%) of this 51% received their training during their registrar period was not surprising considering the specialist auditory nature of the ABR. The vast majority (87%) of respondents with ABR training were trained by an audiologist, whilst the remainder (13%) were trained by an ENT and audiologist. This shows that when formal ABR training did occur, the professional of choice for ABR training, i.e., the audiologist, was involved.

On closer examination of the 51% of respondents who had received formal ABR training, the quality of this training seems questionable with the lecture (68%) and personal reading of literature (53%) methods being the dominant form of education. Audiology Curriculum Guidelines for Otolaryngologists recommend that students need to observe and participate in testing that they are involved in (Campbell, 1995). Whilst such recommendations promote the workshop method as being the ideal (Kimura, 1985; Caffarella, 1994), only 31% of respondents with ABR training received it in this format. The finding that only 53% of respondents with ABR training reported reading ABR literature is also concerning considering the literature review is perceived as the most basic form of continuing education and a primary strategy for developing understanding and skills (Moll, 1974).

Further effecting the quality of ENT ABR training is the finding that only a minority of respondents (32%) received training that extended for a time period of greater than ten hours. Because ABR testing is continually evolving technologically, continuing education programmes of less than 10 hours are unlikely to have kept the respondents up to date in the field (Kimura, 1985). Such brief durations of training commonly educate solely in terms of clinical applications, and run the risk of generating false senses of competence (Kimura, 1985).

Whilst ABR training was generally poor, overall training in audiology was somewhat improved, but was still far from ideal (table 2). Whilst the majority of respondents (as many as 92%) had received training in basic audiological procedures, only a minority of respondents (as few as 0%) had received training in all areas of diagnostic and threshold audiology. This result is concerning considering the well accepted fact that a test battery approach is vital in any assessment of hearing (Hecox & Jacobson, 1984; ASHA, 1989).

With the increased recognition of ABR as an effective screening method for evaluating hearing in young infants, such incomplete knowledge of audiological test procedures also puts ENTs at risk of inappropriately referring for, or over-utilising, electrophysiological tests in lieu of classic behavioural methods. Such a problem would be consistent with literature reports of inappropriate referrals of children aged five to 74 months for immediate ABR testing when behavioural audiometry was the preferred first test of choice (Widen, 1990; Hodgson, 1994; Downs, 1996; Holland, 1996). A comprehensive knowledge of all audiological tests is required by ENTs because, in certain clinical applications, these tests surpass ABR in terms of their diagnostic and threshold capabilities (Cornacchia, Viglian & Arpipini, 1982; Folsom, 1990; Hall, 1992).

Overall, the "extent and nature of ABR training received by ENTs" results suggest that the current education of ENT's in terms of ABR specifically, and audiology generally, is unsatisfactory and supports the many literature reports of a shortage of clinical training opportunities for those who are no longer attending academic institutions (Hall, 1992).

PERCEIVED ADEQUACY OF TRAINING

Whilst the "extent and nature of ABR training received by ENTs" results suggest that the current education of ENT's in ABR is unsatisfactory, on average respondents who had received prior ABR training perceived this training to be of a generally good standard (Figure 1). This was particularly true in the areas of clinical applications of ABR, less so in the anatomy and physiology, clinical limitations and referral criteria of ABR, and not so for interpretation of ABR. Such results are useful in further identifying the areas of ABR knowledge that the ENTs themselves perceive as being their most inadequate.

Whilst those ENTs who have received formal ABR training perceived it to be of a generally high standard, on average, the majority of all ENT respondents (86%) felt their overall adequacy of training in audiology in general was average to very poor (Figure 2). This perception was supported by the low numbers of responses given (as low as 0%) for actual training received in many of the audiological tests listed in table 2. Such poor perceived and actual training in audiology does not provide a good platform for training in more advanced audiological procedures such as ABR.

RESPONDENT'S CURRENT LEVEL OF REFERRAL FOR ABR

All respondents indicated that they refer for ABR testing, with the overwhelming majority (97%) referring to an audiologist. Considering the poor level of knowledge of ABR amongst the ENTs surveyed, the fact that they are all referring for ABRs is concerning. The concurrent finding that these referrals are to audiologists predominantly is reassuring, however, as it provides a safety net for the filtering of unnecessary referrals.

Reasons for referring for ABR, and confidence in ABR results, were less promising with 63% of the respondents stating that they refer for threshold estimation or threshold diagnosis purposes, compared to only 37% for site-of-lesion testing. Similarly, respondent's confidence in ABR results was, on average, higher for threshold assessments than for site of lesion assessments (Figure 3). These findings do not comply with the literature that states the ABR is at its most sensitive and specific when used as a site of lesion tool in an audiological/otoneurological test battery, and is less sensitive and specific when used as a threshold estimation tool (Hall, 1992; Stanton and Cashman, 1997) where the ABR's subcortical properties and poor accuracy in estimating hearing thresholds prevent it from being a true test of hearing (Weber, 1994). The poor confidence, on average, in ABR as a useful tool in hearing aid fitting was consistent with the literature (Kileny, 1982; Gorga, Beuchaine & Reiland, 1987; Seitz & Kisiel, 1990).

Following on from the skewed preference for ABR use as a thresholding tool, was the 69% of respondents who indicated that they would immediately refer an infant (4-18 months) for ABR testing without obtaining prior behavioural measurements. This data conflicts with abundant literature on infant paediatric audiological testing which asserts that it is in the neonatal (0-3 months) population that the clinical applications of ABR measurements are especially salient (ASHA, 1989; Folsom, 1990; Joint Committee on Infant Hearing, 1991; Sininger, Abdala & Cone-Wesson, 1997), whilst behavioural audiometry is preferred for children who are old enough to be conditioned (generally over four months old) (ASHA, 1991). The numbers of respondents who would immediately refer toddlers (19 months to 4 years) (31%), children (5 to 11 years) (8%), and the mentally and the physically retarded (78%) for ABR assessment were more in line with relevant ABR guidelines (Silman & Silverman, 1991; Hall, 1992; Hood, 1995), but still demonstrated an overeagerness for immediate ABR referral.

In agreement with the poor ABR knowledge levels shown previously was the respondents poor responses to appropriate and non-appropriate indicators for ABR referral (table 3), despite the literature coverage of this area being extensive (Hall, 1992; Musiek et al., 1994; Hood, 1995; Stanton & Cashman, 1997). The major ABR indicators (listed as tinnitus, vertigo and hearing loss) and contraindicators (listed as otoschlerosis, ossicular discontinuity and cerebrovascular disease) were well identified (as high as 83%), but many respondents missed (as low as 8%) other, less obvious, direct and indirect ABR indicators (listed as poor speech discrimination, tone decay, intra and extra-axial brainstem lesions, and demylinating lesions of the brainstem, cochlear pathologies, presbyacusis, recruitment, hydrocephalus, comatose patients, intra-operative monitoring after brain injury, and ICU monitoring).

Whilst the respondents showed evidence of poor ABR knowledge and training, most (88%) (figure 4) also reported having an average to high access to ABR. Such accessibility reinforces the need for appropriate education to prevent the underutilisation of, and inappropriate referral for, ABR testing.

Overall, the "respondent's current level of referral for ABR" results were consistent with the "extent and nature of ABR training received by ENTs" results and further suggest a need to improve ENT knowledge of ABR specifically, and audiology generally.

NEED FOR ADDITIONAL ABR INFORMATION

The respondents showed an overwhelming desire (84%) for additional information and gave strong indications of the areas they want covered and the way the information should be presented. According to the majority of ENTs surveyed in this study, ABR education in the ENT population needs to be:

- Primarily in the areas of interpretation, clinical limitations and clinical applications of ABR, then in referral criteria, and then the anatomy and physiology underlying the technique.
- Presented in practical workshops rather than conferences and lectures.
- Presented by audiologists.

ADDITIONAL COMMENTS

These verbatim responses indicated that some respondents in the study felt that both oto-acoustic emissions as well as magnetic resonance imaging were transcending ABR in terms of their diagnostic abilities in both audiology and otoneurology. However, in direct contrast to this, other respondents also indicated that because of its high cost and inaccessibility, ABR is not sufficiently employed . Lastly, the need for further training was also highlighted. Respondents thus again, appeared willing and motivated to increase their knowledge with regard to ABR. This has implications for the provision of future education.

CONCLUSIONS

Overall, a poor level of training and knowledge in ABR and its related areas of audiology, was identified in the surveyed ENT specialists and registrars in Gauteng. This finding was mirrored by a high demand amongst the respondents for further education in ABR technology, preferably in a workshop format run by a qualified audiologist.

This demonstrated willingness amongst ENTs to further their working knowledge of ABR places the responsibility for this education back on the South African audiology community. The South African audiology community needs to be more active in its attempts to make a larger contribution to the audiological education of its ENT allies, both at undergraduate and postgraduate levels.

The ABR remains essential to the modern practice of hearing medicine. Its proliferation in the last 20 years, and the often limited expertise of its users, has seen the ABR become both over and underutilised in the clinical setting. Considering the prevalence of auditory disorders in South Africa, it is hoped that this study's results will heighten the need for improved awareness of ABR in ENT surgeons

and registrars. An improved awareness will motivate increased training in ABR, the enforcement of correct referral guidelines, and further research into ABR and related areas. Such endeavours are likely to lead to a refined use of ABR in South Africa, which in turn should result in improvements in the provision of hearing health care to the population at large.

Limitations of this study include the relatively small and restricted ENT population sampled. These limitations prevent this study's results from being generalised beyond the ENT surgeon and registrar population practising in Gauteng, South Africa.

Note: The questionnaire used in this study is available on request from the corresponding author; Wayne Wilson, Department of Speech Pathology and Audiology, University of the Witwatersrand, Private Bag 3, WITS, 2050, South Africa. Email: 053wayne@muse.wits.ac.za.

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INFORMATION FOR CONTRIBUTORS

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The South African Journal of Communication Disorders publishes reports and papers concerned with research, and critically evaluative theoretical and philosophical conceptual issues dealing with aspects of human communication and its disorders, service provision, training and policy.

The South African Journal of Communication Disorders will not accept material which has been published elsewhere or that is currently under review by other publications.

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EXAMPLES

Locke, J.L. (1983). Clinical Psychology: The explanation and treatment of speech sound disorders. *J. Speech hear. Disord., 48* 339-341.

Penrod, J.P. (1985). Speech discrimination testing. In J. Katz (Ed.), *Handbook of clinical audiology* (3rd ed.). Baltimore: Williams & Wilkins.

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