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Original Article

Knowledge Regarding Interpretation of Brain Stem Evoked Response Audiometry (BERA) Report by Speech -Language Pathologists

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ABSTRACT

According to ASHA assessment of hearing loss is part of scope of practice & service delivery area of SLP's with Brain Stem Evoked Response Audiometry tests being an effective tool. Keeping in view dearth and disparities in the knowledge and professional abilities of SLPs, need of early identification and intervention for hearing impaired population and importance of BERA test and gap in research current study was conceived. **Objective:** To determine the knowledge regarding interpretation of Brain Stem Evoked Response Audiometry (BERA) report by Speech-Language Pathologists. **Methods:** This Cross-Sectional study was conducted at Riphah International University, Pakistan from January, 2022 to June, 2022. Study using convenience sampling recruited N=102 speech language pathologists of both genders, aged 25 to 50 years, working in private and public hospitals, special education schools, private clinics, Universities and Rehabilitation Centers of Rawalpindi and Islamabad. A self-developed questionnaire was used for data collection and analysis performed using SPSS Version-20. **Results:** Knowledge of interpretation of BERA report by Speech and language Therapists/ Pathologist in current study revealed a total mean score of 40.78 ± 7.03, indicating moderate level of knowledge of interpretation of BER. Knowledge of interpretation of BERA is not associated with gender, age and experience, however it revealed significant associated with qualification of SLP. **Conclusions:** It was concluded from the result of present study that the majority of speech and language Pathologists have moderate level of knowledge regarding interpretation of BERA. Knowledge of interpretation of BERA is associated with qualification of SLP.

INTRODUCTION

Brain Stem Evoked Response Audiometry tests is an effective tool to determine underlying auditory processing issues in kids who show disability related to learning and thus assist in early management [1]. A study by Yahata *et al.*, revealed that auditory nerve cell degeneration could result in reduction of auditory brainstem response as well as speech clarity as well in in patients with sensorineural Hearing Impairment [2]. Since Speech Language Pathologists (SLP) and audiologists are the professionals catering to this population and even adjusting the hearing assistive devices, assessing auditory skills and hearing aid performance [3]. SLPs plays a vital role in hearing assessment and give a specific therapy plan on basis of hearing report. Presented with multifarious questions as a result of their efforts to provide substantial professional therapies to individuals of all ages with language impairment, mixed method research seems to be a way to address the issue [4] since knowledge of BERA is essential to access hearing in children and its possible etiology [5]. This is mainly important since early identification and treatment of hearing impairment is essential for timely speech-language acquisition [6] Stakeholders need to collaborate to reach a high standard in education and clinical knowledge and hence research is needed to fill the

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gap [7]. In Pakistan the field of Speech Language Pathology is a new field faced with lot of barriers and only by adopting evidence-based practice, SLPs in Pakistan can make proper decision making in their professional work and provide high level services to meet the needs of population [8]. According to American Speech Language Hearing Association Assessment of hearing loss is part of scope of practice & service delivery area of SLP's in addition to swallowing and communication inclusive of production of fluent speech, cognitive issues, language & phonation issues, and resonance [9]. Literature reveals that SLP's being important professionals to detect hearing loss, there is need to increase awareness of available hearing screening tests and protocols [10]. Keeping in view the gap in research, dearth and disparities in the knowledge and professional abilities of SLPs, need of early identification and intervention for hearing impaired population and importance of BERA test, current study was conceived to determine the knowledge regarding interpretation of Brain Stem Evoked Response Audiometry report by SLPs. This study is very important since it will help achieve insight into a less researched area and help planning to cater to the issue to address the problem of early identification and intervention for hearing impaired population.

METHODS

Current cross-sectional was conducted at Riphah College of Rehabilitation Sciences, Riphah International University, Islamabad over a period of 6 months from 1st January, 2022 to 31st June 2022. The study was initiated after obtaining ethical approval Research Ethical Committee (REC) of Riphah College of Rehabilitation Sciences, Riphah International University vide registration number RIPHAH/RCRS/REC/Letter-01172 dated 10th November, 2021 and written informed consent of participants. Study recruited a sample of N=102 Speech Language Pathologists (SLP) of both genders, with minimum Bachelor's qualification and 1-year experience, working in private and public hospitals, special education schools, private clinics, universities and rehab centers of Rawalpindi/ Islamabad, using convenience sampling. Student SLP's or those with less than 1-year experience were excluded from the study. Sample of 107 using following formula was calculated:

$$N = \frac{z^2_{a/2} * P * (1-p) * DEFF}{d^2}$$

with a prevalence percentage of 7.5%, [11]. DEFF as 1, absolute precision d of 0.05 & confidence level α of 0.05. Five (5) participants left the study leaving behind 102 which was our sample for the study. In addition to basic demographic sheet, a self-developed questionnaire was used for collection of data from participant SLP's. This study was conducted into two phases: In first phase items of questionnaire was modified and send it to panel of experts for content validity. Content validity Ratio for items (CVR) was calculated. Each of these items was rated by 6 experts on 4-point rating scale. Out of which the relevant rating was 3 or 4 which was scored as 1 and non-relevant rating was 1 or 2 which were scored as 0. Content validity Ratio for items I-CVR was calculated by the Lawshe's Method [12]. After content validity pilot study performed. Likert scale was utilized to mark the responses with minimum score 14 and maximum 68. Higher score indicated better knowledge. In second phase main study data were collected from SLP's. The questionnaire was sent online by emails, google forms and also through personally circulated in speech therapists from Rawalpindi/ Islamabad. After data collection, it was entered in SPSS data sheet and analyzed in SPSS Version-20. Descriptive statistics were run to calculate relative and absolute frequency, and means & standard deviation. Tool validity was also calculated. t-test and Annova statistics were utilized to determine any difference of score for demographic variables. $p<0.05$ was considered significant.

RESULTS

Before conducting main study, Content Validity Ratio for items (CVR-I) was calculated. Each item was rated by 6 experts on 4-point rating scale. Out of which the relevant rating was 3 or 4 which was scored as 1 and non-relevant rating was 1 or 2 which were scored as 0. Each of these items was rated by 6 experts in this scale on 4-point rating scale. Average proportion of items judged as relevance across six experts is 0.91. Value of SCVI is 0.9. Pre-testing was conducted on 12 participants of which 6(50%) were female and 6(50%) were male who responded in the pilot study with a mean age of 25 ± 4.66 years, 04 participants were MS(SLP), 04 BS(SLP), 04 were PGD /Diploma. Of the main study sample of N=102 majority were 79(77.5%) females and most 71(69.5%) were in age group 25-30 years and most 60(60.8) being MS (SLP) degree holders and experience of 103 [58(56.9%)] (Table 1).

Table 1: Demographic variables versus Mean Scores Cross Tabulation. T-test and ANOVA Statistics (N=102)

Demographic Variable		N (%)	Score Mean ± SD	t/f, p-value
Gender	Male	23(22.5)	46.00±7.31	1.491 0.139
	Female	79(77.5)	43.41±7.36	
Age	25-30	71(69.6)	43.31±7.93	1.041 0.378
	31-35	20(19.6)	44.50±6.29	
	36-40	4(3.9)	47.25±5.06	
	>40	7(6.9)	47.57±4.47	
Qualification in Speech Language Pathology	PGD	20(19.6)	45.95±6.19	2.933 0.049
	BS	20(19.6)	46.35±6.47	
	MS	60(60.8)	42.60±7.77	
	Nil	12(11.8)	41.00±9.53	

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Experience (Years)	1-3	58(56.9)	43.55±7.85	1.135 0.345
	4-6	21(20.6)	45.52±4.79	
	7-9	5(4.9)	46.20±6.76	
	> 10	6(5.9)	47.00±4.86	
Total Score	Range 15-44		40.78±7.03	

Knowledge of interpretation of BERA report by Speech and language Therapists/ Pathologist in current study revealed a total mean score of 40.78 ± 7.03 (Range 14 to 44), indicating moderate level of knowledge of interpretation of BERA. To the question "how would you rate your basic knowledge for interpretation of BERA test as speech Language Pathologists/ Therapist" majority 58(56.9%) reported little knowledge, while only 2% reported to have expert knowledge and 10(9.8%)revealed they had sufficient knowledge (table 2). Responses to other questions revealed somewhat similar picture, where majority 96(94.1%) knew what BERA stood for, however majority 75(73.5%)didn't know that it was non-invasive.

Table 2: Responses to questionnaire items, Descriptive statistics (n=102)

Item Choices	Response(%)
What does "BERA" stands for?	
Behaviorally Emitted Auditory Response	8(40.0)
Bilaterally Evoked Response Audiometry	12(60.0)
Brainstem Evoked Response Audiometry	20(100.0)
What type of test "BERA" is?	
Don't know	5(4.9)
Subjective and invasive	6(5.9)
Objective and invasive	75(73.5)
Objective and noninvasive	16(15.7)
What is the appropriate age for "BERA" test?	
Don't know	13(12.7)
Before hospital discharge	12(11.8)
1st month of age	27(26.5)
3rd month of age	9(8.8)
6th month of age	41(40.2)
Which frequencies are tested in BERA through chirp?	
Don't know	19(18.6)
1000-4000Hz	18(17.6)
125-8000Hz	25(24.5)
250-8000Hz	25(24.5)
500-8000Hz	15(14.7)
How would you rate your basic knowledge for interpretation of BERA test as Speech language pathologist/ therapist?	
No knowledge	12(11.8)
Little knowledge	58(56.9)
Enough clinical knowledge	20(19.6)
Sufficient knowledge	10(9.8)
Expert	2(2)
Above is a case report of 2-year-old boy. What do you suspect should be the level of his threshold?	
Normal Hearing	30(29.4)
Mild Hearing Loss	28(27.5)
Profound Hearing Loss	2(2)
Severe Hearing Loss	11(10.8)
Moderate Hearing Loss	31(30.4)
According to the case cited in Q6, which intervention the patient is a candidate for?	
Don't know	10(9.8)
No need of hearing devices	26(25.5)
Cochlear Implant	11(10.8)
Hearing aids	55(53.9)
According to case cited in Q6, is the patient a true candidate for auditory rehabilitation?	
Don't know	11(10.8)
No	23(22.5)
Yes	68(66.7)
Above is a case report of 8-year-old boy. What do you suspect should be the level of his threshold?	
Normal Hearing	8(7.8)
Mild Hearing Loss	19(18.6)
Moderate Hearing Loss	23(22.5)
Severe Hearing Loss	34(33.3)
Profound Hearing Loss	18(17.6)
According to the case cited in Q7, which intervention the patient is a candidate for?	
Don't know	7(6.9)
No need of hearing devices	6(5.9)
Hearing aids	48(47.1)
Cochlear Implant	41(40.2)
According to case cited in Q7, is the patient a true candidate for auditory rehabilitation?	
Don't know	11(10.8)
No	11(10.8)
Yes	80(78.4)
Above is a case report of 3-year-old boy. What do you suspect should be the level of his threshold?	
Normal Hearing	19(18.6)
Mild Hearing Loss	27(26.5)
Moderate Hearing Loss	22(21.6)
Severe Hearing Loss	10(9.8)
Profound Hearing Loss	24(23.5)
According to the case cited in Q8, which intervention the patient is a candidate for?	
Don't know	6(5.9)
No need of hearing devices	17(16.7)
Hearing aids	42(41.2)
Cochlear Implant	37(36.3)
According to case cited in Q8, is the patient a true candidate for auditory rehabilitation?	
Don't know	8(7.8)
No	20(19.6)
Yes	74(72.5)
Above is a case report of 5-year-old boy. What do you suspect should be the level of his threshold?	
Normal Hearing	36(35.3)
Mild Hearing Loss	14(13.7)
Moderate Hearing Loss	13(12.7)
Severe Hearing Loss	17(16.7)
Profound Hearing Loss	22(21.6)

No significant difference of knowledge was noted with gender (p=0.139), age groups (p=0.378) and experience (p=0.345) however higher score was present in males compared to females (46.00 ± 7.31 vs. 43.41 ± 7.36), higher age group (>40 years= 47.57 ± 4.47 vs 25-30 years =43.31 ±

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7.93) and higher experience (>10 years = 47.00 ± 4.86 vs. no experience = 41.00 ± 9.53) (Table 2). Interestingly a significant difference (p=0.049) of knowledge was noted with qualification of experience with highest score for bachelor's qualification (46.35 ± 6.47) compared to masters (42.60 ± 7.77).

DISCUSSION

Brainstem Evoked Response Audiometry (BERA) is a useful neurophysiological technique to assess the hearing thresholds in a non-invasive manner in neonates and children [13, 14]. Literature reveals that SLPs are deficient and there are disparities in their knowledge and professional abilities [15]. A study by Silkes and Winterstein revealed that SLPs working for early intervention were felt to be undertrained and less prepared and require continuing education to increase their knowledge [10]. Similarly, evaluation of the knowledge of interpretation of BERA report by Speech and language Therapists/ Pathologist in current study revealed a total mean score of 40.78 ± 7.03 (Range 14 to 44), indicating moderate level of knowledge of interpretation of BERA. Also, to the question "how would you rate your basic knowledge for interpretation of BERA test as speech Language Pathologists/ Therapist" majority 58(56.9%) reported little knowledge, while only 2% reported to have expert knowledge and 10(9.8%) revealed they had sufficient knowledge (table 2). In another local study by Rana *et al.*, with a sample comprising 81% females and 81% aged 20-30 years' age revealed that SLP's have mild to moderate level of skill to interpret pure tone audiograms requiring enhancement of their knowledge and skills [16]. While auditory brainstem responses can detect HL at an earlier age [17]. Hence augmenting the knowledge of interpreting BERA of SLP's is essential since introduction of universal hearing screening programs will help early diagnosis and intervention [18]. However, a Brazilian study revealed that neonatal hearing screening did not meet the quality level which was established due to the fact that 48% SLPs indicated that it was due to equipment issues [19]. Current study did not reveal any association of knowledge with gender (p=0.139), age groups (p=0.378) and experience (p=0.345) however higher score was present in males compared to females (46.00 ± 7.31 vs. 43.41 ± 7.36), higher age group (>40 years= 47.57 ± 4.47 vs 25-30 years =43.31 ± 7.93) and higher experience (>10 years = 47.00 ± 4.86 vs. no experience = 41.00 ± 9.53) (Table 1). Interestingly a significant difference (p=0.049) of knowledge was noted with qualification of experience with highest score for bachelor's qualification (46.35 ± 6.47) compared to masters (42.60 ± 7.77). This might be due to the fact that syllabi in the bachelor's degrees are now better equipped to give the students the required knowledge. There are a lot of people who visit Speech and language Pathologists with hearing problems which are not pre-diagnosed and their hearing loss has affected speech and language. If a SLP knows how to interpret BERA report and other hearing assessment tests, it becomes easy and is beneficial for cooperation with other experts hence, it is essential for Speech and language therapists to have the knowledge regarding hearing tests and their interpretations [20].

CONCLUSIONS

It was concluded from the result of present study that the majority of speech and language Pathologists have moderate level of knowledge regarding interpretation of BERA. Knowledge of interpretation of BERA is not associated with gender, age and experience, however it is associated with qualification of SLP.

Authors Contribution

Conceptualization: HSK
Methodology: HSK, SAHS, RS
Formal Analysis: RS, SAHS
Writing-review and editing: HSK, GS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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