

Electrophysiological (ABR) Findings of A Group Of Patients With Autism Spectrum Disorder



Navneet Gupta*¹, Kalu Raut² and Abhay Kumar Lanka²

¹Consultant Audiologist & Speech Pathologist Acharya Sri Chander College of Medical Sciences & Hospital

²JK Electronic Ears, Prime Speech & Hearing Clinic, India

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*Corresponding author: Navneet Gupta, Consultant Audiologist & Speech Pathologist Acharya Sri Chander College of Medical Sciences & Hospital, India, Tel: 9519261310; Email: navneetaryan@gmail.com

Abstract

Purpose: To describe electrophysiological (ABR) findings of a group of patients with autism spectrum disorder.

Methods: A group of 23 children with autistic disorder were included in an investigation of auditory brain stem responses (ABR). The results from the study group were compared with those of an age-matched comparison group.

Results: All these 23 children diagnosed with ASD exhibited significantly prolonged latencies of ABR wave V and the IPL (Interpeak Latency) of I-V in ABRs. The III-V inter peak latency (IPL) was significantly prolonged in both boys and girls with autism, compared with the controls. The latencies of ABR waves I and V were also significantly lengthened in the study groups.

Conclusion: The Possible causes of the reported ABR abnormalities observed here as well as in other studies, are discussed. Brain stem lesion, occult cochlear dysfunction, and involvement of the cochlear efferent system are probable factors that can explain the ABR findings. Thus comprehension of the potentially atypical auditory processing in children with autism may be key to parsing different etiologies of autism, targeting treatments to children with auditory hyper/hypo-sensitivities, and ameliorating overwhelming auditory sensory input to facilitate learning.

Abbreviations: IPL: Inter Peak Latency

Introduction

Autism spectrum disorder is a developmental disorder characterized by social withdrawal, impairments in communication, resistance to change and repetitive or stereotypic behaviours (American Psychiatric Association, 2000). In recognition of the variability of symptom expression and severity, and the existence of related disorders with overlapping symptomatology (e.g., Rett syndrome), autism was conceptualized as a spectrum disorder in the late 1980s (Allen, 1988). In the literature there is controversy about communication skills in patients autism spectrum and how the hearing handicap can be related to the problems. Despite parents and educators observe atypical and adverse responses to sounds, these hearing behaviours have not been quantified. Patients enrolled in ASD often present different sensory domains that can manifest as hyposensitivity or hypersensitivity to sounds, however the visual- spatial processing appears to be relatively preserved [1,2]. Autism is thought to have an early onset, with symptoms appearing before 30 mo of age in the majority of cases

(APA, 1994; Filipek et al., 1999; Stone et al., 1999). However, a definitive diagnosis of autism is often not made until the age of 4 to 4½ yr (Filipeket al., 2000; Siegel, Pliner, Eschler, & Elliot, 1988; Stone & Rosenbaum, 1988) as a result of overlapping conditions and scant information on behavioural characteristics at younger ages.

The differential diagnosis and appropriate intervention of this population are conducted using subjective and objective procedures to assess hearing. The behavioural assessment is a subjective procedure, i.e., depends on the subject's responses it may be impaired due to interaction problems of this population, which may generate unreliable responses [3]. In order to reduce this variability electrophysiological (ABR) measures in assessment of children with ASD provide an accurate diagnosis and a more effective intervention. The goal of the present study was to compare the ABRs of young children with suspected ASDs with an age-matched control group.

Materials and Methods

Twenty-three children (19 boys and 4 girls) with autism were enrolled in the experimental group. The average age of the experimental subject's was 5:7. All these children were selected from ASCCOMS Hospital & JK Electronic Ears, Prime Speech & Hearing Clinic. Auditory brainstem evoked potentials were recorded in two channel setup with four electrode configuration, that is, two electrode on both sided mastoid processes, one electrode on fore head as ground point and one at vertex to optimize detection of wave V. Band pass from 30 or 100 Hz to 4000 Hz was used to detect principle ABR waves. Click stimuli were rarefaction clicks presented monaurally at rates from 11.1 to 33.3-/s and at intensities from 55 dBnHL to 85 dBnHL and in most cases, 95 dBnHL. Repeated wave replicability testing was administered to cross-check the ABR wave forms. Different averages were documented for wave interpretation throughout testing. Electrode generated impedance value and artifact rate were eventually monitored to maintain test-retest reliability. Latency-intensity function test, interpeak latency, and wave amplitude were taken into account for better diagnosis.

Results

Absolute latencies and IPLs of the ABRs were compared between infants with ASD (n =23) and case-matched controls (n = 23). In comparison to matched-case controls, children's who were later diagnosed with ASD exhibited significantly prolonged latencies of ABR wave V and the IPL of I-V in ABRs during stimulation of either the right or left ear.

The III-V interpeak latency (IPL) was significantly prolonged in both boys and girls with autism, compared with the controls. The latencies of ABR waves I and V were also significantly lengthened in the study groups. Out of these 23 autistic children, 14 had abnormalities of one or more of eight ABR parameters studied. The most common abnormalities were prolongation of wave V (40%), and of I-V IPL (26%).

Discussion

Autism is a developmental disorder characterized by disturbances in social interaction, communication, and restricted interests or activities. Although there is little evidence of a marked reduction in autistic features, it has been determined that early interventions have had positive effects in significantly improving social behaviour, self care, and academic skills [4,5]. Research on the higher-order auditory processes can be conducted by using more objective measures such as ABR, middle, and late evoked responses as well as visual scanning procedures. Many earlier studies assessed the neurolinguistic characteristics of children with autism by using neurophysiological measures, but the results obtained were contradictory [6-12]. Particularly, Maziade et al. observed the prolongation of the early brain evoked response inter-peak latency, I-III in autistic probands [6]; however, Wong et al. reported that children with infantile

autism or autistic conditions had a significantly longer brainstem transmission time than those with normal by using ABR [13].

Our study also showed a significant prolongation of the latency values of wave V, I-V, and III-V inter-peak latency values in the ASD group. The underlying neuropathology that may account for the ABR prolongation in ASD remains unknown. One potential explanation is that prolonged wave V latencies are due to impaired progression rates of myelination of the auditory system in children with ASD, with some research pointing to marked delays [Perkins et al., 2014; Peterson, Mahajan, Crocetti, Mejia, & Mostofsky, 2014; Roberts et al., 2013; Wolff et al., 2012], while others suggest that white matter development is accelerated in ASD [Ben Bashat et al., 2007; Weinstein et al., 2011]. It is interesting to note that neuroanatomical and neuropathological studies on autism reported hyperplasia of some brainstem nuclei, reduction in Purkinje cells, hyperplasia of the cerebellar vermis, neuronal immaturity, increased cell packing density in the amygdale and hippocampus [14-16].

Conclusion

ABR informs us regarding the processing of acoustic stimuli, particularly in brainstem, these findings provide clinical evidence of brainstem abnormalities and suggest that the brainstem may be partly responsible for deviant language, cognitive, and social development in children with ASD. As language deficits are a core feature of ASD, the study of auditory processing is essential to considering the roots of ASD as well as to conceptualize rational interventions.

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