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Is There Any Specialization in Auditory Pathway by Brainstem Auditory Evoked Potentials-An Electro Physiological Approach

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Abstract:
It is an established fact that right cerebral hemisphere is specialized for musical tones and left is for verbal tones. ***Aim of the study:*** *This study is aimed at exploring whether there is any specialization in right and left auditory pathways as well like in cerebral hemispheres, by recording the inter peak latencies of brainstem auditory evoked potentials with a musical acoustic stimulus in normal healthy individuals.* ***Materials and methods:*** *42 young healthy individuals of both the sex aged around 20 years are voluntarily took part in the study. Brainstem auditory evoked potentials were recorded with Recordus Medicare System (RMS) machine. Monoaural rarefaction click and musical stimulus were applied one after other in each ear while simultaneously blocking the other ear with a white noise of 40 dB. Rarefaction click was used as it increases the amplitude of wave I.* ***Statistical analysis:*** *Analysis of the data was done with student t test. P value <0.05 will be considered as significant.* ***Results:*** *Left ear inter peak latencies of wave I-III, III-V and I-V with rarefaction click and musical tone are 1.92±0.23 & 1.94±0.30 (p=0.73), 2.02±0.44 & 2.13±0.36 (p=0.22) and 3.98±0.38 & 4.02±0.60 (0.72) respectively. Right ear inter peak latencies of wave I-III, III-V and I-V with rarefaction click and musical tone are 2.08±0.41 & 2.04±0.59 (p=0.72), 1.83±0.42 & 2.03±0.57 (p=0.08) and 3.85±0.53 & 3.98±0.77 (0.20) respectively.* ***Conclusion:*** *This study concludes that there is no specialization in the left and right auditory pathways starting from the spiral ganglion till the inferior colliculus.*
Key words: *brainstem auditory evoked response, inter peak latencies, recordus medicare system, rarefaction click*

I. Introduction:

Brainstem auditory evoked potentials are the records of far field potentials, they are the records of standing potentials at different locations of a specific neuronal pathway generated due to propagation of travelling impulses along the neuronal pathway, that is due to change in the geometry of volume conductors of those specific locations[1]. Brainstem auditory evoked responses arereflected as seven waves recorded in the auditory pathway starting from the spiral ganglion till the auditory cortex[2]. Wave **I** arises from spiral ganglion, wave**II**and **III** are from cochlear nucleus and superior olivary nuclei respectively, wave **IV** is from nucleus of lateral lemniscusand wave **V** from inferior colliculi[3]. Identification of wave I is crucial in measuring the inter peak latencies[4]. It is an established fact that right cerebral hemisphere is specialized formusical sensation that means stimulus should be in the left ear and left cerebral hemisphere is specialized for verbal tones that is stimulus should be in the right ear[5,6].So this study is aimed at exploring whether there is any specialization in the right and left auditory pathways like in cerebral hemispheres,starting from the spiral ganglion till the inferior colliculus by recording the BAERwith Recordus Medicare System.

II. Materials and methods:

Study was approved by the institutional ethical committee and the subjects were voluntarily participated in the study after obtaining the written informed consent. Routine general examination was done based on history taking and by clinical examination.**Inclusion criteria:**subjects arehealthy individuals, both the sex, age 18-20 years, medical and nursing students.**Exclusion criteria:**hypertensive's, endocrine pathology, congenital anomalies, hearing disorders, recent history of trauma or major surgeries, smokers, alcoholics.Brainstem Auditory Evoked Response (BAER) was recorded with Recordus Medicare System (RMS). BAER was recorded in a sound attenuated room with a rarefaction click initially and then with a musical tone.The intensity of the rarefaction click is 90 db and the stimulus repetition is 2/sec. In the present study rarefaction click is applied as it produces wave I with high amplitude[7, 8, 9].BAER was recorded in each ear with mono aural stimulation while simultaneous blocking the contra lateral ear with a white noise of 40 db. In a person with normal hearing abilities blocking of the contra lateral ear is not required as the impulse generated in the ipsilateral side will block the impulse coming from the contralateral side of the cochlear nuclei due to natural physiological delay of the impulse. But we have blocked the contra lateral ear as a routine procedure to exclude

the chance of disturbing the wave properties by some unidentified pathological process of either side.Specifications of RMS for recording of BAER:Channels-1 and 2, sensitivity 200 µv/division,high cut-2 pole filters at 200 Hz,andlow cut at 200 Hz**,** sweep speeds 1000, input impedance>100, noise 0.5 µv rms, 14 bit analog digital conversion, number of averages 9999, stimulation duration 1ms, hand held electrical stimulator, head phone auditory, rarefaction click, 2000 Hz, 90db, white noise 40db for contra lateral masking.

Statistical analysis: Data was analysed by using Med Calc Statistical Software version 12.7.8 (Med Calc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2014). Student's t-test was used in comparing the means of inter peak latencies. A p-value <0.05 was considered as statistically significant.

III. Results:

Table: 1 Mean Inter peak latencies of BAER results in milli seconds with Standard Deviation

Inter peak lat	Left Ear			Right Ear		
	Click	Music	P value	Click	Music	P value
I-III	1.92±0.23	1.94±0.30	0.73	2.08±0.41	2.04±0.59	0.72
III-V	2.02±0.44	2.13±0.36	0.22	1.83±0.42	2.03±0.57	0.08
I-V	3.98±0.38	4.02±0.60	0.72	3.85±0.53	3.98±0.77	0.20

IV. Discussion:

Lower auditory pathways in moleare having the similar characteristics that of mammals[10]. It is an established fact that right and left cerebral hemispheres are specialized for music and verbal tones respectively[5, 6]. Though the acoustic stimulus from each ear reaches to both the hemispheres, right auditory cortex receives the stimulus from left ear a bit earlier than the stimulus from the right ear likewise left auditory cortex receives the stimulus from right ear a bit earlier than the stimulus from the left ear.Right cerebral hemisphere is specialized for musical tone, so the inter peak latencies should be less when the musical stimulus is given in the left ear than when the rarefaction click, if the left auditory pathway is also specialized like the right cerebral hemisphere, which was not observed in the present study. Left cerebral hemisphere is specialized for verbal tone, so the inter peak latencies should be less when the rarefaction click is given in the right ear than when the musical tone, if the right auditory pathway is also specialized like the left cerebral hemisphere, which was also not observed in the present study.Right and left auditory pathways have shown the similar response in terms of inter peak latencies to the two different acoustic stimuli that is rarefaction click and musical tone that was shown in table 1, and these values are within the physiological limits[11], which means there is no specialization in left and right auditory pathways starting from spiral ganglion till the inferior colliculus unlike that is seen in cerebral hemispheres.

V. Conclusion

This study concludes that there was specialization among the right and left auditory pathways starting from the spiral ganglion till the inferior colliculus.

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