

BRAINSTEM AUDITORY EVOKED POTENTIALS (BAEPs) IN PREGNANT WOMEN

O. P. TANDON*, R. MISRA AND I.TANDON**

*Departments of Physiology and Obstetrics & Gynaecology,
University College of Medical Sciences &
G.T.B. Hospital, Shahdara, Delhi - 110 095*

(Received on December 12, 1989)

Abstract: The electrophysiological correlate of change in sensory function during pregnancy has not been reported. The brain stem auditory evoked potentials were recorded in eight pregnant women during third trimester from CZ-A1 and CZ-A2 position, with alternating 90dB sound pressure click stimuli delivered at 10/sec and -40dB (white noise) masking of contralateral ear. Two thousand and forty eight responses were analysed and replicated. The noise and other artefacts were rejected with filter bandpass setting 150 to 3000Hz. The evoked responses in pregnant women were compared with ten age matched normal subjects using Student's 't' test. The threshold for eliciting wave V of the brainstem auditory response was higher in pregnant women (28.1 ± 2.1 dB). The absolute peak latencies of waves I to V were similar in both groups. However, Inter peak latencies (IPLs) I-III, III-V were on higher side in the pregnant women, and I-V, in particular (3.9 ± 0.14) was significantly higher when compared with controls (3.73 ± 0.16). These findings suggest that besides an increase in evoking wave V threshold, neural conduction process in brainstem auditory pathways during pregnancy is also delayed within + 2SD of the mean central conduction time in nonpregnant state.

INTRODUCTION

Brainstem auditory evoked potential (BAEP) responses serve as a noninvasive clinical tool in characterising the electrophysiological phenomena of neural excitation, conduction and transmission across the auditory pathways. The waves of BAEP (I-V) represent volume conducted electrical activity from auditory nerve to midbrain through medullo-ponto-lemniscal system (1). The normal values of BAEP show variation due to age, and stimulus parameters for evoking these responses. The sex differences might be due to anatomical differences in the length of auditory Pathways or hormonal differences (2-5). The effect of sex steroids on electro-physiological responses in sensory nervous system has been reported (6). Absolute thresholds for numerous tasks including visual and auditory thresholds in females have been found to vary systematically through menstrual cycle (7,8). However Fagan & Church (9) did not find a cyclic variation in BAEP during the menstrual cycle. Broverman et al(10) suggested that hearing sensitivity may be affected by estrogen secretion through its influence on the acetyl choline which has been shown to be the neurotransmitter in the auditory system. As pregnancy involves a number of neuro-endocrine interactions it was of interest to

work out the normative data of BAEP in the pregnant state and to find out any variation in BAEP due to pregnancy.

MEHTODS

Eighteen, healthy female subjects, 21-26 years of age of comparable socio-economic status were the subjects of this study. Eight of them were at 30-40 weeks of pregnancy, and ten formed age matched nonpregnant controls. These subjects were from the medical and nursing staff of the the G.T.B. Hospital and UCMS complex. The subjects were carefully scrutinised and those who had a history of (a) hearing impairment in the family (b) having given birth to malformed babies or small-for-date babies (c) frequent abortions (d) drug medication during pregnancy and for (e) toxemia of pregnancy, were excluded from this study. These subjects were given a thorough ENT examination to exclude any ear pathology. The pregnant women were regular attendants of the antenatal clinic and their pregnancy had been uneventful and normal.

BAEPs were recorded by Neuropack II Plus (Nihon Kohden Japan) using Ag/AgCl scalp electrodes affixed

*Corresponding Author

**Consultant Gynaecologist

with collodion at CZ-A1 & A2 positions of 10/20 electrodes placement system. Alternating clicks of 1 m sec duration were delivered at 90 dB sound pressure monoaurally through shielded headphones with -40dB contralateral ear masking. Two thousand forty eight averages were recorded and replicated with filter band-pass of 150 dB to 3 KHz and automatic artefact rejection. The absolute and interpeak latencies (IPLs) and the amplitudes of waves I & V were compared in pregnant women and controls, using Students' one-tailed t test.

might be due to the effect of changed hormonal milieu during pregnancy on the peripheral auditory mechanism, which includes cochlear receptors and their response. It is not known whether the hormones showing increased levels during pregnancy influence sensory receptors. However, it has been shown that numerous tasks including visual and auditory thresholds of click lateralisation, vary systematically through the menstrual cycle with reduction in threshold during menstruation in adult women(7,8). This would imply that withdrawal of sex

TABLE I : Mean values of absolute peak latencies and amplitude of waves V&I of BAEP in pregnant women.

Group	n	Absolute Peak Latencies Mean SD (msec)			IV	V	Amp Mean±SD (uv)		Ratio V/I
		I	II	III			V	I	
Pregnant	8	1.53±.14	2.55±.12	3.55—.2	4.71±.24	5.41±.15	*.37±.04	.19±.24	1.94±.24
Non-Pregnant (controls)	10	1.59±.12	2.66±.12	3.56±.17	4.76±.25	5.35±.19	.47±.10	.23±.05	2.01±.21

*P<0.05

TABLE II : Mean values of the interpeak latencies of BAEP in pregnant women.

Group	n	Interpeak Latencies Mean±SD (msec)		
		I-III	III-V	I-V
Pregnant	8	2.02±.24	1.88±.15	*3.90±.14
Non-pregnant (controls)	10	1.97±.11	1.77±.15	3.73±.12

* P<.05

RESULTS

The threshold of sound stimulus producing V wave of BAEP ranged from 19-22 (21.2±2.1) dB in non pregnant and 23-32 (28.1±5.6) dB in pregnant women. Table I shows the values of absolute peak latencies of waves I to V and amplitude of waves I and V. Table II gives the values of IPLs in nonpregnant (control) and pregnant women. Student's 't' test shows that values of stimulus threshold for evoking the V wave, its amplitude and IPL (I-V) are significantly higher in pregnant women as compared to controls.

DISCUSSION

The threshold for evoking V wave of BAEP in the pregnant group is higher as compared to control. This

hormones as happens during the menstrual phase improves the hearing and visual thresholds and in pregnancy, when levels of sex steroids are raised, hearing threshold (as seen in present study) is also raised. This is in agreement with the suggestion made by Baker and Weiler(6) that the circulating female sex steroids affect the functioning of the sensory nervous system. Observation of a raised threshold for getting V wave of BAEP during pregnancy in this study suggests that increased level of sex steroids desensitises the brainstem auditory mechanism responsible for production of wave V of BAEP. Nevertheless Table I shows that absolute latencies of waves I,II, IV are lower and that of V higher as compared to controls, but variations are not significant. These findings suggest that the neural conduction process from wave I to V, becomes relatively slower in pregnant women, so that the amplitude of wave V is significantly reduced (Table I). This is further supported by the IPLs, I-III, III-V which are slightly increased and the overall IPL I-V shows a significant increase in the pregnant group (Table II). Since the IPL and amplitudes of waves V&I represent neural conduction processes in the central auditory pathways in the brainstem, prolongation of I-V in pregnant women would indicate delayed conduction time of auditory impulses from auditory nerve to midbrain through the pontomedullary regions. The mechanism responsible for such a change in conduction process is not known. Tobias(11) suggested that neural transmission might be

affected by an elevated level of sex steroids and this can also affect hearing sensitivity through interaction with acetyl choline synthesis(10). Klinke and Galley(12) worked out the possibility of acetylcholine as a neurotransmitter in the auditory pathways. Additional support for hormonal changes influencing neural conduction time is provided by the study of Bruce and Russell (13). They noted that retention of water and sodium due to variation in levels of sex steroids during menstrual cycle, might influence the process of axonal conduction time and/or the availability of neurotransmitter at synapses in the auditory pathways. Changes in either of these two processes might cause conduction time to vary during menstrual cycle(8). If this explanation is valid, observation of the present study would suggest that a raised level of sex steroids during the third trimester of pregnancy, affects auditory conduction. Rise in their level could have a direct depressant effect on secretion's of acetyl choline in the synapses of the auditory pathways, or indirectly through changes in metabolism of sodium, potassium

and water retention which then could prolong axon conduction time in the brainstem auditory afferents. The latter mechanism is more likely, as disturbed electrolyte and water balance during pregnancy would affect the volume conducted signals of BAEP in the brain to cause central conduction delay which is being reflected in delayed I-V in pregnant women of this study. As the raised value of I-V in pregnant group is within Mean + 3SD (99% Tolerance limit) of control group, it is not clinically abnormal.

Although the number of subjects in our pregnant group is small observation made in the present study is significant, indicating that normal pregnancy has some depressant effect on auditory conduction process and it should be considered as one of the nonpathological factors influencing BAEPs. Further it will be of interest to extend this type of study is abnormal pregnant states, to work out incidence and cause of hearing impairment during pregnancy.

REFERENCES

1. Stockard JJ, Stockard JE, Sharbrough FW. Brainstem auditory evoked potentials in Neurology: Methodology, Interpretation and Clinical application. IN: Aminoff MJ ed. *Electrodiagnosis in Clinical Neurology*, New York, Edinburg, London, Melbourne Churchill Livingstone 1986; 467-503.
2. Stockard JJ, Stockard JE, Sharbrough FW. Non pathologic factors influencing brainstem auditory evoked potentials. *Am J EEG Technol* 1978; 18: 177-209.
3. Jerger J, Hall JW. Effects of age and sex on auditory brainstem responses. *Arch Otolaryngol* 1980; 106: 387-91.
4. Rosenhamer BJ, Lindstrom B, Lundberg T. On the use of click evoked brainstem responses in audiological diagnosis II. The influence of sex and age upon neural response. *Scand Audiol* 1980; 9: 93-100.
5. Chu NS. Age related latency changes in the brainstem auditory evoked potentials. *Electroencephalogr Clin Neurophysiol* 1985; 62: 431-6.
6. Baker MA, Weiler EM. Sex of listner and hormonal correlates of auditory thresholds. *Br J Audiol* 1977; 11: 65-8.
7. Diamond M, Diamond AL, Mast M. Visual sensitivity and sexual arousal levels during the menstrual cycle. *J Nerv Ment Dis* 1972; 155: 170-76.
8. Haggard M, Gaston JB. Changes in auditory perception in the menstrual cycle. *Br J Audiol* 1978; 12: 105-18.
9. Fagan PL, Church GT. Effect of the menstrual cycle on the auditory brainstem response. *Audiology* 1986; 25: 321-28.
10. Broverman DM, Klaiber EL, Kobayashi Y, Vogel W. Roles in activation and inhibition in sex differences in cognition abilities. *Psychol Rev* 1968; 75: 23-50.
11. Tobias JV. Consistency of sex differences in binaural beat perception. *Int Audiol* 1965; 4: 179-82.
12. Klinke R, Galley N. Efferent innervation of vestibular and auditory receptors. *Physiol Rev* 1974; 54: 316-57.
13. Bruce J, Russell GFM. Premenstrual tension: a study of weight changes and balances of sodium, water and potassium. *Lancet* 1962; ii: 267-71.