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AUDITORY EVOKED POTENTIAL RESPONSES IN MENOPAUSAL WOMEN : A NORMATIVE STUDY

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Abstract : Three types of auditory evoked potential responses i.e. auditory brainstem response (ABR), middle latency response (MLR) and slow vertex response (SVR) were studied in 22 post-menopausal Indian women to have a normative value for each response. Recordings were done on computerised evoked potential recorder using 10/20 system of electrode placement and standard click stimuli. The results were comparable with similar studies done in the western world indicating that there is no ethnic variation in evoked potential responses. The latencies of ABR waves showed an increase in menopausal females when compared with young adults indicating a delay in neural transmission which might be due to changed hormonal millieu of sex hormones after menopause. The normative values of MLR and SVR which represent the thalamo-cortical and cortical auditory projections are being reported in Indian menopausal women for the first time.

Key words : auditory brainstem response (ABR) menopausal females middle latency response (MLR) slow vertex response (SVR)

INTRODUCTION

The reproductive capacity of woman begins to wane in the fifth decade of life and menses completely ceases at an average age of 50 (1). As women live about one third of their lives beyond cessation of their reproductive capacity, it becomes a challenge to medical scientists and physicians to prevent or retard degenerative changes due to aging and hormonal imbalance in older women so as to enhance their quality of life during the latter third of their life span.

With the disappearance of virtually all the follicles, ovarian secretion of estrogens and inhibins essentially ceases. From then on, a low plasma estradiol concentration (characteristic of menopause) is maintained. Loss of estrogens produces a period of increased bone resorption with accelerated bone loss. It also increases the risk of coronary artery disease. Apart from these,

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the changes in CNS functions affecting mood, memory and cognition are also reported (2, 3).

Evoked potential responses (EPR) which are indicators of functional integrity of sensory and cognitive pathways and their abnormality are not much studied in the menopausal females. These are valuable clinical tools for objectively testing sensory and cognitive functions. Stimulus related EPR's are generally classified into early i.e. auditory brainstem response (ABR, 0-8 ms), middle i.e. middle latency response (MLR, 8-50 ms) and late i.e. slow vertex response (SVR, > 50 ms). ABR's are used in routine clinical practice, while MLR and SVR have been least studied. By measuring MLR and SVR along with ABR it becomes a more complete and appropriate test, as these scan wide tract of auditory pathways from auditory nerve to auditory cortex and association areas. Since these parameters are highly dependent upon a number of physiological and technical variables, it becomes imperative to delineate a normative data in a clinical laboratory keeping these variables as much constant as possible.

The age and sex related changes in ABR have already been reported (4, 5). It was seen that latencies of waves I, III and V were significantly higher in older subjects. The sex related changes were observed in young adults after puberty, which indicate that there are hormonal effects on these parameters (5, 6). If the hormonal hypothesis is correct, it should also affect the postmenopausal phase. Hence this study is designed to derive normative data of ABR, MLR and SVR in post-menopausal females.

METHOD

Twenty-two women between 50 and 70 years of age who had attained natural menopause (without pan-hysterectomy) for at least one year were selected from Gynecology OPD over a period of four months. Except for minor post-menopausal symptoms of hot flushes, night sweats, insomnia and mood swings, these patients were not suffering from any medical ailments. The females having hearing impairment and those on hormone replacement therapy were excluded from the study.

The recordings were taken on computerized evoked potential recorder (MEB 5200 Nihon Kohden, Japan). The subjects were lying down and relaxed at the time of testing in sound proof air conditioned room. EPR's were obtained from Ag/AgC1 disc electrodes affixed with collodion at 10/20 international placement (7). Positive electrode was kept at Cz position, negative (reference) at ipsilateral ear lobule, (A_1) and the ground electrode at the forehead. The contact impedance was constantly monitored with an impedance meter and electrode to skin contact resistance was kept below 5k ohm. Alternating clicks at the rate of 10 /sec were delivered at 90 dB SPL through shielded ear phones with - 40 dB pure white noise masking of the contralateral ear. For ABR this was then filtered (with band pass 150–3000 Hz) and averaged to 2048 stimuli. Recording were obtained from each ear separately in duplicate. The absolute peak latency, interpeak latency and amplitude of waves were measured with cursors on the screen. For MLR 256 clicks were given at alternate polarity for 0.1 ms at the rate of 5/sec, at intensity of 90 dB. SVR was measured by giving 64 clicks of alternate polarity for 0.1 ms at the rate of 0.5/sec and at same sound intensity.

The results of the present study were compared with similar studies done earlier. Statistical analysis was done by using student's 't' test.

RESULTS

The latencies, interpeak latencies and amplitudes of different waves of ABR are given in Table I. The latencies of different waves of MLR and SVR are also given in Tables II and III respectively The latencies of wave I, III, V and the interpeak latencies between I-III, I-V and III-V are significantly increased ($P<0.05$) in the present study as compared to the similar study done earlier in young adult females (5). There are no significant differences in ABR results of our study, and similar studies done on menopausal females in western world (Table IV).

TABLE I: ABR in menopausal women.

	Latencies (m see)					Interpeak latencies (m see)			Amplitude (mV)		
	I	II	III	IV	V	I-III	I-V	III-V	I	III	V
Left ear	1.76±0.37	2.8±0.51	4.11±0.44	5.6±0.54	6.04±0.29	2.95±0.41	4.62±0.29	1.089±0.41	0.34±.08	0.37±0.11	0.40±0.09
Right ear	1.68±0.31	2.67±0.52	4.08±0.51	5.8±0.50	6.1±0.21	2.82±0.60	4.39±0.34	1.94±0.19	0.35±0.04	0.36±0.13	0.38±0.11

TABLE II : MLR–Latencies (m sec) in menopausal women.

	N0	*P0*	*Na*	*Pa*	*Nb*	*Pb*
Left ear	10.1±1.15	13.28±3	17.64±3.2	24.76±4.9	38.2±8.7	41.5±5.2
Right ear	10±1.2	15±3.2	17.5±3.8	25.2±5	39.3±8.6	42.2±3.5

TABLE III : SVR–Latencies (m sec) in menopausal women.

	P1	*N1*	*P2*	*N2*
Left ear	53.66±4.5	95±4.3	181.12±11	251.33±25.2
Right ear	48.66±1.8	98±76	187.20±14.5	263.32±18.4

TABLE IV : Comparison of results in different studies.

	Present study	*Lenzi et al (16)*	*Wharton et al (15)*
Age group (years)	50–70	60–70	50–70
Number of subjects	22	29	10
ABR (msec)			
I	1.76±0.37	1.8±0.33	2.01±0.34
III	4.11±0.44	4.19±0.61	4.30±0.35
V	6.04±0.29	6.19±0.48	6.20±0.31
I–V	4.62±0.29		4.19±0.35
III–V	1.89±0.41		1.91±0.25
I–III	2.95±0.41		2.28±0.32
MLR (msec)			
Na	17.64±0.82	18±4.6	
Pa	24.76±4.9	30±6.4	
Nb	38.12±8.7	43.5±6.8	

DISCUSSION

A normative data of auditory evoked potential response in menopausal women was determined. It was predicted that there would be increase in latencies of different waves for ABR in menopausal females, as compared to young adult females. The results of present study was comparable with similar studies done in Western world.

It was reported earlier (4) that the values of latencies and interpeak latencies of ABR waves were increased in older age group. This could have been a consequence of aging process, which causes changes in the tissue density and volume conduction in auditory pathways. Apart from this the threshold of stimulation of receptors in the ear is also changed with age. These findings were supported by other studies also (8, 9).

It was also reported in earlier studies that gender differences in young adults on ABR had shown a significant decrease in latencies of most of the waves in females after puberty (5). Similar changes were observed by other workers (10, 11). It was presumed that hormonal milieu cause sex differences in ABR. There were reports of interaction between estrogen and acetylcholine for improvement of sensory transmission (12, 13) and the possibility of acetylcholine as one of the neurotransmitters in auditory pathways (14). Therefore in young adult females, with onset of increased production of estrogen and progesterone the neural transmission and conduction velocity in auditory pathways was much better than in males. The reverse occurred after menopause i.e. with fall in estrogen and progesteron levels the neural transmission was decreased. This was also an explanation of our result of ABR, which were observed significantly different from those in young adult females. The latencies of wave I, III, V and the interpeak latency between I-III, I-V and III-V were significantly increased in menopausal women in the present study as compared to young adult women studied earlier (5).

The results of present ABR study are consistent with the studies done on menopausal women in western world (15, 16). No significant difference could be found regarding latencies of different waves and intepeak latencies. In general the longer conduction time in menopausal women might be due to the unique hormonal changes or the drop in core temperature and metabolic rate resulting from menopause (15).

It is difficult to compare normative values of MLR in the present study with others because no two studies have similar controlled parameters i.e. intensity, frequency and duration of stimuli. The nearest close to the values reported in this study are those of Lenzi et al (16) in their 60-70 years age group females, but they too had used clicks at an intensity of 15 and 50 dB SL for 0.1 ms at 9 pps, as compared to 90 dB SL for 0.1 ms at 5/sec in our study. The increase in latencies of Nb, Pa and Na in their study may be due to the use of lower intensity stimuli. Lower intensity stimuli are known to produce waves of more latency, may be due to smaller number of fibres getting excited in CNS circuits.

The normative data of SVR in the present study could not be compared, as the literature is deficient in data of SVR on menopausal females. But since SVR is exploring a wider tract of pathway i.e. temporoparietal association cortex upto the frontal cortex, is a more complete and appropriate method than ABR and MLR alone.

Keeping this normative data as baseline further studies can be done in menopausal females. The mechanism and site of action of hormone replacement therapy in improving CNS functions in post-menopausal women can be established.

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