

## Introduction

- As the elderly population continues to increase, a greater number of females are in their postmenopausal phase.
- Most authors agree that neurosteroids such as estrogen play a role in modulating neuronal function of the auditory pathway, but there is not complete agreement regarding the effects of menopause on specific waves.
- Studies have shown that low estrogen levels can impair hearing, potentially by altering neuroregulatory mechanisms, cochlear blood flow, neuronal physiology, and bone metabolism in the otic capsule.
- The influence of age differences when establishing normative data for the clinical use of the auditory brainstem response (ABR) is undetermined.

## Purpose

- To determine the effect of decreased estrogen levels due to menopause on auditory brainstem response measurements.

## Methods

- Retrospective study reviewing all adult patients who had presented to the senior author (RTS) from January 2010 through July 2022 who underwent ABR testing.
- All subjects underwent ABR testing, and females with self-reported menopausal status were included in this study.
- Females were assigned to premenopausal or postmenopausal groups, and males were assigned to young or old male groups.
- Non-parametric Mann-Whitney U test, t-test, and two-way ANOVA test were used for the analysis. All statistical tests were performed two-tailed, and a P value < 0.05 was considered statistically significant.

## Results

ABR	Wave	Female			Male		
		pre-M (n=40)	Post-M (n=30)	P-value	Younger males (n=25)	Older Males (n=23)	P-value
		Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Latencies : Slow (msec)	I	1.63 (0.13)	1.68 (0.11)	0.05	1.67 (0.12)	1.74 (0.14)	0.12
	III	3.72 (0.17)	3.79 (0.17)	0.10	3.82 (0.14)	3.88 (0.17)	0.12
	V	5.63 (0.22)	5.74 (0.23)	0.03*	5.78 (0.21)	5.93 (0.18)	0.013 *
Latencies : Fast (msec)	I	1.71 (0.20)	1.78 (0.13)	0.20	1.75 (0.16)	1.80 (0.23)	0.10
	III	3.90 (0.20)	3.98 (0.19)	0.07	4.00 (0.28)	4.01 (0.42)	0.19
	V	5.96 (0.25)	6.07 (0.25)	0.04*	6.11 (0.23)	6.18 (0.61)	0.016 *
Amplitude (uV)	I	0.32 (0.16)	0.21 (0.09)	0.002*	0.22 (0.12)	0.18 (0.09)	0.40
	III	0.38 (0.12)	0.33 (0.13)	0.10	0.31 (0.17)	0.29 (0.12)	0.71
	V	0.47 (0.17)	0.45 (0.17)	0.56	0.38 (0.13)	0.34 (0.10)	0.23
	V/I ratio	1.81 (0.93)	2.77 (1.57)	0.008*	2.84 (2.30)	2.46 (1.41)	0.85
Audiogram (dB)	PTA	12.9 (5.87)	15.47 (6.18)	0.08	11.60 (6.82)	15.4 (6.40)	0.07
	.5K	12.81 (7.62)	14.17 (6.80)	0.20	10.40 (6.40)	13.59 (6.94)	0.15
	1K	13.56 (6.88)	14.55 (6.53)	0.35	10.20 (6.88)	13.59 (7.02)	0.11
	2K	12.31 (6.51)	17.70 (9.09)	0.007*	14.20 (11.59)	18.26 (12.42)	0.18
	3K	16.18 (11.35)	22.07 (9.40)	<.001*	20.11 (16.89)	30.11 (12.40)	0.017*
	4K	20.44 (15.25)	26.83 (14.43)	0.02*	21.00 (16.86)	36.41 (11.82)	<.001*
	6K	28.38 (17.05)	26.92 (14.32)	0.83	26.25 (18.06)	43.61 (15.89)	0.004*
	8K	29.41 (16.86)	44.71 (40.56)	0.005*	22.92 (18.37)	47.78 (19.66)	<.001*

Table 1: Comparison of ABR measurements and audiogram results within female and male groups with normal hearing.

## Discussion

### Latencies:

- Post-M had significantly longer latencies in wave V for slow and fast click rates
- A trend of prolonged latencies in waves I and III in post-M
- A decrease in neurosteroids such as estrogen during menopause is associated with prolonged ABR latencies, with wave V being affected most.

### Amplitude:

- Overall trends include post-M having lower ABR amplitudes at waves I, III, and V than pre-M and male subjects.
- Our findings of reduced wave I amplitude relative to wave V amplitudes are consistent with other studies' interpretations of age-related cochlear synaptopathy.
- The V/I amplitude ratio may be of significant diagnostic and research value as the mechanics of synaptopathy and hormonal effects on the auditory system become better understood.

### Audiogram:

- Our results are in alignment with prior studies, suggesting the role of estrogen in sex differences in the prevalence and characteristics of age-related hearing loss.

## Conclusion

- Normative ABR data for pre- and post-menopausal females should be established and utilized when ABR measures are used clinically.
- Knowledge of gender differences in wave I may be important when ABR is used to assess possible synaptopathy.

## Future Prospects

- Future studies should use serum estrogen measurements when studying the impact of menopausal status on ABR, central auditory processing, and potentially the relationship of ABR measurements with cochlear synaptopathy.