Abstract
While there are various known hormone-related effects on different auditory-evoked potential (AEP) classes, there is a paucity of research on the effect of pregnancy on the ABR, MLR, and LLR. We collected audiological data as well as AEPs throughout the healthy pregnancies of two mothers, one with normal hearing and one with stable, but moderately severe, sensorineural hearing loss. Our findings and both research and clinical implications will be discussed.

Background and Significance
During the menstrual cycle, levels of estrogen and progesterone similar to pregnancy, however, there are contradictory findings concerning the impact of menstruation on hearing sensitivity. For example, Reasende et al. (2000) reported no change in auditory brainstem response (ABRs) during the menstrual cycle, while another study by Eilkhah-Hirchi et al. (1992) reported a significant increase in the peak latencies of waves I, III, and V during active menstruation. Furthermore, Eilkhah-Hirchi et al. indicated that wave V latency is increased by estrogen while decreased by progesterone. Given that hormones may have some affect on hearing sensitivity, there has been some interest in the literature of the possibility that hormones associated with pregnancy may affect auditory evoked potentials. During pregnancy, both estrogen and progesterone rise, but in significantly different amounts. One of the major estrogens (estradiol) rises from less than 2 ng/ml in the first few weeks of pregnancy to as high as 18 ng/ml. On the other hand, progesterone rises from less than 25 ng/ml to 150 ng/ml in the same time frame. This is quite different from the menstrual cycle in which estrogen (estradiol) rises at the beginning of the menstrual cycle to peak of 7.5 ng/ml just before ovulation and gradually falls back down to pre-menstrual levels. Progesterone levels during the menstrual cycle rise immediately and after ovulation coming to a peak at about 8 ng/ml before gradually falling back to pre-menstrual levels. Thus, pregnancy and menstrual cycles reflect two different hormonal patterns between estrogen and progesterone.

Methods
Participants

- No known neurological problems reported
- Symptomatic with static admittances between 0.3 and 1.8 mmhos and tympanometric peak pressure between -100 and +50 daPa
- Healthy pregnancies with no reported ototoxic or renal medical conditions
- Completed informed consent form (Study approved by the UALR Institutional Review Board, Protocol #08093M)

Equipment

1. Channel Bio-Logic NaPro-Auditory Evoked Potential System
2. Electrode montage: Fz referent to stimulus site and ground on the contralateral ear (impedances kept < 4 kΩ, inter-electrode < 2 kΩ)
3. 24-channel amplifier with 50kHz gain

Recording Parameters

- # Points: 256
- Filter Settings: 3.9kHz/0.1Hz
- Stimulus Polarity: 2000μV/2000μV
- Artifact Rejection: 10μV
- Slope: 20dB/NL
- Peak: 200μV
- Repeated: 50
- Duration: 10μS
- Stimulus Rate: 0.17/s
- Stimulus Polarity: non-inverted
- Filter Settings: 0.1-3kHz
- Recording Parameters: 100μV and 100μV

Results

Case 1 - (Sensorineural Hearing Loss)
- Age: 23 years
- Stable sensorineural hearing loss since childhood due to ototoxicity
- Recorded participant with SNHL

Case 2 - (Normal Hearing)
- Age: 36 years
- Hearing within normal limits

Discussion

In the present study, a longitudinal study of ABR, MLR, and LLR latencies conducted on two individual mothers with stable sensorineural hearing loss and one with normal hearing. Although not reported here, audiometry and tympanometry remained stable during and following pregnancy.

The absolute latency values plotted across the weeks of pregnancy and 1 month post-partum show the following patterns:
- ABR latencies for waves I, III, and V between ears are similar and stable over time for both participants.
- MLR latencies for Na and Pa are similar between ears and quite stable over time for the participant with sensorineural hearing loss. For the participant with normal hearing, however, Na and Pa latencies gradually appear stable but had highly variability from session to session.
- LLR latencies for P1, N1, and P2 were largely similar between ears and stable over time for both participants.

The results presented here support the conclusions of Sennaroglu and Belgin (2001) that there are no changes in ABR latencies over time, but are in contrast to results reported by Tandon et al. (1995) and Egel and Güzel (1999). One study (i.e., Yadav et al. [2003]) indicated no changes in MLR during pregnancy, but our participant with normal hearing showed the most instability of MLR latencies between ears over time. We are unable to attribute this variability to any single reason. For both participants, LLRs remained showed little differences between ears and were largely stable over time, which is in contrast to Yadav et al. (2003) indicating that LLRs are prolonged in pregnant women. We see no such result here in our two participants when viewed in a longitudinal fashion.

Conclusions

Except for the MLR Na and Pa latency, the participant with normal hearing, waves I, III, V of the ABR and P1, N1, and P2 components of the LLR remain relatively stable. The MLR appearance may be relatively stable, probably more influenced by technical variability and physiological variability rather than the signal averaging process. The relative lack of variability seen in the participant with sensorineural hearing loss may reflect the existing pathology of the cochlea that might otherwise be sensitive to hormonal changes. Additionally, although conservative artifact rejection levels were employed, future studies could consider using a similar stimulus for MLR and LLR.

Lastly, future studies could consider adding endocrinologic measures, incorporating a rigorous timeline, conducting regular audiologic examinations (including otocoustic measures with and without contralateral suppression), incorporating the study of the P300 component, and exploring other acoustic stimuli to come to some more solid conclusions about the effect of pregnancy on auditory evoked potentials.

References