



## Photoacoustics as a new imaging technique for in utero assessment of fetal cerebellar tissue oxygenation

Gil Guevara E, Diaz R, Oria M, Aydin E, Duru S, Peiro JL

Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio, United States

### Objective

This pilot study aimed to assess the feasibility of evaluating the fetal cerebellar oxygenation in pregnant rats by real-time photoacoustic imaging on day 20 of pregnancy (E20) and to specify variations in oxygen saturation among normal rat fetuses. Photoacoustic (PA) imaging is a real-time, non-invasive imaging method combining laser pulse tissue excitation and ultrasonic detection of the tissue response. This technology is currently being investigated in preclinical and clinical studies, some of which highlight its potential applications in clinical practice.

### Methods

We conducted an experimental pilot study in four rat fetuses, from two different pregnant rats that were scanned transabdominally on E20 with a PA imaging system coupled to high-resolution ultrasound imaging. The Vevo 2100 and Vevo LAZR were used to first identify the fetal cerebellum and then assess its oxygen saturation. PA images were acquired with a 15 MHz probe connected to the Vevo LAZR PA imaging system (Fujifilm Visualsonics Inc., Toronto, Canada).

### Results

The  $sO_2$  Av represents the average blood oxygen saturation, which is the sum of all oxygenated pixels in the region of interest (ROI), divided by the oxygenated and deoxygenated pixels. All the measurements were generated for ROI's in the 2D slice as well as 3D region. The  $sO_2$  Av in the cerebellum of the first two fetuses was 82.44% and 79.76%; and the  $sO_2$  Av 3D was 81.1% and 79.2%; and in the other two fetuses the  $sO_2$  Av was 78.59% and 74.72%; and the  $sO_2$  Av 3D was 80.89% and 78.82%. The observed range was from 74.72% to 82.44% and the median was 79.48% with a SD of 2.31.

### Conclusion

This pilot study demonstrates that PA imaging can be a useful tool that enables non-invasive determination of blood oxygen saturation in fetal tissue. This is the first study, to our knowledge, to assess fetal cerebellar oxygenation using this technology, crucial for future clinical applications.