Title
First RealTime Optical Imaging of Experimental Brain Ischemia and Hemorrhage in Neonatal Piglets

Journal
Pediatric Research, 45(7)

ISSN
0031-3998

Authors
Stankovic, Miljan R
Maulik, Dev
Rosenfeld, Warren
et al.

Publication Date
1999-04-01

DOI
10.1203/00006450-199904020-02066

The American Pediatric Society and The Society for Pediatric Research 1999 Abstract

Pediatric Research (1999) **45**, 347A–347A; doi:10.1203/00006450-199904020-02066

First RealTime Optical Imaging of Experimental Brain Ischemia and Hemorrhage in Neonatal Piglets

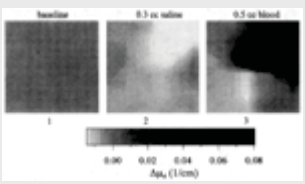
Miljan R Stankovic[1], Dev Maulik[1], Warren Rosenfeld[1], Phillip G Stubblefield[1], Maria Angela Franceschini[1], Dennis Hueber[1], Enrico Gratton[1] and Sergio Fantini[1]

[1]Winthrop Univ. Hospital, Mineola, NY, Boston Univ., Boston, MA, Dept Physics, Urbana, IL, ISS, Champaign, IL

Abstract 2050 *Poster Session II, Sunday, 5/2 (poster 229)*

Optical imaging, based on the ability of near infrared light to non-invasively penetrate through the intact scalp and skull, can monitor cerebral hemodynamics and oxygenation in real-time, assuming that images are acquired fast enough. Previously reported acquisition times of 5 s, 10 min, 2 h, or even 1 to 3 days per image, were far too slow to allow for real-time imaging, particularly in clinical settings where acute events are the focus of our attention. This study presents the first application of real-time optical imaging in the detection of experimental brain ischemia and hemorrhage and the accompanying cerebrovascular changes in newborn piglets. Optical imaging was performed on 7 anesthetized, instrumented, and ventilated newborn piglets secured within a stereotaxic instrument. We used a modified near-infrared oximeter and a custom-built 16 - light - source - 2 - detector optical probe rendering 64 pixel / 4 × 4 cm / 2-D brain absorption images with the acquisition time of 0.19 s per image (or 5.26 images per sec). Once the baseline was recorded (**Fig 1**), 0.3 cc of saline and 2 cc of blood were injected into the left frontal subcortical brain region aimed to induced focal and global anatomical and functional brain absorption changes. The imager readily detected: 1) *focal* changes in brain absorption caused by the appearance of the saline (white changes) and blood (dark changes) in the brain featuring brain ischemia and hemorrhage, respectively; 2) *global* bilateral ischemic changes (white changes) caused by the accompanying increase in intracranial pressure featuring brain ischemia followed by reperfusion and hyperemia; 3) five subcortical hematomas and two large bilateral subarachnoid hemorrhages with small subcortical hematomas, as confirmed on autopsy. The imaging detection limit was ~0.07 cc (5 mm in diameter) for saline and ~0.04 cc (4 mm in diameter) for blood at the estimated depth of 1 -1.5 cm. Our 1-min movie clip demonstrates the capability of optical imaging in detecting brain ischemia, hemorrhage, and reperfusion non-invasively and real-time, with high temporal and good spatial resolution.

Fig 1.



No caption

Full figure and legend (64K)