Measuring cognitive brain function in newborns in rural Gambia

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Aims

- To establish functional near infrared spectroscopy (fNIRS) as a low cost, non invasive brain imaging tool for assessing neurocognitive function in infants from birth in resource poor settings.
- To provide early biomarkers of cognitive development to inform and evaluate nutritional intervention strategies.

Study Protocol

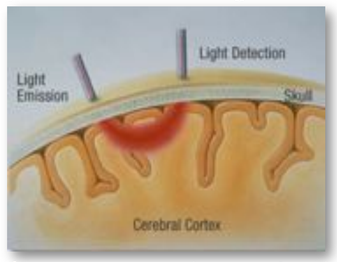
Twenty three 0 - 2 month olds took part in the study. Infants wore an fNIRS source detector array over the right hemisphere. Newborn infants were presented with social and non-social auditory stimuli whilst sleeping. Continuous fNIRS measurements of the changes in HbO_2 and HHb were used to detect regions of significant cortical activation.

Method

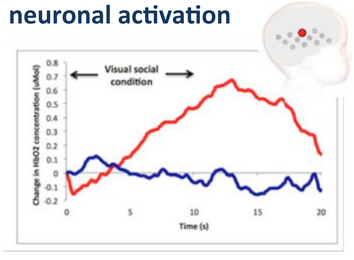
- fNIRS is an optical imaging technique which measures changes in brain blood flow and oxygen consumption associated with neuronal activation.
- Very low levels of near infrared light are used to provide a continuous and non invasive measure of oxy- (HbO_2) and deoxy- (HHb) haemoglobin. The characteristic response to neuronal activation is a localised increase in HbO_2 and decrease in HHb.
- fNIRS offers superior spatial resolution to EEG, and unlike fMRI, is well suited to field studies. The technique is completely safe, low cost and requires minimal set up and training.

1) Source and detector probes

2) shine and detect light



3) and measure changes in HbO_2 (red) and HHb (blue) in response to neuronal activation



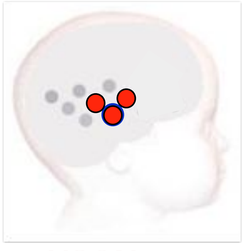
Results

AUDITORY

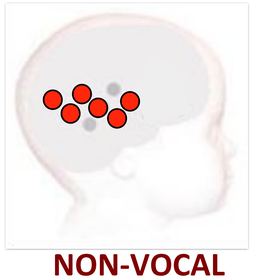
social vs. *non-social*

social	non-social
cough cry throat-clear laugh	rattle shake running water

Brain regions showing significant cortical activation:



VOCAL sounds



NON-VOCAL sounds

Conclusions

- fNIRS can be used to measure neurocognitive function in infants from birth to 24 months of age in a resource poor setting.
- Cross-sectional and longitudinal studies revealed distinct regions of the posterior superior temporal and inferior frontal cortex activated by either visual or auditory social stimuli.
- fNIRS may be used to elucidate typical and atypical brain development from birth and hence investigate the effects of nutritional insults and interventions in global health studies.

More Information

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Brain Imaging for Global Health