CONTINUOUS EEG MONITORING IN THE NEONATAL ICU USING *micro*EEG® – A NEW PORTABLE EEG DEVICE

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Introduction

Access to conventional EEG monitoring in the Neonatal Intensive Care Unit (NICU) may be limited due to a variety of factors. Few NICUs are equipped with EEG machines or staffed with specialized technologists who can properly apply EEG electrodes and provide a technically adequate study. The *micro*EEG® is a small (88gm, 9.4 x 4.4 x 3.8cm), portable, wireless FDA-approved device developed by the BioSignal Group. The *micro*EEG® device digitizes EEG signals close to the electrodes and transmits the digital data wirelessly to a personal computer (Figure 1), which then uploads the EEG to a remote secure server. The *micro*EEG® can be used with electrode caps applied by the bedside staff. The *micro*EEG® has the potential to overcome many of the obstacles to obtaining EEG recordings in the NICU setting.

Objectives

1. To determine ease of recording EEG using the *micro*EEG® device in a preterm baby by the beside neonatal staff
2. To determine quality of EEG recordings obtained with the *micro*EEG® device

Methods

A total of 16 premature infants were recruited at 2 academic centers as part of an ongoing NIH-funded study of preterm babies with apnea / bradycardia / desaturation events. The corrected gestational age of these preterm infants ranged from 27–32 weeks at the first recording. Continuous *micro*EEG® monitoring was performed over a period of 9 hours in each preterm infant. The EEG was recorded using the *micro*EEG® device (BioSignal Group) with an electrode cap (waveguard™ ANT Neuro) of appropriate head size. The electrode cap consisted of 20 scalp electrodes using the 10-20 international system. In addition, two eye channels and EKG were recorded. Continuous EEG recording was repeated at 2-4 week intervals, such that each preterm infant obtained 2-3 continuous EEGs.

The electrode cap was applied to the preterm neonate by the neonatologist who had no prior training in the technical aspects of EEG. The *micro*EEG® device was connected to the cap using a connector and recording commenced. (Figure 2) Signals from the *micro*EEG® device were sent wirelessly by Bluetooth technology to a laptop next to the incubator. Any significant events were annotated by the bedside staff on the laptop screen. At the end of the recording, the EEG data was uploaded to a central server. An electroencephalographer reviewed and interpreted the studies remotely using a web-based case manager with secure log-in credentials.

Results

- A total of 48 recordings were obtained from the 16 preterm infants.
- 9/48 (18.75%) studies were technically limited due to abundant artifacts.
- Thirty nine recordings were of good quality. (Figure 3)
- 10 of these 39 prolonged EEGs (25%) showed alterations.
- 6/39 (15.38%) had EEG maturation > 2 weeks below corrected gestational age.
- Three EEGs revealed sharp transients at either the temporal or central regions (Figure 3).
- Clinical and electrographic seizures were recorded in one patient.

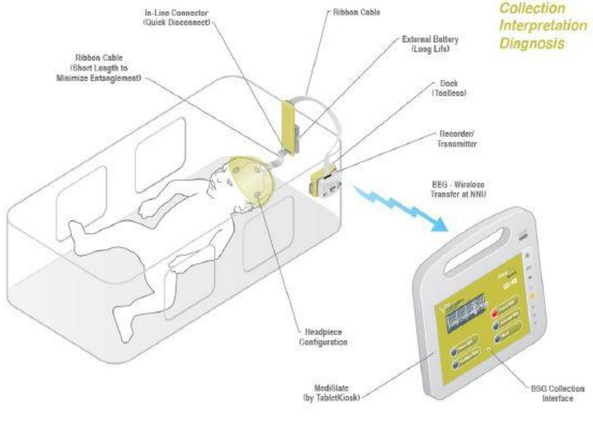

Figure 1 - The *micro*EEG® system in the NICU

Figure 2 - Baby with cap and microEEG

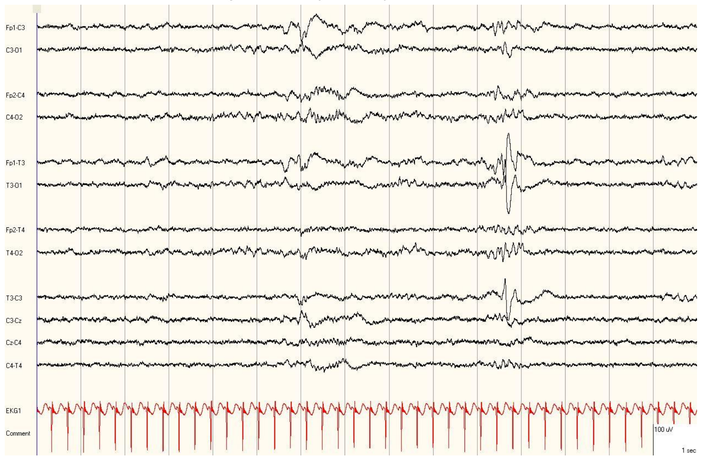

Figure 3 - EEG in a 30 weeks corrected gestational age preterm, with a left temporal sharp transient

Conclusions

Use of the *micro*EEG® system can provide a practical, accessible, high quality continuous EEG recording in the neonatal ICU. Clinically acceptable EEG recordings can be obtained in preterm babies using the *micro*EEG® device and electrode cap. These can be remotely reviewed and interpreted. This approach has the potential to improve access to EEG in the neonatal ICU.

Support

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