Cerebral activity in the premature infant, the feasibility of a multi channel continues EEG monitoring

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"Quality analyses of 8-channel continuous bedside EEG-monitoring in extreme premature infants during the first 72-hours of life"

Background and aims: Early EEG-monitoring of the brain may give important signals/information that could predict later neurological development. Clinically, up to date, time compressed amplitude integrated EEG-monitoring is the method most commonly used, to monitor brain activity. This has given important information about the brain activity in both term-born and premature infants during the neonatal period of time. However, a method with a more informative EEG recording is needed and the information of the premature brain so far has been obtained through normal the EEG recording of the premature. There are several studies that have tried to define the "normal" EEG in the premature. This studies defines the relation ship between continuous, discontinuous and undifferentiated patterns, as well as the burst intervals. Also the change in amplitude, depending in GA has been described.

This indicates:

- The development of the brain in the last trimester is reflected in EEG changes in this period
- EEG changes with behavioral state cycles
- Dependant on advancing conceptional stage

Some studies have shown a relationship between EEG changes and brain damage. However, in all studies both the ones describing normal pattern as well as those describing pathological patterns, the time for registration differed, and there were no early EGG recordings (within first days of life). The EEG recordings were also of short duration.

Based on this lack of a developed method to continuously EEG monitor the premature, we wanted to explore the possibility to devise a method for continuous long-term EEG-monitoring of premature babies covering both hemispheres of the brain.

Here we present the degree of success of 72 hours continuous recordings starting soon after delivery.

Methods: With consent from the parents and approval from the Ethics Committee we recruited 49 inborn infants with a GA < 31 weeks and without evidence of congenital anomalies within twelve hours after birth. We applied a digital EEG-system (Nicolet-One ™ Monitor) for continuous EEG monitoring during their first three days of life. Eight active electrodes were symmetrically placed over both hemispheres leaving space over vertex for ultrasound measurements under the monitoring (fig. 1). This allowed us to perform ultrasound examinations which will be discussed.
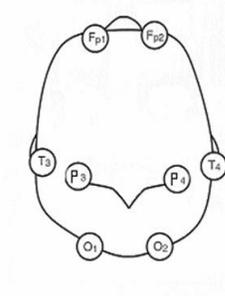

(fig 1)

Results: A total of *3528* hours of recordings including all patients were systematically evaluated with regards to the rate of success. The mean recording time of each patient was 72hours and the mean monitoring start was 6 hours after birth. Successfulness was defined as interpretable EEG. We accepted artifact contamination as long as it did not compromise the EEG interpretation. Artifacts were mostly easily identifiable such as movement artifacts, muscle activity and interference from electrical equipment. As an average 90% of the recordings were considered successful according to our criteria.
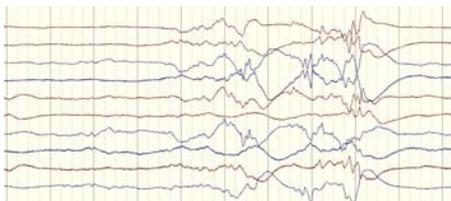
EEG recording 1 hour after start
of monitoring. Discontinuous EEG
pattern which is typical for this age
group.
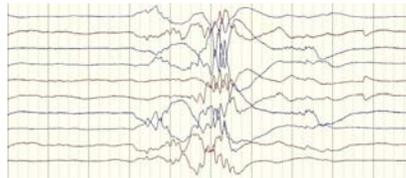
EEG recording at the end
of continuous monitoring
71 hours later

Conclusions: Our evaluation confirms that it is possible to perform continuous long-term EEG monitoring in extreme premature infants. The examination of the quality of the continuous

multichannel long-term EEG registration, demonstrates high quality recordings. Although artifacts to some degree could contaminate the recordings, they were easily identifiable and did not preclude the EEG analyses. Thus, multichannel long-term EEG recordings are useful and reliable in the premature infant