Continuous cerebral function monitoring in neonatal intensive care

Svenningsen, N.W., L. Hellström-Westas, I. Rosén, I. Bjerre
Neonatal Intensive Care Unit and Department of Clinical Neurophysiology, University of Lund, Sweden

Introduction: In neonatal intensive care today several functions can be monitored continuously e.g. cardiac function, respiration, temperature, O_2-tension and CO_2-tension, blood pressure and various environmental parameters related to incubator and ventilator care. Monitoring of cerebral function can usually be made only intermittently by e.g. clinical evaluation, ultrasound or computorized tomography examination. In the present study we have applied a neurophysiological technique allowing minute-by-minute continuous monitoring of cerebral electrical activity. The aim was to estimate the diagnostic and prognostic value by this method.

Method: The Cerebral Function Monitor (CFM) ad modum Pamela Prior (CFM™, Devices Ltd)(1): The signals are derived from a single pair of parietal electrodes and registered on a slow speed chart recorder. As cerebral activity fluctuates the pen moves up and down. The paper speed is only 6 cm/hour. The trace appears as a thick band on the chart and represents the level of cerebral activity. The records were classified as continuous or discontinuous i.e. suppression-bursts or no identifiable cortical activity. Occurrence of paroxysmal activity is also registered. The first and last 12 hours of CFM recording and the initial EEG which was performed in all infants as well were interpreted at the Department of Clinical Neurophysiology without knowledge of the outcome of the infant. Comparisons were also made between CFM tracings and simultaneous EEG.

Material: The CFM method has been evaluated generally as a monitoring system during neonatal intensive care in various groups of infants. Furthermore, the diagnostic and prognostic value of the CFM was studied in a group of 39 infants with severe asphyxia either at birth (n=28) or in later infancy (n=11). Thirty-five infants needed intensive care treatment including ventilator therapy.

Results: The median duration of continuous minute-by-minute cerebral function monitoring with the CFM was 4,5 days ranging between 0,5 and 49 days. Nineteen infants died early and 2 at a later time from postasphyxial sequelae. The con-

cordance between background activity and paroxysmal ictal activity showed complete agreement in 35 cases with simultaneous CFM and EEG recordings.

In the group of infants with severe asphyxia it was found that among infants not changing from discontinuous to continuous tracing within 3 days after the asphyxial catastrophy only 3 of 18 infants survived. Two surviving infants were very immature born in the 26th-27th week of gestation. The CFM method has thus a certain prognostic value. Furthermore, treatment with anticonvulsants like phenobarbital within therapeutic levels did not influence the CFM recordings. In infants with early change from discontinuous to continuous CFM recording within 2 days after severe asphyxia the major part (60 %) survived without cerebral sequelae (2).

Besides the capacity to diagnose or exclude ictal cerebral activity at clinical signs of tonic fits and jerks in neonates the CFM tracings have revealed the occurrence of "silent seizures" in preterm infants. They may be time-connected with attacks of bradycardia or apnea but in several infants without any clinical signs at all. Instantaneous evaluation of the effectiveness of anticonvulsant treatment can be made. The cerebral activity level on the CFM is related to the gestational age with lower cerebral activity and more discontinuant tracings in very immature infants.

Summary: The CFM method allows continuous surveillance with minute-by-minute monitoring of the cerebral function activity, diagnoses of both clinical and "silent" seizures and immediate evaluation of anticonvulsant drug effects. CFM cannot replace EEG for local diagnosis. CFM can be applied for several days and does not interfere with routine neonatal care. Further studies are in progress regarding the relation to cerebral blood flow and intracranial hemorrhages.

References

1. Prior, P.: Monitoring cerebral function. Longterm recordings of cerebral electrical activity. Amsterdam: Biomedical Press (1979).
2. Bjerre, I., Hellström-Westas, L., Rosén, I., Svenningsen, N.: Cerebral function monitoring in infants with severe asphyxia. Arch Dis Child (1983), in press.