SLEEP IN PREMATURE INFANTS: CORRELATION BETWEEN EEG SLEEP-STATE SPECTRAL VALUES AND GESTATIONAL AGE

Patrizia S. Bisiacchi

Department of General Psychology, University of Padova, Italy

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Objectives: The aim of the study was to compare the spectral values of EEG sleep states in preterm infants born at different gestational age who were at the same 35 weeks of post-conceptional age (PCA).

Methods: One-hour monopolar EEG was recorded before discharge in twenty-one NICU admitted premature infants (mean gestational age-GA 30 weeks, range 27–35) during active (AS) and quiet sleep (QS) from electrodes Fp1, Fp2, Fz, T3, T4, C3, Cz, C4, O1 and O2. Fast Fourier transform algorithm was applied for power spectral analysis of the EEG. The existence of changes between sleep states and gestational age in the power of delta, theta, alpha, beta, low gamma and gamma bands was tested.

Results: The results of the spectral measures show a power increase in the low frequency bands (delta and theta) positively correlated with gestational age in active sleep, which can be mainly traced on fronto-central electrodes (p<.002). The power in the higher frequency bands remains homogeneous between subjects. No significant differences are found in quiet sleep.

Conclusions: At the same post-conceptional age, differences in brain electrical activity are highlight between premature infants depending on their gestational age and sleep state. The differences are present in the low frequency bands, the most prominent activity in the immature brain of the preterm neonate.

Discussion: Spectral EEG power, an index of local neural synchrony, is considered the strongest indicator of maturation after 36 PCA (Scher et al., 1995). The lack of changes in the higher frequencies is compatible with the assumption that generation of these oscillations typically requires well-formed structural intra-cortical inhibitory circuitry which are not yet mature at this developmental phase (Kostovic and Judas, 2002). Interestingly, the detected differences in our study are present only in active sleep, the sleep state in that occurs endogenous neurosensory stimulation, fundamental process for cortical development and cognitive processing (Graven, 2006, Bisiacchi et al 2009). These results may reflect alterations in brain function as a results of conditions leading to extreme premature birth and/or of prolonged adaptation to extra-uterine life. These findings show that differences are evident even before term age and points to the importance of early identification of risk factors on brain development.
Publications:
GOLJAHANI A.; D'AVANZO C., SCHIFF S., AMODIO P.; BISIACCHI P.; SPARACINO G., (in press) A novel method for the determination of the EEG individual alpha frequency, *NEUROIMAGE*

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