Correlation of voiding pattern with the video–EEG in healthy preterm neonates

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Aim Whether the brains of preterm neonates participated in the voiding during quiet sleep was still unknown. The mechanism of voiding control in newborn, especially in preterm is unclear. Recently, it has been reported that video-EEG has shown a very good advantage to evaluate the brain activity and effects of environmental factors on the EEG. However, correlation between voiding pattern and brain activity recorded by video-EEG has not been reported. The purpose of present study is to investigate the relationship between voiding pattern and brain activity that recorded by video-EEG in healthy preterm newborn.

Methods Forty-seven healthy preterm neonates (16 female) whose conceptional age (CA) was 34.10±1.81 weeks (mean ± standard deviation), group I: 31 weeks ≤ CA < 33 weeks; n=13; group II: 33 weeks ≤ CA < 35 weeks; n=14; group III: 35 weeks ≤ CA < 37 weeks; n=20. Eight EEG electrodes were placed at Fp1, P3, O1, T3, Fp2, P4, O2 and T4 according to the international 10-20 system. Bipolar recordings from channels Fp1-T3, T3-O1, Fp2-T4, T4-O2, Fp1-C3, C3-O1, Fp2-C4 and C4-O2 were used in the analyses. Video-EEG data from eight cortical regions were recorded from 8:00 am to 12:00 am. Meanwhile, the 4h free voiding parameters were recorded: including voiding frequency (VF), voiding volume (VV), post-voiding residual volume (PRV) status at voiding (awake/sleep). Statistical significance between groups in the EEG power was determined using the nonparametric Kruskal-Wallis test. An ANOVO test was used to compare the average CA, VF, VV, PRV and birth weight (BW) values obtained in the three groups. Whenever differences were significant at the P < 0.05, a post hoc Bonferroni test was used to check for differences between two groups. The data were analyzed using the statistical software of Statistic Package for SPSS 17.0.

Results Voiding was recorded 146 times. Awake voiding pattern was seen in 51.37% of all bladder voiding. Intermittent voiding pattern (urination ≥ 2 every 10 minutes) was up to 15.07% (22/146) of all voiding. There was no significant difference in Voiding time and VV / BW between the three groups (P > 0.05). But voiding time in sleeping preterm neonates of group III was significantly less than that of the other two groups (P < 0.05). PRV/BW of group I was significantly larger than that of group II and group III. The electrode pair Fp1-T3 and Fp2-T4 amplitude showed significant difference in group II and group III during quiet sleep voiding, 5 second before and after voiding (P < 0.05). The electrode pair C3-O1 and C4-O2 amplitude showed significant difference in group I during quiet sleep voiding, 5 second before and after voiding (P < 0.05). But the EEG frequency showed no significant difference in the three groups (P > 0.05).

Conclusion The study found that the brain has played a role, even in the very early of newborn, in control of voiding function. With the age increasing, the central region and occipital area of the brain in preterm neonates played an important part in voiding. The voiding reflex pathway connection to the cerebral cortex has been developed anatomically, but the function is immature and the signal only disturbs the neonate.