Slow wave activity

Slow wave activity (SWA), i.e. slow oscillations of frequency < 4 Hz, has been observed in electroencephalograms (EEG) during sleep; it increases with prior wakefulness and decreases with sleep.

To investigate the characteristics of slow wave activity (SWA) during sleep and the changes of SWA after adenotonsillectomy in children with severe obstructive sleep apnea (OSA).

A total of 24 children with severe OSA, who completed adenotonsillectomy in Sleep Center of Beijing Children's Hospital and 26 control children category matched for age and sex and excluded from OSA were included as subjects from May 2018 to December 2019. The subjects underwent overnight PSG, as well as SWA analysis of sleep electroencephalogram. The differences of PSG indexes and SWA intensity between children with severe OSA and control children, before and after operation in severe OSA children were compared and the correlations between SWA intensity and PSG indexes were analyzed. Results: The age of the children with severe OSA before surgery was (6.1±1.7) years, including 20 males (83.3%), and the interval M(Q1,Q3) between surgery and follow-up was 6.3 (5.8, 7.1) months. The age of the control children was (6.2±1.1) years, including 20 males (76.9%). In severe OSA group, the M (Q1,Q3) of non-rem sleep stage 1 to total sleep time, obstructive apnea hypopnea index, oxygen desaturation index (ODI) and proportion of oxygen saturation (SpO2)<90% during night sleep to total sleep time were 6.8% (5.6%, 8.9%), 1.2 (0.4, 2.4) events/h, 2.1 (0.7, 4.3) events/h and 0(0, 0) after surgery, respectively, which were lower than those before surgery [9.1% (7.5%, 16.8%), 21.6 (14.1, 39.5) events/h, 23.1 (10.2, 36.0) events/h and 0.8% (0, 3.9%), respectively], while non-rem sleep stage 3 to total sleep time%, rem sleep stage to total sleep time% and lowest SpO2 were (24.3±5.7)%, (19.1±3.7)% and 91%(86%, 94%) after surgery, which were higher than those before operation [(19.0±5.3)%, (15.4±3.9)% and 83%(70%, 88%) respectively] (all P values<0.05). The repeated measure ANOVA of SWA intensity in phase N1 showed no interaction between OSA and sleep time course (F=0.02, P=0.997), the main effect of OSA was statistically significant (F=5.12, P=0.040), SWA intensity in children with severe OSA at stage N1 was higher than that of the control group [SWA(severe OSA group before surgery-control group)(95%CI): 0.379,(0.020, 0.739)], while the main effect of sleep time course was not statistically significant (F=1.66, P=0.191). There was no interaction between adenotonsillectomy and sleep time course (F=0.88,P=0.461), the main effect of surgery was statistically significant (F=8.95, P=0.010), SWA intensity of children with severe OSA at N1 stage after surgery was lower than before [SWA(after surgery-before surgery)(95%CI):-0.572(-0.982, -0.162)] and the main effect of sleep time course was statistically significant (F=6.33, P=0.001). The intensity of SWA in the fourth sleep cycle of N1 stage was positively correlated with ODI (r=0.299, P=0.048).

The intensity of slow-wave activity at N1 stage is affected by OSA which might be caused by intermittent hypoxia, and adenotonsillectomy significantly reduces SWA intensity at stage N1 [1)].

EEG of the Traumatic brain injury patients has showed more irregular slow-wave activities than that of the normal controls. Furthermore, the above changes were more significant in the Apolipoprotein E carriers in the early stage of TBI patients.

The APOE ε4 allele may be associated with poor rScO2 and more slow-wave activities at the early

stage of TBI [2].

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Wu YX, Wang CM, Xu L, Tang YF, Wu PT, Zhang Y, Xu Z. [Characteristics of slow wave activity of sleep electroencephalogram and the changes of slow wave activity after adenotonsillectomy in children with severe obstructive sleep apnea]. Zhonghua Yi Xue Za Zhi. 2022 Mar 1;102(8):544-549. Chinese. doi: 10.3760/cma.j.cn112137-20210527-01218. PMID: 35196775.
2)
Yang B, Liang X, Wu Z, Sun X, Shi Q, Zhan Y, Dan W, Zheng D, Xia Y, Deng B, Xie Y, Jiang L. APOE gene polymorphism alters cerebral oxygen saturation and quantitative EEG in early-stage traumatic brain injury. Clin Neurophysiol. 2022 Feb 4;136:182-190. doi: 10.1016/j.clinph.2022.01.131. Epub ahead of print. PMID: 35193096.