Abstract BSH (550)

Title:
Does auto-adjusting positive airway pressure (APAP) aid memory and learning in children with sickle cell disease and sleep disordered-breathing?

Background:
Children with sickle cell disease (SCD) are at risk of hypoxic exposure due to complications such as chest crisis and sleep apnoea and are more likely to develop cognitive difficulties over time. Although intermittent hypoxia impairs verbal learning and spatial memory in animal models, there are few data on any association of potential reversible memory or learning difficulty with hypoxic exposure in SCD and the effect of treatment remains very controversial.

Sleep disordered breathing (SDB), common in these children, seems to impair executive function and processing speed. Interestingly difficulties in memory (i.e., working-, visual and verbal memory) performance impact other cognitive processes (i.e., processing speed and executive functioning) and hence lead to difficulties in academic attainment and intelligence.

It is well supported that sleep improves memory consolidation and that any disruption in sleep, either through SDB or sleep deprivation, could impair memory performance. In our randomised trial of auto-adjusting positive airway pressure (APAP) in SCD, cancellation, a measure of attention and processing speed, improved. In this secondary analysis we explored any effect of APAP on sleep behaviour, sleepiness and verbal and spatial memory.

We hypothesised that APAP compared to standard care alone will improve (1) memory and learning, (2) sleep behaviour and (3) sleepiness.

Methods:
30 Patients (mean age 12.6) were randomised for a 6 month at home treatment of either APAP and standard care (n=15;) or standard care alone (n=15). Questionnaires on sleep behaviour, sleepiness (i.e., Epworth Sleepiness Scale (ESS)) and neuropsychological assessment (i.e., Children Memory Scale (CMS): Verbal Memory (i.e., Word Pairs) and Visual/Spatial Memory (i.e., Dot Location) were administered before and after treatment period. The CMS tasks consists of an immediate, delayed and recognition subtest.

Results:
Patient receiving the APAP treatment felt less sleepy (ESS: mean -2; 95% confidence intervals (CI) -3.13; -0.87) compared to controls (ESS: mean 0.15; 95%CI -1.03; 1.32), p=0.018 and took less time to fall asleep (mean -5.39; 95%CI -10.8; -0.03) vs. controls (mean 2.96; 95%CI -2.88; 8.80), p=0.05. However, no difference was found for total amount of sleep.

Raw scores for spatial memory performance improved after APAP treatment for (1) (Dot Location Total: mean 3.26; 95%CI 1.65; 4.87) vs. controls (mean -0.14; 95%CI -1.89; 1.61), p=0.012 and (Dot Learning: mean 2.50; 95%CI 1.29; 3.70) vs. controls (mean 0.20; 95%CI -1.11; 1.50), p= 0.21. There was no statistically significant difference for Dot Delay.

Raw scores for verbal memory performance indicated an improvement after APAP use but this was not statistically significant (e.g., Word Pair Learning: mean 3.95; 95%CI 0.64; 7.25 vs. controls mean 1.91; 95%CI -1.69; 5.51), p= 0.433. The same was true for the overall memory learning performance (mean 6.24; 95%CI 2.48; 10.01) vs. controls (mean 2.34; 95%CI -1.76; 6.43), p=0.195.

Discussion:

In accordance with other literature APAP treatment was able associated with improved cognitive function, sleepiness and sleep behaviour. The following limitations might have contribute to the differences in results and should take into account for future studies: (1) small sample size; (2) compliance with APAP; (3) factors influencing cognitive assessment (i.e., environmental distractions, emotional wellbeing and time of day). Improving daytime sleepiness aids concentration thought the day, hence, improves academic attainment. Improving spatial memory, important for planed and guided behaviour could support and improve other cognitive functions (i.e., executive function and processing speed) impaired in children with SCD and SDB.