Sleep Disorders and Inspection Time in Children with Cerebral Palsy

L. Shank1, J. N. Kaufman1, L. O'Brien2, and S. Warschausky1

1Department of Physical Medicine and Rehabilitation, University of Michigan, Ann Arbor, Michigan, USA
2Department of Neurology, University of Michigan, Ann Arbor, Michigan, USA

E-Mail: laurasha@umich.edu

Sleep disorders are associated with neuropsychological impairments. Children with cerebral palsy (CP) are four times more likely than typically developing children to exhibit sleep disorders. This study examined the relationship between parental reports of sleep disordered breathing and visual inspection time (IT) in both children with CP and typically developing (TD) peers. Greater sleep disordered breathing was hypothesized to be associated with longer IT. IT measures components of cognitive processing speed, relatively independent of motor speed. Participants and Methods: Participants were 44 children with CP and 76 TD peers, ages 8-16, mean 11.5 (2.5) years, 62% male. In the CP group, 27 were at a Gross Motor Function Classification System (GMFCS) level I, 3 at GMFCS II, 16 at a GMFCS III, 7 at a GMFCS IV, and 4 at a GMFCS V. The IT task consisted of a Pi stimulus presented on a computer screen for brief experimenter controlled durations. Examinees were asked to make a simple decision regarding visual properties of the stimuli using arrow keys to indicate choice. Parents completed the Pediatric Sleep Questionnaire (PSQ-16). Results: There was a significant correlation between PSQ-16 and IT in the CP group only, with greater sleep disordered breathing associated with higher IT threshold. In the CP group, medical variables and motor functioning were not significant predictors of PSQ-16 scores. Conclusion: For children with CP, greater reported sleep disordered breathing is associated with longer IT durations, reflecting slowed processing speed. Findings are discussed in terms of the attentional and sleep disorder risks associated with CP.

Introduction

- Children with CP are approximately four times more likely than typically developing children to exhibit sleep disorders (Newman, O'Regan, & Hensley, 2006).
- Studies of neurobehavioral correlates of sleep disordered breathing indicate risk for impaired attention (Beebe, 2006; O'Brien et al., 2004).
- Children with CP are at significant risk for attentional impairments including evidence to suggest slowed processing speed (PS), though PS instruments are typically confounded by speeded motor response demands (Christ et al., 2003).
- Recent work suggests that Inspection Time (IT) is a measure of general PS, but more specifically measures speed of visualization (O'Connor & Burns, 2003). As a procedure that largely bypasses the speeded motor response demands of traditional PS instruments,
- IT tasks have potential as accessible measures of PS for individuals who have physical impairments.
- Hypothesis: Children with and without CP will show significant positive correlations between sleep disordered breathing scores and IT thresholds, with higher scores associated with higher thresholds.

Methods

Demographic and developmental characteristics by Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>CP (n=44)</th>
<th>TD (n=76)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>11.7 (2.4)</td>
<td>11.3 (2.6)</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>70%</td>
<td>53%</td>
</tr>
<tr>
<td>PPVT-III</td>
<td>103.8 (17.5)</td>
<td>108.7 (15.3)</td>
</tr>
<tr>
<td>Gestation (weeks)</td>
<td>31.5 (6.7)*</td>
<td>38.2 (2.4)</td>
</tr>
<tr>
<td>Birth Weight (lbs)</td>
<td>4.2 (2.4)*</td>
<td>7.3 (1.3)</td>
</tr>
<tr>
<td>History of seizure</td>
<td>13.6%*</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

- Participants were 76 Typically Developing (TD) children and 44 children with CP ages 8-16.
- Children in the CP group were oral communicators with Gross Motor Functional Classification Scale (GMFCS) levels I-II.
- All children in the CP group demonstrated the ability to provide a reliable dichotomous choice response.
- Children were recruited in accordance with IRB requirements from the community and associated medical appointments at two Michigan health care facilities.

Analyses and Results

- Children with CP require significantly longer Visual Inspection Times (i.e. longer on-screen stimulus durations) than TD children (p < .001).
- Children with CP have more reported symptoms of sleep disordered breathing, than TD children (p < .001).
- There were significant correlations between IT and PSQ16 in the CP, but not the TD sample.
- Common comorbidities associated with CP (prematurity, low birth weight, motor impairments) were not significant predictors of PSQ-16 scores.

Conclusions

- Consistent with previous research, children with CP are at significant risk for sleep disordered breathing (SDB) (Beddoes & Khan, 2003).
- Findings provide preliminary evidence visual IT is slower in a sample of children with CP than in TD peers.
- For children with CP, SDB is associated with slower IT.
- For TD children, no relationship was found between sleep disordered breathing and slowed processing speed. The IT task was relatively easy for the TD sample resulting in a restriction of range. That said, these findings also are consistent with more recent community studies which suggest that children with mild sleep disordered breathing show no significant attentional impairments (Calhoun et al., 2008; Coulomb et al., 2009).
- Findings suggest that for children with CP, having sleep disordered breathing may increase their risk for attentional impairments.

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