Utility of a Clock Drawing Task in Identifying Spatial Neglect in Children with Perinatal Stroke

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Introduction

The Clock Drawing Test (CDT) was originally used to evaluate visuo-constructive abilities, and is now broadly used to assess cognitive impairments in adults. CDT is widely used as a measure of spatial dysfunction and unilateral neglect in adults. Spatial neglect is a neuropsychological syndrome occurring after damage to one hemisphere of the brain that involves a deficit in attention to stimuli, generally in contralesional space. Adults with right hemisphere stroke have generally shown more contralateral neglect than those with left hemisphere damage. Clock drawings in adults may demonstrate neglect of the contralesional half of extra-personal space after stroke by omission of numbers, transposition of the numbers and hands from the neglected side to the other, or improper spatial layout of numbers. In the most severe cases of neglect, clock drawings may show all numbers drawn on the side of the clock ipsilateral to the lesion.

Clock drawing has not been used extensively in children. This study compared the effect of children’s clock drawings with performance of those typically developing children in order to determine whether there is evidence of hemi-spatial neglect in children with focal lesions, and to examine the effect of age on clock-drawing skills.

Methods

Study Population
Thirty-eight individuals (age range 6-21 years) with left hemisphere (LH) or right hemisphere (RH) focal lesions and one hundred and seventy-nine age-matched controls were given the free-drawn Clock Drawing Test (CDT) in a cross-sectional design.

Scoring System
An adapted scoring system was developed to identify errors including omissions, repetitions, deficits in spatial arrangement of numbers, reversals, incorrect placement of hands, and perseveration (numbering beyond 12). For this purpose, different available scoring protocols for the clock drawing were reviewed. Omissions of numbers and hands were scored based on the scoring system of the Clock Drawing Test. Based on this scoring system, the CDT that considered individualized errors was designed. This scoring system comprises a 25-point scale for an overall score. In addition to the total score, the system quantifies left-sided and right-sided errors, and system comprises a 25-point scale for an overall score. In addition to the total score, the system considers errors in both the left and right hemisphere.

Results

Because of the wide age range of children in this study, we divided them into three subgroups based on age (6 to 8 years, 9 to 14 years, and 15 years and older). Then, the total errors of our control group dropping dramatically from ages 8 to 9, and then from 14 to 15. A previous study of typically developing children also showed major changes in clock drawing ability after age 6. Figure 1 displays representative clock drawings in each age subgroup. Number of left and right errors of the clock drawings, based on the scoring system, are demonstrated in Figure 2. Children with LH lesions made a greater number of errors on both the right and left sides of the clock drawing throughout all age subgroups (6-8 years, 9-14 years, and 15-21 years) compared to controls. Children with RH lesions showed greater left and right errors in the younger groups compared to controls, with significantly poorer performance on the left at 6-8 years, suggestive of contralateral neglect. However, at ages 15-21, the RH lesion subjects no longer differed from controls.

Conclusions

The results of this study show a pattern of spatial neglect in children with left or right focal lesions that is distinct from that which has been previously described in adults. The pattern of bilateral errors seen in children with LH lesions is different from the pattern of mild and transient contralateral neglect observed in adults with LH lesions but similar to what has been described in children (Thanaye et al., 2012). On the other hand, the pattern of contralateral inattention seen in children with RH lesions is consistent with what is seen in adults, but appears to be confined to the younger age range and to largely disappear by adolescence.

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