Measuring intellectual ability in children with cerebral palsy: Can we do better?

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A B S T R A C T

Standard intelligence tests such as the WPPSI-III have limitations when testing children with motor impairment. This study aimed to determine the proportion of children with cerebral palsy with sufficient verbal and motor skills to complete the WPPSI-III, to determine their comparative ability to complete tasks with and without a significant motor component, and to investigate short forms of the WPPSI-III as alternatives. Participants were 78 of 235 eligible 4–5 year old children with cerebral palsy resident in the Australian state of Victoria. Verbal IQ (VIQ), Performance IQ (PIQ), and Full-scale IQ (FSIQ) were determined using the WPPSI-III. Initial screening for pointing and verbal abilities determined which tests were attempted. The impact of speed was investigated by comparing scores on the Block Design subtest with and without an imposed time limit. FSIQ scores were calculated from two short forms of the WPPSI-III and compared to the full form. On screening, 16 children had inadequate pointing (14) and verbal abilities (2). FSIQ was obtained in 62 (82%) children. Strong associations were seen between completion of the entire test battery and topographical pattern, level of manual ability and level of gross motor function. Scores on subtests requiring manual ability were depressed relative to other scores. Children performed better using short forms of the WPPSI-III and, for a minority, when time limits were disregarded. In summary, children with cerebral palsy often lack the fine and gross motor skills necessary to complete the WPPSI-III, scoring relatively poorly on tasks requiring a fine motor response. Using short-form estimations of FSIQ comprised of subtests without a significant fine motor component has the potential to increase a child's FSIQ by approximately 5 points. These findings have important clinical implications when assessing a child with both motor and cognitive limitations.

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1. Introduction

Cerebral palsy (CP) is the most common cause of neurodevelopmental disability in childhood in developed countries, with a prevalence of approximately 2 per 1000 live births (Paneth, Hong, & Korzeniewski, 2006). CP is a clinical descriptive term for a heterogeneous group of permanent movement disorders resulting from non-progressive disturbances to the developing foetal or infant brain. The motor disorders are often accompanied by epilepsy and problems with cognition, sensation, perception, communication, and behaviour (Rosenbaum, Paneth, Leviton, Goldstein, & Bax, 2007). Previous research has shown that approximately 20% to 30% of children with CP have difficulty in responding to general intelligence tests (Sigurdardottir et al., 2008). Although not directly assessing motor skills, most of the subtests of the typically employed, standard intelligence tests are dependent upon verbal responses, motor coordination to manipulate stimuli, or a written or point response (Fennell & Dikel, 2001). Assessments using such measures risk contamination due to verbal and motor impairment and do not always reflect the true cognitive abilities of the child (Losch & Dammann, 2004; Sabbadini, Bonanni, Carlesimo, & Caltagirone, 2001). Despite these limitations, standard intelligence tests are often a requirement of the education system in determining a child's level of functioning, eligibility for funding or special school placement, and the degree and type of assistance required.

Using a representative sample of preschool children with CP, the primary aim of this study was to determine the proportion of children having sufficient verbal and motor skills to complete the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-III; Wechsler, 2002), using standardised assessment procedures. The WPPSI is the most commonly used measure of young children's general intellectual ability in Australia. The second aim was to examine the ability of children with CP to complete tasks with a significant motor component relative to tasks without a significant motor component. The third aim was to investigate short forms of the WPPSI-III. These comprise subtests which require only simple motor responses and may minimise the potential disadvantage imposed on children with motor impairment.

2. Method

2.1. Setting

The study was conducted within the Developmental Disability and Rehabilitation Research group at the Murdoch Childrens Research Institute and The Royal Children's Hospital in Melbourne, Australia. Prior ethics approval for the study was obtained from the Hospital's Human Research Ethics Committee.

2.2. Participant selection criteria and recruitment

The Victorian CP Register was used to identify a study cohort fulfilling the following criteria: (1) a clinical diagnosis of CP; (2) still alive; (3) aged 4 or 5 years at study recruitment; (4) sufficient fluency in English to complete language-based tasks; (5) residence within the Australian State of Victoria; and (6) ability to be contacted within the ethical constraints of the Register.

Recruitment letters were sent at regular intervals over a 16 month period. Over this time frame, the Victorian CP Register comprised 426 children aged four or five years. Of these, 235 families met the study selection criteria and were contacted by mail, 135 replied to the letter of invitation, and 80 consented to participate. Appointments were arranged for these 80 families to meet the study psychologist (SS).

2.3. Clinical information

Clinical information was obtained from parental report and from the child's medical record. Topographical pattern was classified as hemiplegia, diplegia, or quadriplegia. Monoplegia was classified with hemiplegia and triplegia with diplegia. Gross motor function was classified according to the Gross Motor Function Classification System (GMFCS; Palisano et al., 1997), and manual ability according to the Manual Ability Classification System (MACS) (Eliasson et al., 2006). For comparative analyses, MACS levels III and IV were combined to achieve reasonably comparable group sizes. Additional information was obtained on visual impairment (present, absent, functional blindness, squint or strabismus only), hearing impairment (absent, some impairment, bilateral deafness), epilepsy (present, absent, resolved), length of gestation, and birth weight.

2.4. Screening tests

The screening test used was the WPPSI-III. In the standardisation sample (4:0 to 5:11 age group), reliability coefficients of the WPPSI-III subtests demonstrate good to excellent reliability. The reliability coefficients for the Word Reasoning (WR) subtest is excellent ($r = \geq .90$). The remaining subtests exhibit good reliability: Block Design (BD, $r = .75–.84$), Information (INFO, $r = .84$ to $.90$), Vocabulary (VOC, $r = .86–.89$), Picture Concepts (PC, $r = .89–.93$), Coding (CD, $r = .79–.88$), Receptive Vocabulary (RV, $r = .86–.90$), and Picture Naming (PN, $r = .87–.90$). The reliability coefficients for the WPPSI-III composite scales (Verbal Intelligence Quotient [VIQ], Performance Intelligence Quotient [PIQ], Full Scale Intelligence Quotient [FSIQ])