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Bladder and bowel continence in bilateral cerebral palsy: A population study

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Summary

Introduction
The attainment of continence is an important milestone in all children, including those with disability.

Objective
To describe the age of bladder and bowel continence in children with bilateral cerebral palsy (BCP), and the association with intellectual impairment (II) and severity of motor disability.

Patients and methods
The parents of 346 children with BCP were interviewed as part of a population-based prospective study of the children at 3, 7, and 17 years of age. The age of bladder and bowel continence by day and night was ascertained and compared with controls from the Avon Longitudinal Study of Parents and Children (ALSPAC).

Results
The median age for daytime bladder and bowel continence in BCP children was 5.4 years compared with 2.4 years in the controls. At 13.8 years of age, 59.4% of BCP children and 99% of controls were continent by day. In BCP children, there was no difference between the attainment of daytime bladder and bowel control. Night-time bladder and bowel control was slower and less completely attained, with 50% of BCP children continent by the age of 11.8 years compared with 3 years in control children. At 13.8 years of age, 51.9% of BCP children compared with 99.4% of controls were continent for bowel and bladder at night. Gross Motor Functional Classification Score (GMFCS) and intellectual ability (IA) (II) were strongly associated with continence attainment ($P < 0.0001$), but gender was not.

Discussion
Delayed and less complete continence attainment was noted in other clinic series of children with cerebral palsy (including hemiplegics) and children with II. Severity of motor disability (GMFCS), and II impacted on other aspects of toilet training, such as: motivation, understanding, communication, and independence skills. The presence of neurogenic bladder and bowel dysfunction can occur in all levels of GMFCS. Thus, there are many reasons that can prevent continence attainment.

Conclusions
Children with BCP achieved day and night-time bladder and bowel continence more slowly and less completely than controls, with 60.8% being continent by day and 54.6% by night at the age of 17 years. The majority of BCP children who were continent by day had achieved this by the age of 5.5 years (86%). At least 88% of BCP children with GMFCS I/II and normal, specific or mild learning impairment were continent for bladder and bowel by day and night. Expectations should be shared with parents, and failure to attain expected continence should be actively investigated.

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Introduction

Attainment of bladder and bowel control is an important developmental milestone in children. Epidemiological studies have shown that daytime control is achieved before night-time, with the majority of children achieving daytime continence at 3—4 years of age and night-time between 3.5 and 5 years of age [1—4]. Mature bladder and bowel eliminatory behaviour requires close integration of the autonomic and somatic nervous systems, which depend on a complex neural control system located in the brain and spinal cord. Gender appears to be the single most important factor affecting control, with several studies showing that girls are continent earlier than boys [4—7]. Developmental delay and intellectual impairment adversely affect attainment of continence [8—11].

Limited information is available about the age of continence attainment in children with cerebral palsy (CP). A single, large cross-sectional Dutch study (n = 459) reported an overall prevalence of primary urinary incontinence of 23.5% with negatively associated factors of tetraplegia and low intellectual ability; bowel continence was not reported [12].

In order to diminish the considerable long-term physical, psychosocial and financial burden of incontinence, healthcare professionals and parents need information regarding the attainment of bladder and bowel control in children with cerebral palsy. The present study aimed to describe the age of attainment of bladder and bowel control in children with bilateral cerebral palsy (BCP), using a prospective, longitudinal population study including associated factors of gender, intellectual impairment and severity of functional motor disability, as measured by the Gross Motor Functional Classification Score (GMFCS). The patients were part of an original study that set out to chart the natural history of hip dysplasia in CP; it included five X-rays by 5 years of age. As hip dysplasia is uncommon in hemiplegic CP, it was not ethically justifiable to include them, leaving bilateral CP patients only (www.icps.org.uk). The continence data that were collected in this study formed the basis for the present paper.

Methods

The methods of the original SH&PE study (spine, hips and postural experience) of BCP children have previously been described [13,14]. Briefly: all children born between 1989 and 1992 in the South East Thames Regional Health Authority of the United Kingdom with BCP at 15 months of age were included and followed up until 17 years of age with longitudinal collection of data. Children who died before 12 months of age were excluded. For original methods of recruitment, ethical permission, consent, diagnosis and definition of CP, please refer to the original paper [15].

Parents were asked (questionnaire administered by a physiotherapist or original author), when their children were 3, 7, and 17 years old, about the children's toileting habits for bladder and bowel by day and night (see Table 1). For the purposes of this study '*always*' at age 3 and 7 years, and '*yes*' at age 17 years were accepted as having bladder and bowel continence.

Control data were obtained with appropriate permission from the Avon Longitudinal Study of Parents and Children (ALSPAC), with a population birth cohort of 14,541 from April 1991 to December 1992, and 13,971 children alive at 12 months of age [16]. Parents were asked about their children's bladder and bowel continence, day and night at 2 years, and again at 3 years, and yearly from 4.5 to 9.5 years; the young person was asked at 13.8 years (see Table 1). For the purposes of this study '*always*' at 2/3 years and '*never*' or '*occasionally less than once/week*' were accepted as having continence, and this cohort was referred to as the control group.

In order to minimise recall bias, the earliest reported age for bladder and bowel continence was recorded as the most accurate.

Functional motor ability was assessed at 5 and 16—18 years, and categorised using GMFCS [17] and Intellectual ability (IA) was measured using the British Picture Vocabulary Scale administered at 16—18 years by therapists (see Table 1 for definitions).

Statistical analysis

To compare BCP children with the control group, the median age for completion of the questionnaire in the control group (2, 3.1, 4.5, 5.5, 6.4, 7.6, 9.6, and 13.8 years) was taken, and the proportion of BCP children who had achieved daytime bladder, daytime bowel and/or night-time bladder and bowel continence at each age was calculated. The Chi-squared test analysed whether they were significantly different. To determine whether gender, GMFCS or IA were associated with achieving continence, a time-to-event analysis, with children entering the analysis at birth and exiting the analysis when they achieved continence or at the end of the study (age 17 years), was carried out and hazard ratios were estimated using Cox-regression. The GMFCS and IA were both fitted as scores, such that the hazard ratios presented were for a unit increase in GMFCS or IA, with the baseline groups of I (GMFCS) and 0 (IA). Kaplan—Meier plots were used to graphically summarise this data. All statistical analyses were carried out using STATA software (version 11.0; College Station, TX). All reported *P*-values were two-sided.

Results

A total of 346 children with BCP were identified as being alive from 1 year of age (1.7/1000 live births), with six (1.7%) unable to be traced at 17 years (2006—2008). At 3 and 7 years of age, data were available for 344 patients, with data unavailable due to death, loss to follow-up, or unavailability in 120 children by 17 years of age. Further exclusions applied were:

i. inconsistent data (this would include children who experienced secondary incontinence)
ii. the age of reported continence differed by >18 months in the 3, 7, and 17-year BCP questionnaires