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Original Article

Pediatric Cerebral Palsy in Botswana: Etiology, Outcomes, and Comorbidities

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ABSTRACT

BACKGROUND: Cerebral palsy is the most common cause of motor dysfunction in children worldwide and is often accompanied by multiple comorbidities. Although cerebral palsy has been studied extensively in high-resource settings, there are few published studies on cerebral palsy etiology, outcomes and comorbidities in low-resource settings. **METHODS:** Children with cerebral palsy were prospectively enrolled from inpatient and outpatient settings at a referral center in Gaborone, Botswana, in a cross-sectional study conducted from 2013 to 2014. Cerebral palsy etiology, outcomes, and comorbidities were determined through caregiver interviews, review of medical records, and direct physical examination. **RESULTS:** Sixty-eight children with cerebral palsy were enrolled. Subjects were 41% male, with a median age of 4 years (interquartile range = 2 to 7). The most common etiologies for cerebral palsy in our cohort were intrapartum hypoxic events (18%), postnatal infections (15%), prematurity (15%), focal ischemic strokes (10%), and prenatal infections (10%). Severe motor impairment was common, with the most severe category present in 41%. The predominant comorbidities were cognitive impairment (84%), epilepsy (77%), and visual impairment (46%). **CONCLUSIONS:** Cerebral palsy in Botswana has different etiologies and is associated with poorer outcomes and higher prevalence of comorbidities than what has been reported in high-resource settings. Further studies are necessary to determine optimal preventative and treatment strategies in this population.

Keywords: International Child Health, neurologic disorders, cerebral palsy, Africa

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Introduction

Cerebral palsy is the most common cause of motor impairment in children worldwide[1-3] and is associated with significant morbidity and mortality.[4-6] A variety of prenatal, perinatal, and postnatal insults can lead to the development of cerebral palsy, including hypoxic events, congenital brain malformations, and infections.[3,7,8] Cerebral palsy is associated with a variety of comorbidities such as visual impairment, epilepsy, and cognitive impairment.[9] In many children with cerebral palsy, associated

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comorbidities are the major drivers of outcome and quality of life.[10]

Cerebral palsy etiology and outcomes have been well characterized in high-resource settings, which has contributed to risk-reduction interventions and facilitated appropriate allocation of resources. However, there have been few high-quality studies conducted in low-resource settings. A recent systematic review of the literature on cerebral palsy in Africa[11] noted few African studies of cerebral palsy etiology and no high-quality studies on outcomes and comorbidities. The few studies that have been performed in Sub-Saharan Africa have identified birth asphyxia and neonatal infections as the most common etiologies, suggesting that cerebral palsy etiology may be significantly different in Africa compared with the United States and Europe. A recent conference on cerebral palsy conducted jointly by the International Child Neurology Association and the African Child Neurology Association identified research on cerebral palsy etiology and outcomes as a key research priority to improve care for children in the region.[11]

The objective of this study was to systematically evaluate cerebral palsy etiology, outcomes, and comorbidities in a prospective cross-sectional study of children with cerebral palsy recruited from a referral center in Gaborone, Botswana. We hypothesized that intrapartum hypoxic events would be a major contributor to cerebral palsy in Botswana and that children with cerebral palsy in Botswana would have poorer outcomes and a higher frequency of comorbidities than historical controls in high-resource settings. We also sought to determine if outcomes and comorbidities would vary by etiology or by severity of illness.

Methods

Study design and setting

We conducted a prospective cross-sectional study of all children with cerebral palsy at Princess Marina Hospital. Princess Marina Hospital, the largest hospital in the country, is a 525-bed tertiary referral center located in Gaborone, Botswana's capital city. Enrollment in the study was conducted from June-September in 2013 to June-September 2014. This sampling strategy was used to maximize the number of subjects enrolled. We attempted to capture all subjects with cerebral palsy coming into contact with the health care system during the period of data collection. Patients were recruited from all settings at which children with cerebral palsy receive care at Princess Marina Hospital including general pediatric clinic, pediatric neurology clinic, physical therapy, occupational therapy, and inpatient wards. Ethical approval was obtained from institutional review boards at University of Botswana, Botswana Ministry of Health, and Princess Marina Hospital.

Inclusion criteria

Subjects met all of the following inclusion criteria: (1) children ages two to 18 years with a clinical diagnosis of cerebral palsy (confirmed by study author D.R.B., a board-certified pediatric neurologist), (2) motor weakness defined as a score of less than or equal to four of five on the Medical Research Council Scale for Muscle Strength in at least one limb associated with activity limitation, (3) onset of signs before age 12 months, and (4) presumed central origin of weakness based on neurological examination.

Exclusion criteria

Presence of one or more of the following: (1) human immunodeficiency virus (HIV) infection, (2) obstructive hydrocephalus, (3) history of malignancy, (4) evidence of developmental regression, (5) diagnosis of a known genetic syndrome, (6) primary neuromuscular disorder, or (7) major extracerebral birth defects. HIV status was determined by review of records. All children enrolled in the study had documented negative HIV tests after age six months.

Recruitment and case ascertainment

Potential recruitment sites were surveyed daily by study personnel for potential subjects. All potential subjects were approached and screened by one of the study authors and invited to participate in the study. Parents or relevant caregivers provided verbal and written informed consent in either Setswana or English as preferred by the participant and when possible subjects were asked for verbal assent. A diagnosis of cerebral palsy was confirmed through caregiver interviews, evaluation of medical records, examination of the child, and review of all relevant studies and imaging (by study author D.R.B.). Activity limitation was determined through caretaker interview.

Data sources and variable definitions

Data were obtained through caregiver interviews, chart review of inpatient and outpatient records, standardized physical examinations, cognitive testing, and review of imaging. Interviews were conducted in English or Setswana based on caregiver preference. Interviews in Setswana were conducted by a study team member fluent in Setswana or with the assistance of an interpreter fluent in Setswana. All data were collected on paper case report forms and verified (by study author D.R.B.) before entry into a password protected anonymized database.

Variables and data sources are reported in Tables 1 and 2. Cerebral palsy was defined according to the consensus definition by Bax et al.[1]

TABLE 1.
Demographics of Study Cohort

Subject Characteristics	Total n = 68
Age in years, median (IQR)	4 (2-6.5)
Male sex	28 (41%)
Birth weight in kg, median (IQR)	3.0 (2.6-3.2)
Living situation	
Large city	48 (71%)
Small city/town	12 (18%)
Small village/rural area	8 (12%)
Electricity in home	48 (71%)
Running water in home	49 (72%)
Maternal characteristics	
Maternal age at delivery, median (IQR)	29 (24-32)
Maternal HIV infection	17 (25%)
Maternal years of education, median (IQR)	12 (10-14)
Received prenatal care during pregnancy	61 (90%)
Characteristics of the delivery	
Delivered in hospital	65 (96%)
Preterm delivery (<34 wk)	10 (15%)
Multiple gestation	2 (3%)
Complications during delivery	31 (46%)
Cesarean section	18 (27%)
Admitted to NICU	44 (65%)
Days in NICU, median (IQR)	7 (0-14)

Abbreviations:
HIV = human immunodeficiency virus
IQR = interquartile range
NICU = neonatal intensive care unit
Values are n (%), or median (IQR) where noted.