Comorbidities in children with cerebral palsy: A cross-sectional study

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ICNC 2022
17th INTERNATIONAL CHILD NEUROLOGY CONGRESS
ANTALYA, TURKEY | OCTOBER 3-7, 2022

INTRODUCTION

- ✓ Disabilities in cerebral palsy (CP) include not only the motor dysfunction and the associated functional limitations, but also multiple additional disorders of cerebral functioning. These comorbidities reflect the brain injury, which may vary based on the underlying etiology and brain development.
- ✓ In contrast to developed nations, the etiological spectrum of CP in low-middle-income-countries (LMIC) is dominated by well-characterized and modifiable factors like hypoxia-ischemia, prenatal infections, hypoglycemia and hyperbilirubinemia.
- ✓ Hence, the nature of CP subtype, the comorbidities associated with them and the associated functional limitations are likely to be different in children with CP in LMICs as compared to the high-income countries.

Objectives

- ✓ To describe the comorbidities in children with CP.
- ✓ To determine the CP characteristics associated with different comorbidities.

Sample size and Statistics

- ✓ Prevalence of the co-morbidities associated with CP varies from 20% to 75%
- ✓ Considering a 95% confidence level and 5% confidence limits and 50% prevalence of comorbidity, the sample size was calculated as 384
- ✓ Prevalence of comorbidities associated with CP was determined as proportion
- ✓ Risk of comorbidities with different subtypes of CP different GMFCS level was analyzed by logistic regression

Materials & Methods

- ✓ This cross-sectional observational study was undertaken in the Pediatric department of a tertiary care referral hospital, between April 2018 to Oct 2021.
- ✓ CP was defined as a group of disorders causing permanent impairment of voluntary movement or posture attributed to non-progressive disturbances occurring in the developing fetal or infant brain.
- ✓ *Inclusion*: Children aged 2 to 18 years with a confirmed diagnosis of CP were eligible
- ✓ *Exclusion*: Children with transient motor disabilities, motor disabilities due to meningomyelocele or other spinal cord lesions, isolated hypotonia, motor abnormalities solely due to mental deficiency, and neurodegenerative disorders were excluded.
- ✓ All children underwent review of their medical records and a detailed neurological evaluation. The child was thus, subclassified into hemiparetic CP, spastic diplegia, dyskinetic CP, spastic quadriparesis and mixed CP.
- ✓ Comorbidity evaluation:
  - ✓ *Functional: GMFCS scale*
  - ✓ *Visual*: Clinical evaluation and visual evoked potential (VEP)
  - ✓ *Hearing*: Brainstem Evoked Response Audiometry (BERA)
  - ✓ *Cognitive*: Vineland Social Maturity Scale (VSMS)
  - ✓ *Communication*: MacArthur Communicative Development Inventory
  - ✓ *Behavior*: Childhood Behavior Check List (CBCL)
  - ✓ *Epilepsy*: Clinical evaluation ± EEG
  - ✓ *Sleep*: Children's Sleep Habits Questionnaire (CHSQ)
  - ✓ *Pain*: Non-communicating children's pain checklist (NCCPC)
  - ✓ *Gastrointestinal dysfunction*: Evaluation of biting, chewing, vomiting, constipation and sialorrhea

Results

Flow of patients

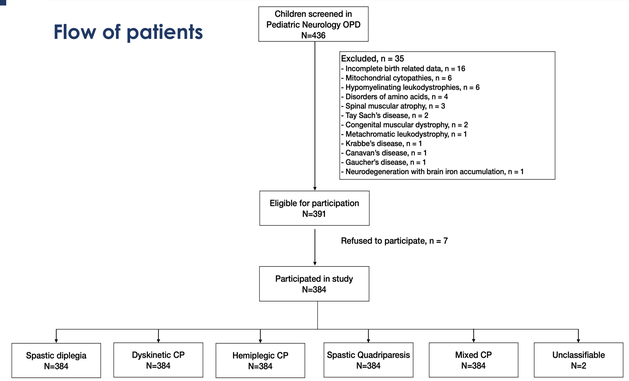

Table 1. Baseline data

Characteristic	Overall	Dyskinetic	Hemiparetic	Mixed CP	Spastic Diplegia	Spastic Quadriplegia
Age, months	78 (38)	93 (42)	72 (41)	82 (37)	66 (27)	77 (41)
Male	251 (65%)	50 (86%)	36 (69%)	77 (70%)	30 (43%)	56 (61%)
Gestational age						
Mean (SD)	37(4)	38(3)	37(4)	38(2)	33(3)	38(3)
Term	231(60%)	43(74%)	32(62%)	81(74%)	7(10%)	66(72%)
Moderate to late preterm	97 (25%)	13 (22%)	11 (21%)	25 (23%)	29 (41%)	19 (21%)
Very preterm	48 (13%)	1 (1.7%)	7 (13%)	4 (3.6%)	31 (44%)	5 (5.4%)
Extremely preterm	8 (2.1%)	1 (1.7%)	2 (3.8%)	0 (0%)	3 (4.3%)	2 (2.2%)
Mode of delivery						
Vaginal	241 (63%)	36 (62%)	39 (75%)	58 (53%)	49 (70%)	58 (63%)
LSCS	130 (34%)	21 (36%)	13 (25%)	46 (42%)	21 (30%)	28 (30%)
Instrumental	13 (3.4%)	1 (1.7%)	0 (0%)	6 (5.5%)	0 (0%)	6 (6.5%)
Birth Weight, grams	2,343 (796)	2,715 (709)	2,300 (880)	2,563 (582)	1,451 (439)	2,548 (752)
Etiology/ Risk Factors						
Antenatal factors	32	0	10	9	4	7
Genetic	23 (6.0%)	0 (0%)	10 (19%)	3 (2.7%)	1 (1.4%)	7 (7.6%)
Intrauterine infections	9 (2.3%)	0 (0%)	0 (0%)	6 (5.5%)	3 (4.3%)	0 (0%)
Birth related factors	320	58	40	82	66	74
Hypoglycemia	102 (26.6%)	0 (0%)	0 (0%)	61 (55%)	0 (0%)	41 (45%)
Perinatal asphyxia	90 (23.4%)	35 (60%)	7 (13%)	14 (13%)	7 (10%)	27 (29%)
Prematurity	81 (21.1%)	2 (3.4%)	11 (21%)	3 (2.7%)	59 (84%)	6 (6.5%)
Neonatal sepsis	74 (19.3%)	7	0	35	10	22
Neonatal jaundice	24 (6.3%)	21 (36%)	0 (0%)	3 (2.7%)	0 (0%)	0 (0%)
Perinatal stroke	23 (6.0%)	0 (0%)	22 (42%)	1 (0.9%)	0 (0%)	0 (0%)
Birth trauma	17 (4.4%)	4 (6.9%)	1 (1.9%)	2 (1.8%)	1 (1.4%)	9 (9.8%)
Etiological factors after neonatal period	26	0	0	17	0	9
Febrile encephalopathy	13 (3.9%)	0 (0%)	0 (0%)	10 (9.1%)	0 (0%)	3 (5.4%)
Surgery related hypoxia	11 (2.9%)	0 (0%)	0 (0%)	7 (6.4%)	0 (0%)	4 (4.3%)
Traumatic brain injury/ drowning	2	0	0	0	0	2
Unknown	6 (1.6%)	0 (0%)	2 (3.8%)	2 (1.8%)	0 (0%)	2 (2.2%)

Table 2. Prevalence of comorbidities among children with CP

Characteristic	Dyskinetic N = 58	Hemiparetic N = 52	Mixed N = 110	Diplegia N = 70	Quadriplegia N = 92
GMFCS 1	0 (0%)	27 (52%)	0 (0%)	3 (4.3%)	0 (0%)
GMFCS 2	2 (3.4%)	18 (35%)	2 (1.8%)	35 (50%)	2 (2.2%)
GMFCS 3	11 (19%)	2 (3.8%)	9 (8.2%)	29 (41%)	5 (5.4%)
GMFCS 4	19 (33%)	5 (9.6%)	24 (22%)	3 (4.3%)	13 (14%)
GMFCS 5	26 (45%)	0 (0%)	75 (68%)	0 (0%)	72 (78%)
Visual Impairment	50 (86%)	49 (94%)	99 (90%)	68 (99%)	89 (97%)
Abnormal BERA	36 (62%)	2 (3.8%)	35 (32%)	14 (20%)	25 (27%)
Others					
Severe GI Dysfunction	20 (34%)	1 (1.9%)	37 (34%)	0 (0%)	31 (34%)
Significant pain	37 (64%)	9 (17%)	88 (80%)	22 (31%)	72 (78%)
Social Quotient, Mean (SD)	20 (21)	71 (22)	15 (14)	59 (24)	15 (15)
Epilepsy	27 (47%)	24 (46%)	88 (80%)	24 (34%)	81 (88%)
Sleep impairment	38 (66%)	8 (15%)	70 (64%)	6 (8.6%)	54 (59%)
Behavioral abnormalities	29 (50%)	17 (33%)	57 (52%)	21 (30%)	39 (42%)

CONCLUSIONS

- ✓ Unlike the developed countries, a large proportion of children with CP in LMIC are of severe type with GMFCS 4 or 5
- ✓ Hypoglycemia and hyperbilirubinemia collectively accounted for 1 in 3 children with CP. Both these factors are potentially preventable
- ✓ Type of CP (Dyskinetic, mixed or spastic quadriplegia) is associated with increased odds of comorbidities than with hemiparetic or diplegic CP
- ✓ The risk of comorbidities increases with increasing GMFCS from 1 to 5
- ✓ These are significant for developing policies and community participation programmes for these children

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