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Frequency and Severity of Drooling in Children with Cerebral Palsy– A Cross-Sectional Study

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Abstract

Background:
Drooling is a common problem in children with cerebral palsy (CP), which has both physical and psychological impacts. So, this problem should be addressed among the CP patients.

Objective:
The aim of this study was to find out the frequency and severity of drooling in children with Cerebral palsy.

Methods:
This was a cross-sectional study conducted in the Pediatric Neurology outpatient department of the National Institute of Neurosciences and Hospital (NINS), Dhaka, from January to December 2022. A total of 100 children aged 3–14 years with a primary diagnosis of cerebral palsy who had drooling were included. The severity and frequency of drooling were assessed by Thomas Stonell and the Greenberg drooling rating scale. This Scale was used to measure the drooling severity and frequency. Data were collected via a structured questionnaire and analyzed using SPSS (version 25), with $p<0.05$ considered statistically significant. Ethical approval was obtained, and informed consent was secured from parents/caregivers.

Results:
Among the 100 participants, 54% were male and 46% were female, and about half of them were under five years of age. Spastic quadriplegia was the most prevalent CP type (45%), followed by spastic hemiplegia (30%), diplegia (19%), and dyskinetic CP (6%). Constant (42.2%) and frequent (37.8%) drooling were observed predominantly in children with spastic quadriplegia ($p=0.007$). In terms of severity, severe drooling was most common (74.2%), followed by profuse (50%) and moderate drooling (34.7%) in quadriplegic CP children ($p=0.001$), then diplegic and hemiplegic children.

Conclusion:
This study highlighted that the drooling frequency and severity both had a significant association with the types of CP.

Keywords: Cerebral palsy, Drooling, Frequency, Duration, Children thomas stonell, Greenberg drooling rating scale

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Introduction:

Cerebral palsy (CP) is the most common cause of motor disability in children.[1] It is a heterogeneous syndrome resulting from a non-progressive brain lesion during the period of brain development, with consequences that include a motor dysfunction such as abnormal tone, posture, or movements, and other associated impairments. This can be visual or hearing problems, intellectual disability, epilepsy, or communication

issues.[2] Worldwide, the prevalence of CP is 1-5 per 1000 live births. In CP, drooling or anterior sialorrhoea is a common problem, which is the unintentional loss of saliva from the mouth.[1] In normal development, 'salivary continence' is usually achieved by 15-18 months as control of the tongue and musculature improves. Drooling is considered abnormal over 4 years of age and has a prevalence of 0.6% in the general population and is more common in children with developmental or neurological co- morbidities. In children with Cerebral Palsy (CP), the prevalence can be as high as 30 to 53%.[3] The most common cause of drooling is neuromuscular dysfunction; other causes are hypersecretion and sensory or anatomic dysfunction.[4] Others are open mouth position, a lack of lip sealing, and certain malocclusions.[5] In CP, drooling is caused by oral motor dysfunction, dysphagia, and/or intraoral sensitivity disorder, inefficient labial sealing, suction disorder, reduced intraoral sensitivity, reduced frequency of spontaneous swallowing, and dental malocclusion. Inadequate head posture, intellectual disabilities.[1] Complications of sialorrhoea can be both physical and psychological and can harm quality of life. Drooling can result in perioral chapping, irritation, and maceration, with secondary infection of the facial skin, dehydration due to chronic loss of fluids, and increased risk of recurrent aspiration pneumonia.[4] Oral cavity should be examined for sores on the lip and chin, dental problems, tongue size and movement, and tonsillar hypertrophy; nasal blockage, malocclusion, and jaw stability should be assessed. A neurological examination should be carried out to investigate the level of alertness, swallowing ability, motor skills, and sensory dysfunction of the patient.[6,] Assessment of drooling severity and frequency is crucial for effective management. The Thomas-Stonell and Greenberg Drooling Rating Scale is a standardized tool used to evaluate these parameters. This scale assesses the severity of drooling on a scale from 1 (dry) to 5 (profuse drooling) and frequency from 1 (never drools) to 4 (constant drooling).[7] Treatment of sialorrhea is a multidisciplinary team approach. Treatment aims to reduce the excessive salivary flow while maintaining a moist and healthy oral cavity. Treatment options are conservative, including pharmacological therapy, photocoagulation of the salivary gland ducts, botulinum toxin injections, surgery, and radiotherapy.[2,6]

This study is carried out to understand the severity and frequency of drooling among cerebral palsy children which will in turn help to find out effective treatments, improving the quality of life of children with cerebral palsy.

Methods:

This cross-sectional study was conducted among children with cerebral palsy attending the Pediatric Neurology outpatient department of the National Institute of Neurosciences and Hospital (NINS), Dhaka, from January 2022 to December 2022. Children aged 3–14 years with a primary diagnosis of cerebral palsy who had drooling were screened. Children previously receiving any medical/surgical treatment for drooling, poorly controlled seizures (defined as daily seizures), and who had any local pathology that causes sialorrhea (oral ulcerations, stomatitis, dental caries, dental malocclusion, tonsillitis, any gum deformity, inefficient labial sealing) were excluded from the study. A total of 100 cases were enrolled in this study. The Thomas-Stonell and Greenberg Drooling Rating Scale was used to measure drooling severity and frequency. This scale classifies the frequency of drooling from never to frequently, as well as the severity of drooling, ranging from dry (never drools) to profuse (wet hands, trays, clothing, and things within reach). Data were collected via a structured questionnaire and analyzed using SPSS (version 25), with $p<0.05$ considered statistically significant. Ethical approval was obtained, and informed consent was secured from parents/caregivers.

Result:

Among 100 patients, the majority were under 5 years of age and male. Most children were delivered normally and had a history of perinatal asphyxia. In addition to drooling, the associated problems were feeding, chewing, swallowing difficulty, nasal regurgitation, and epilepsy. (Table-I)

About 45% children had spastic quadriplegia. Spastic hemiplegia, spastic diplegia, and dyskinetic type CP were found in 30%, 19% and 6% respectively (Table-II).

Table-I: Demographic characteristics of the study populations (N=100)

Demographic characteristics	no. (%)
Mean age (year)±SD	6.15±3.13
Age distribution (Years)	
<5	45(45)
≥5-10	39(39)
≥10	16(16)
Sex	
Male	54(54)
Female	46(46)
Birth weight (gm)	
<1500	12(12)
1500-2499	35(35)
>2500	53(53)
NVD	84(84.0)
LUCS	16(16.0)
Perinatal asphyxia	94(94.0)
Feeding difficulty	85(85.0)
Chewing difficulty	73(73)
Nasal regurgitation	1(1)
Swallowing difficulty	11(11)
Epilepsy	57(57)

Table-II: Types of cerebral palsy among the study population (N=100)

Types of CP	no. (%)
Spastic hemiplegia	30(30.0)
Spastic diplegia	19(19.0)
Spastic quadriplegia	45(45.0)
Dyskinetic	6(6.0)

Occasional and frequent drooling was more common among children under 5 years of age**.** Whereas constant drooling was more between 5- and 10-year-old children which was statistically not significant (Table-III).

Moderate and profuse drooling was more common in children under 5 years of age. Severe drooling was more common in 5 to 10-year-old children. (Table IV)

Constant and frequent drooling was significantly higher in the spastic quadriplegic CP (p 0.007). Occasional drooling was more in hemiplegic CP (Table-V).

All modalities of drooling, except mild drooling, were more common in spastic quadriplegic CP.

Table-III: Drooling frequency among different age groups based on thomas stonell & greenberg drooling rating scale (N=100)

Types of CP	Age				p-value
	Total n=100 no. (%)	<5 year n=45 no. (%)	>5-10year n=39 no. (%)	>10year n=16 no. (%)	
Occasionally drools	10(10)	19(42.2)	15(38.5)	6 (37.5)	
Frequently drools	49(49)	17(37.8)	12(30.8)	5(31.3)	0.812
Constantly drools	41(41)	9(20.0%)	12(30.8)	5(31.3)	

Table-IV: Drooling severity among different age groups based on thomas stonell & greenberg drooling rating scale (N=100)

Types of CP	Age				p-value
	Total N-100 no. (%)	<5 year n=45 no. (%)	>5-10year n=39 no. (%)	>10year n=16 no. (%)	
Mild	7(7)	5(11.1)	2(5.1)	0(0.0)	
Moderate	51(51)	25(55.6)	18(46.2)	8(50.0)	0.714
Severe	26(26)	7(15.6)	13(33.3)	6(37.5)	
Profuse	16(16)	8(17.8)	6(15.3)	2(12.5)	

Table-V: Relationship between drooling frequency and types of CP among the studied population (N=100)

Drooling frequency	Spastic Hemiplegia no. (%)	Spastic Diplegia no. (%)	Spastic Quadriplegia no. (%)	Dyskinetic no. (%)	p-value
Occasionally drools	17(56.7)	11(57.9)	9(20.0)	3(50.0)	
Frequently drools	8(26.7)	7(36.8)	17(37.8)	2(33.3)	0.007
Constantly drools	5(16.7)	1(5.3)	19(42.2)	1(16.7)	

Table-VI: Relationship between drooling severity and types of CP among the studied population (N=100)

Types of CP	Mild no. (%)	Moderate no. (%)	Severe no. (%)	Profuse no. (%)	p-value
Spastic hemiplegia	6(42.9)	15(30.6)	7(22.5)	2(33.3)	
Spastic diplegia	3(21.4)	15(30.6)	1(3.2)	0(0.0)	0.001
Spastic quadriplegia	2(14.3)	17(34.7)	23(74.2)	3(50)	
Dyskinetic	3(21.4)	2(4.1)	0(0.0)	1(16.2)	

The severity of drooling was found significant association with the types of CP. (Table-VI).

Discussion:

Drooling is one of the challenging problems in children with CP, which is often difficult to manage. This study was a hospital-based cross-sectional study among children having CP aged between 3 and 14 years. This study aimed to document the severity and frequency of drooling among these children. In this study, the mean age of the children was 6.15±3.13 years. It was observed that children under 5 years of age were more frequently enrolled. Previously, a study was done by Zeller et al with a similar age group (3-18 years) that included most children of 5-10 years in the experimental group and <5 years in the control group.[8] Other studies conducted by Mier et al. showed a similar mean age (7 years 10 months). But Rio et al showed a slightly higher mean age (10 years 9 months).[9,10]

Parr et al, Chavez et al, and Hedge et al have conducted a similar type of study and found males were predominant in their series (61%, 52%, 65.5% respectively).[11-13] The Present study also showed male predominance (54%). In the present study, most of the children had birth weight >2500g, most of them were delivered by NVD, and had a history of perinatal asphyxia. Development was delayed in all children, but Rio et al showed that developmental delay was only 31.6% which is contrary to our observation.[9] That may be due to the introduction of early developmental or effective therapy in developed countries.

In our study, about half of the children were found to have spastic quadriplegic CP (45%), followed by hemiplegic (30%), diplegic (19%), and dyskinetic (6%), which was similar to a previous study done by Rio et al. That study showed 62% quadriparesis, 22% hemiparesis, 8% diparesis, 6% triparesis, and 2% paraparesis.[9] Spastic quadriplegia was also the most prevalent form of CP among the subjects studied by Hedge et al[11] whereas spastic hemiplegia was the least common in that study, but we found hemiplegic CP as the 2nd frequent type of CP.

In the present study, 99% children had co-morbidities including speech delay (>90%), feeding difficulty (>80%), cognitive delay (>80%), and epilepsy (>50%). Rio et al. found that 74% cases had co-morbidities that were similar to the current study.[9]

Apraj et al found that drooling frequency was more frequent in spastic quadriplegic CP (45%), followed by diplegia (12%) and

hemiplegia (5%). Similarly, drooling severity was most pronounced in children with quadriplegic CP, with a significant proportion experiencing moderate (29%) to profuse drooling (26%).[7] This study found similar findings like drooling frequency (constant 42.2%, frequent drooling 37.8%) and severity (moderate, severe, and profuse 34.7%, 74.2%, 50% respectively), both were more frequent in spastic quadriplegic CP.
Kyuong-Chul Min et al showed that the frequency and severity of drooling were 60.8%, 35.6% in spastic quadriplegia, respectively, which was more than in other CP. Those findings match with this study's findings.[14]

Conclusion:

This study highlighted that drooling frequency and severity both had a significant association with types of CP. Although occasional and frequent drooling were more frequent in children under 5 years of age, constant and profuse drooling was more frequent between 5 and 10 years old. Children having spastic quadriplegia suffered significantly from constant to frequent and severe to profuse drooling than spastic diplegic and hemiplegic CP.

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