

# Sleep disorders in children with cerebral palsy and its correlation with sleep disturbance in primary caregivers and other associated factors

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## Abstract

**Aims:** To observe prevalence of sleep disturbance (SD) in cerebral palsy (CP) children in a specific age-group and its correlation with SD in primary caregivers and other associated factors. **Materials and Methods:** This was a prospective cross-sectional study. SD assessed using Sleep Disturbance Scale for Children (SDSC) in CP children and Pittsburgh Sleep Quality Index (PSQI) in caregivers. Fifty cases of clinically diagnosed CP [27 females, mean age: 107.9 ± 29.5 months (range: 78-180 months)] fulfilling criteria were included. **Results:** Eighteen (36%) children had pathological sleep total score (TS) and Disorders of Initiating and Maintaining Sleep (DIMS) was the commonest SD ( $n = 25, 50\%$ ). All primary caregivers were mothers. Twenty-five (50%) mothers had SD on PSQI scale. DIMS, Disorders of Excessive Somnolence (DES), and TS had significant correlation with PSQI ( $P < 0.05$ ). Disorders of Arousal (DA) and TS had significant correlation with seizures ( $P < 0.05$ ) in CP children. Bed-sharing had significant correlation with SD in caregivers ( $P < 0.001$ ) but not with CP children. No significant correlation was observed between SD in CP and gross motor function (Gross Motor Function Classification System), use of orthoses, and dental caries. **Interpretation:** Children with CP have underreported significant SD, which negatively impacts caregiver's sleep also. Seizure disorders and medications contribute significantly to SD.

## Key Words

Cerebral palsy, correlates, SDSC, seizures, sleep disturbance

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## Introduction

Children with cerebral palsy (CP) are more prone to sleep disturbances (SDs) than their peers.<sup>[1,2]</sup> Various factors contributing to sleep disorders include mental retardation,<sup>[3]</sup> visual impairment,<sup>[4]</sup> seizures,<sup>[5]</sup> anti-epileptic medications,<sup>[6]</sup> obstructive sleep apnea,<sup>[7]</sup> restricted movements due to contractures, spasticity and motor impairment<sup>[1]</sup>, pain<sup>[8]</sup> to due to spasticity, dental caries, use of orthoses, etc. Disturbed sleep in mothers (caregivers) secondary to abnormal sleep patterns in children correlate with maternal depression.<sup>[9]</sup> The objective of

this study was to observe the prevalence of sleep disturbance (SD) in children with CP and its correlation with SD in primary caregiver and other associated factors.

## Materials and Methods

This prospective cross-sectional study was conducted in Neurological Rehabilitation department of a University tertiary research hospital in India between January-June 2013. The study was approved by the institute's ethics committee. Fifty clinically diagnosed CP children with presence of documented delay in motor milestones, no regression of acquired milestones or progression of the symptoms, with presence of abnormal findings on neurological examination like spasticity, dystonia, brisk deep tendon reflexes, rigidity, cerebellar signs, and presence of abnormal movements or persistence of primitive reflexes were included.

CP children with age between 6.5-15 years (scale used in this study is valid for this age-group only), primary caregiver present with patient and able to provide detailed antenatal

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and perinatal history, patients on stable dosage of antiepileptic, antispastic, or any other drugs, which can cause sedation, in last one month, and those who consented (patient or caregiver) to participate in the study were included. Hypotonic/floppy child, unreliable history, comorbid health problems like cardiorespiratory or any other illness, which may alter sleep pattern, and CP children and caregivers with diagnosed depression, other psychiatric or chronic medical illness etc., which may alter sleep pattern, were excluded.

The sociodemographic details were collected and detailed clinical examination was done as per pre-structured proforma. Children were also classified based on their gross motor function using Gross Motor Function Classification System<sup>[10]</sup> (GMFCS). Sleep Disturbance Scale in Children (SDSC)<sup>[11]</sup> and Pittsburgh Sleep Quality Index (PSQI)<sup>[12]</sup> questionnaires was administered to assess sleep disorders in children and their caregivers, respectively.

SDSC questionnaire assesses sleep quality and disturbances in children over the past 6 months. It contains 26 items and covers 6 most common sleep disorders of childhood and adolescence: Disorder in initiating and Maintaining Sleep (DIMS), Sleep Breathing Disorders (SBD), Disorders of Excessive Somnolence (DES), Sleep Wake Transition Disorder (SWTD), Disorders of Arousal (DA), and Sleep Hyperhydrosis (SHY).

PSQI questionnaire assesses sleep quality and disturbances over a 1-month time interval. Nineteen individual items generate seven "component" scores: Subjective sleep quality, sleep latency, sleep duration, habitual, sleep efficiency, SDs, use of sleeping medication, and daytime dysfunction. Each component score ranges from 0 (no difficulty) to 3 (severe difficulty). The component scores are summed to produce a global score (range, 0-21). A PSQI global score of  $\geq 5$  is considered to be suggestive of significant SD.

GMFCS focuses on determining the best level that represents the child's present abilities and limitations in gross motor function. Five functional levels (Level-I-Level-V, in the decreasing order of functional capabilities) with description of skills for five different age groups which includes age: <2 years, 2-4 years, 4-6 years, 6-12 years, and 12-18 years.

### Statistical analysis

Gathered data were tabulated and analyzed using the Statistical Package for Social Sciences (SPSS) version 19 (IBM, IL, Chicago,

USA). General characteristics of the study population were analyzed by frequencies and cross tabulations. The association between SDs in children/caregivers and variables such as GMFCS, bed-sharing, seizures, dental caries, use of night orthoses, etc. was analyzed using Chi-square/Fisher's exact test.

### Results

Study included 50 children (27 females and 23 males), aged between 78 months and 180 months (mean age:  $107.9 \pm 29.5$  months). Mother's age at child birth ranged from 17 years to 31 years, (mean age:  $23.3 \pm 3.9$  years); all primary caregivers were mothers.

Forty-two children (84%) had spastic CP, five (10%) had mixed CP, and three (6%) had dyskinetic CP. Fifteen out of 42 with spastic CP were hemiplegic, 14 were diplegic, 4 were triplegic, and 9 were tetraplegic CP.

Twenty (40%) children were in GMFCS level-I, 14 (28%) children were in level-II, 6 (12%) children were in level-III, 1 (2%) child was in level-IV, and 9 (18%) children were in level-V. All the cases of hemiplegic, dyskinetic CP, and the majority of the diplegics (71%) were in level I and II. Majority of the tetraplegic (55.6%) and mixed CP (60%) were in level V.

Total score and scores of individual sleep disorders were categorized into pathological and normal based on the normative data for the scale.<sup>[11]</sup> A T-score of more than 70 (>95 percentile) was regarded as pathological and T-score of 70 or less was taken as the normal range. It corresponds to difficulties occurring three or more times per week. Distribution of SD among children and caregiver is shown in Table 1.

Correlation between SD in CP children and caregivers has been mentioned in Table 2.

Seventeen children (34%) in the study had a history of at least one episode of seizure at presentation. Nine out of these 17 children (52.9%) had seizure episodes in the past 6months. Eleven out of 17 children (64.7%) with history of seizures were on antiepileptic drugs (AEDs). Children having seizures had statistically significant association with DA ( $P = 0.002$ ) and TS ( $P = 0.034$ ). Children on AEDs had statistically significant correlation with DA, TS, SBD, SWTD, and DES ( $P < 0.05$ ). Thirty-five (70%) children were sharing their bed with their

**Table 1: Sleep disturbance in children and caregivers**

	SD in children according to SDSC							SD in caregivers according to PSQI
	DIMS	SBD	DA	SWTD	DES	SHY	TS	
Score range*	7-31	3-11	3-9	6-22	5-16	2-10	26-83	0-11
Mean	16.98	4.04	3.38	10.66	7.98	2.84	45.88	4.58
Standard deviation	7.501	2.194	1.141	4.284	3.210	1.811	14.156	3.38
Cut off	$\geq 17$	$\geq 7$	$\geq 6$	$\geq 14$	$\geq 13$	$\geq 7$	$\geq 52$	$\geq 5$
Normal (n)	25	44	46	37	45	47	32	25
Pathological (n, %)	25 (50.0%)	6 (12.0%)	4 (8.0%)	13 (26%)	5 (10.0%)	3 (6.0%)	18 (36%)	25 (50.0%)

DIMS = Disorders of initiating and maintaining sleep, SBD = Sleep breathing disorders, DA = Disorders of arousal, SWTD = Sleep wake transition disorders, DES = Disorders of excessive somnolence, SHY = Sleep hyperhydrosis, TS = Total score, PSQI = Pittsburgh sleep quality index, SDSC = Sleep disturbance scale for children

mothers. Bed-sharing had no association with SD in children but it was significantly associated with SD in caregivers ( $P < 0.001$ ). Eight children (16%) were using orthoses during night time and 20 (40%) children were having dental caries. SD in children had no statistically significant association with both ( $P > 0.05$ ) [Table 3].

## Discussion

Females' outnumbered males (27:23, a ratio of 1.17:1) in the study although male gender is a known risk factor for CP.<sup>[13,14]</sup> Caregivers were mothers in all cases with 41 (82%) homemakers and 9 (18%) employed, with none working in shifts thus eliminating the interference of irregular sleeping timings.

Eleven children (22%) had SD as one of the presenting complaints. Eighteen children (36%) had pathological sleep TS. DIMS was the most frequently reported SD ( $n = 25$ , 50%), which is similar to earlier studies.<sup>[1,2]</sup>

Thirty-five children (70%) were sharing their bed with their mothers. Bed-sharing had no association with pathological sleep TS or individual SD in CP patients in our study unlike an earlier study,<sup>[15]</sup> where it was associated with increased DIMS, SBD, SWTD, etc.

**Table 2: Correlation of SDSC with PSQI**

		PSQI		P-value
		NS (n)	PS (n)	
SDSC	TS	4	14	0.007
	DIMS	8	17	0.01
	SBD	3	3	1.0
	DES	0	5	0.05
	SWTD	4	9	0.196
	DA	1	3	0.609
	SHY	2	1	1.0

NS = Normal sleep, PS = Pathological sleep, DIMS = Disorders of initiating and maintaining sleep, SBD = Sleep breathing disorders, DA = Disorders of arousal, SWTD = Sleep wake transition disorders, DES = Disorders of excessive somnolence, SHY = Sleep hyperhydrosis, PSQI = Pittsburgh sleep quality Index, SDSC = Sleep disturbance scale for children

**Table 3: Correlation between seizures, antiepileptic drugs (AEDs), night orthoses, dental caries, and bed-sharing with sleep disorders in children/caregivers**

		GMFCS	Seizures in	AEDs	Night orthoses	Dental caries	Bed-sharing
		P-value	last 6 months	P-value	P-value	P-value	P-value
			P-value				
SDSC	DIMS	0.333	0.713	0.306	0.702	0.083	0.355
	SBD	0.231	0.297	0.005	0.572	0.672	0.348
	DA	0.932	0.002	0.008	0.557	0.377	0.305
	SWTD	0.302	0.164	0.015	0.662	0.065	1.0
	DES	0.969	0.177	0.031	1.0	1.0	1.0
	SHY	0.310	0.476	0.625	1.0	1.0	1.0
	TS	0.659	0.034	0.004	1.0	0.279	0.523
PSQI		1.0	1.0	0.73	0.247	0.083	<0.001

GMFCS = Gross motor function classification system, NS = Normal Sleep, PS = Pathological sleep, DIMS = Disorders of initiating and maintaining sleep, SBD = Sleep breathing disorders, DA = Disorders of arousal, SWTD = Sleep wake transition disorders, DES = Disorders of excessive somnolence, SHY = Sleep hyperhydrosis, AED = antiepileptic drug, SDSC = Sleep disturbance scale for children, PSQI = Pittsburgh sleep quality index

## SD in caregivers

Twenty-five (50%) caregivers had SD with significant correlation with children having pathological sleep TS, DIMS, and DES. Whether SD in CP children caused SD to mothers or vice versa could not be determined.

Bed-sharing was prevalent in 70% of cases. Twenty-three out of 25 caregivers (92%) having disturbed sleep, were sharing beds with the children. There was a significant association between SD in caregivers and bed-sharing ( $P < 0.001$ ). Reasons for this could be children required constant parental attention<sup>[16]</sup> as a consequence of their SD, decreased bed mobility, etc. However, this does not provide information regarding the cause and effect relationship.

## Other clinical correlations of sleep disorders in children

There was no statistically significant correlation between SD and GMFCS with increase in the levels of functional impairment as recorded on GMFCS did not increase the level of SD in children.

Interaction between epilepsy and SDs is not well understood, but most frequently reported problems are those of sleep fragmentation with reduced sleep efficacy and frequent arousals.<sup>[17]</sup> Children having seizures had significant association with DA ( $P = 0.002$ ) and pathological sleep TS ( $P = 0.034$ ) in the study. Children on concurrent AEDs were associated with DES ( $P = 0.031$ ), DA ( $P = 0.008$ ), and Pathological Sleep TS ( $P = 0.004$ ). One theory which can explain this is the presence of disordered sleep microarchitecture due to unrecognized subtle nocturnal seizures. Sleep electroencephalography (EEG) would have been helpful in such cases to rule out the nocturnal seizures and to titrate appropriate AEDs. There was no increase in daytime somnolence in children on AEDs who were seizure-free and DES was strongly associated with presence of active seizures. Similar observation was reported by another study.<sup>[18,19]</sup>

Eight children (16%) were using orthoses during night time. It was expected that children wearing orthoses at night time have increased frequency of SD, but no significant association was observed. Similar trend has been reported in some previous studies also.<sup>[1,2]</sup> Twenty children (40%) in our study had dental caries with no statistically significant association with SD unlike some previous studies.<sup>[19,20]</sup>

This study has limitations like small sample size, cross-sectional design, not matching the data with age-matched controls, not performing Intellectual Quotient (IQ) test, etc.

## Conclusions

More than one-third CP children had pathological sleep in the study. Half of the mothers had SD with significant association with SD in children (TS, DIMS, and DES). CP Children with seizures had significant association with SD like DA and TS. Children on concurrent AEDs also had significant association with SD. Bed-sharing had significant association with SD in caregivers. Association between SD in CP children and dental caries, use of orthoses at night, and severity of motor impairment was insignificant in the study.

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