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Original Article

Prevalence of Sleep Abnormalities in Indian Children With Autism Spectrum Disorder: A Cross-Sectional Study

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ABSTRACT

BACKGROUND: The prevalence of autism spectrum disorder (ASD) is on the rise. Apart from the core behavioral issues of impaired communication, impaired social interaction, and restricted and/or repeated behavioral phenotype, comorbidities like sleep problems are increasingly getting recognized as important determinants of management and overall quality of life. **METHODS:** This study was conducted in a tertiary care teaching hospital in northern India over a two year period. Children diagnosed with ASD and normally developing children (control subjects) aged 3 to 10 years were enrolled in the study. Both groups underwent sleep evaluation based on the Children's Sleep Habit Questionnaire. Children with ASD also underwent polysomnography, Childhood Autism Rating Scale, Childhood Behavioral Checklist, and Developmental Profile 3 assessments. **RESULTS:** The prevalence of poor sleepers among children with ASD and control subjects was 77.5% (confidence interval 66 to 86.5). and 29.2% (confidence interval 18.6 to 41.5), respectively ($P < 0.001$). The salient findings on polysomnography were reduced sleep efficiency, decreased rapid eye movement and slow wave sleep duration, and desaturation index>1. The Childhood Behavioral Checklist score was significantly high in poor sleepers compared with good sleepers on Children's Sleep Habit Questionnaire ($P = 0.004$). There was no correlation of Childhood Autism Rating Scale or Developmental Profile 3 score with sleep problems in children with ASD. **CONCLUSIONS:** Nearly three fourths of children with ASD have sleep abnormalities with a possible effect on the behavioral phenotype. The polysomnographic findings provide further insight with opportunity for pharmacological interventions. Screening for sleep problems is imperative for the appropriate management and overall improvement in quality of life in children with ASD.

Keywords: ASD, sleep problems, CSHQ, PSG

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Introduction

Autism spectrum disorder is characterized by the triad of impaired communication, impaired social interaction, and restricted and/or repetitive behavioral pattern or interests. However, it has numerous comorbidities like epilepsy, sleep problems, motor impairments, intellectual disability, attention problems, externalizing behaviors, and impaired sensory perception.[1]

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Children with ASD who sleep poorly at night are more likely to exhibit daytime behavioral problems.[2] Poor sleep interferes with the child's rehabilitation, and it also causes disruption of the entire family's sleep, impairing the quality of life of the child and the family.[3] Improved sleep in these children is associated with improvement in core behavioral features.[4]

The prevalence of sleep problems in children with ASD ranges from 40% to 80% compared with 11% to 53% in normally developing children.[4-9] Children with autism have a greater frequency of sleep problems when compared with children with other developmental disorders.[7]

In the beginning of the twenty-first century, there were very few studies evaluating sleep in children with ASD. The past decade has seen a rise in research interest on this entity, especially in the past five years. There have been occasional attempts to objectively characterize the sleep architecture pattern in children with ASD and correlate it with the behavioral phenotype and cognition. Estimating the magnitude of sleep problems and characterizing them are imperative for planning appropriate interventions in these children. The current study is the first from India to characterize sleep problems in children with ASD compared with age-matched control subjects.

Material and Methods

This study was conducted at a tertiary care teaching hospital in north India over a two year period. Children aged three to ten years who received care in the pediatric outpatient department and were diagnosed with ASD using the *Diagnostic and Statistical Manual of Mental Disorders* Fourth Edition (DSM IV) criteria were included in the study. Age-matched normally developing children were recruited as control subjects after applying a screening questionnaire to ensure normal development. The screening questionnaire underwent construct and face validation and was then piloted in ten children before using it in the study. Children with chronic systemic disorders known to interfere with sleep and children with ASD with tuberous sclerosis, fragile X syndrome, and Down syndrome were excluded. Informed consent was obtained from either of the parents or the guardian accompanying the child. Ethical clearance was obtained from the Institute Ethics Committee.

The primary objective was to estimate the prevalence of sleep abnormalities in children with ASD compared with age-matched control subjects using Children's Sleep Habits Questionnaire (CSHQ).

The secondary objectives were to

(1) characterize the type of sleep abnormality in autistic children using polysomnography (PSG),
(2) compare the presence of sleep abnormalities with the severity of autism using Childhood Autism Rating Scale (CARS),
(3) compare the presence of sleep abnormalities with behavioral problems using Child Behavior Checklist Score (CBCL) and
(4) compare the presence of sleep abnormalities with Development/Intelligence quotient (DQ/IQ) of autistic children using Development Profile 3 (DP3).

Studies have found the prevalence of sleep abnormalities in children with autism to be 40% to 80% and in normally developing children to be 11% to 53%.[4-9] With an anticipated prevalence of sleep abnormalities in autism to be 60% and in normally developing children to be 30%, using test of two proportions, with a two-sided alpha error of 0.05% and power of 80%, the sample size calculated was 65 children in each group.

A standard operating procedure was developed for all patients. In one setting, the children underwent DSM, CSHQ, CARS, DP3, and CBCL evaluation, and subsequently they were given appointment for PSG. All control subjects after they passed the initial screener underwent CSHQ evaluation.

The CSHQ was administered by the principal investigator in Hindi or English. The original English version was translated to Hindi and reverse translated by two independent people, and it was ensured that it conveyed the same meaning. The questionnaire was then piloted in ten autistic and ten control subjects before applying to the study participants. Parents were asked to answer the questions based on the sleep habits of the child based on the past week. In case the last week was unusual for a specific reason, the questions were answered with respect to the most recent typical week. The CSHQ is a 33-item questionnaire that is summed into eight subscales (Bed time resistance, Sleep onset delay, Parasomnias, Sleep anxiety, Sleep duration, Sleep-disordered breathing, Daytime sleepiness, Night waking). The CSHQ is a retrospective questionnaire in which parents are asked to recall the sleep behaviors of the child over the most recent typical week and rated on a three-point scale. Based on the results of previous studies, a cutoff of 41 was chosen to differentiate children with good and poor sleep. Children who scored 41 or less were classified as good sleepers, whereas those who scored 42 and above were classified as poor sleepers. Even if the total CSHQ score was less than 41, the child was classified as poor sleeper if more than 50% of the items in each subscale had a "Yes" response in parental concerns even if the total score was 41 or less.[10,11]

All the children with ASD diagnosed on the basis of DSM IV criteria were evaluated with CARS to estimate the severity of autism (30 to 37.9: mild to moderate and greater than 38: severe) and CBCL for determining the behavioral comorbidities. The CARS is a 15-item scale used to grade the severity of autism in 14 behavioral domains. The CBCL assesses behavior in 11 domains, and there are two sets of questionnaires, one for age 1.5 to 5 years and another for age 5 to 18 years.[12-14]

Development Profile 3 (DP3) was used to estimate the development or intelligent quotient. DP3 assesses the DQ/IQ in five domains (Physical behavior, Adaptive behavior, Cognition, Social emotional, and Communication) by parental reporting as well as direct observation.[15]

Subsequently, within two weeks of the above-mentioned assessment, appointment for overnight PSG was given as per the convenience of the family. Parents were advised to continue the child's usual pattern of sleep before the test. For children who were on pharmacological therapy for seizures and behavioral issues, drugs were continued so as to not interfere with the child's treatment and conform to ethics. The parents were also told to bring the child on the night of the study in his or her night clothes along with pillows, bedsheets, and any other sleep association objects that the child wanted. The parents were shown the laboratory once before the actual testing. This step helped them in replicating the child's routine sleeping pattern as far as possible in the PSG laboratory on the night of testing. The PSG (Somnomedics, 2010) record was analyzed[16] under the supervision of neurology faculty members who were blinded to the clinical status and the CSHQ score of the child.

The flow of the study has been depicted in the Figure.

Statistical analysis

Demographic profile; CSHQ, CARS, CBCL, and DP3 scores; and PSG data collected were entered on a predesigned proforma and concurrently recorded in a Microsoft Excel spreadsheet.

The analysis was performed using STATA 12 software. Prevalence of sleep abnormalities in children with ASD and control subjects were expressed as percentage with 95% confidence interval (CI). The mean ± SD values of the CSHQ scores and CBCL scores were analyzed using Student t test/Wilcoxon rank sum test. Categorical variables were compared with the sleep abnormalities using Fisher exact test/chi-square test.

Results

In this study, 109 children with ASD were screened, of which 71 fulfilled the inclusion criteria and were recruited in the study. At the time of this study, the DSM version being used globally was DSM-IV. All these children were under follow-up and have been re-evaluated subsequently