

Prevalence of Sleep Disorders in Thai Children

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Abstract

Objective To evaluate the prevalence of sleep disorders in Thai children who underwent polysomnography at a single institution.

Methods A retrospective analysis of pediatric polysomnographic studies was performed from January 2011 through December 2014.

Results One hundred sixty-six studies were conducted; 142, 7, and 17 were diagnostic, split-night, and positive airway pressure (PAP) titration studies, respectively. In total, 136 diagnostic/split-night studies were performed to diagnose sleep disorders with presentation of snoring (92.6 %), heavy breathing (0.7 %), witnessed apnea (14.7 %), excessive daytime sleepiness (10.3 %), hyperactivity (2.2 %), restless sleep (11.0 %), enuresis/nocturia (5.9 %), abnormal behavior (4.4 %) and poor weight gain (0.7 %). Eleven diagnostic studies and one split-night study were performed to follow-up obstructive sleep apnea (OSA) after adenoidectomy and/or tonsillectomy. One diagnostic study was conducted to follow-up OSA after postmandibular distraction. OSA was the most common diagnosis with a prevalence of 92.7 %; 40.4 % of patients were diagnosed with severe OSA. The

prevalence of sleep-related hypoventilation was 15.4 %. The second most common diagnosis was periodic limb movement disorder with a prevalence of 20.6 %. Seventeen PAP titration studies were performed. Four CPAP titration studies were conducted for OSA treatment. Twelve bi-level (BiPAP) titration studies were performed in eight children with hypoventilation. One BiPAP/average volume-assured pressure support titration was conducted in a patient with congenital central hypoventilation syndrome (CCHS).

Conclusions The prevalence of sleep disorders in Thai children who underwent polysomnography at a tertiary-care hospital is very high. The factors that contribute are the limited availability and high costs of polysomnography in Thailand. This information will encourage pediatricians to look for sleep disorders in children.

Keywords Polysomnography · Prevalence · Sleep disorders

Introduction

Sleep disorders in children are being increasingly recognized by pediatricians, pediatric pulmonologists, pediatric neurologists, and pediatric otolaryngologists. The most well-known disorder is obstructive sleep apnea (OSA). Other disorders include central sleep apnea, sleep-related hypoventilation, periodic limb movement disorder, and narcolepsy [1]. Polysomnography is the gold standard for diagnosis of sleep disorders in children [2, 3]. Sleep specialists and trained sleep technicians are essential in the performance of polysomnography. In Thailand, polysomnography in children is available in only a few tertiary-care hospitals. The prevalence of sleep disorders in Asian countries is unknown. Most of the studies in the literature evaluated only the prevalence of OSA [4, 5]. The most recent study on the prevalence of OSA

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in Thai children who underwent polysomnography was performed 16 y ago and had a small sample size [6].

In the present study, authors evaluated the prevalence of sleep disorders in children who underwent polysomnography at the Excellence Center for Sleep Disorders, King Chulalongkorn Memorial Hospital/The Thai Red Cross Society. This information will be useful for our pediatricians to better understand the current situation of sleep disorders in Thai children.

Material and Methods

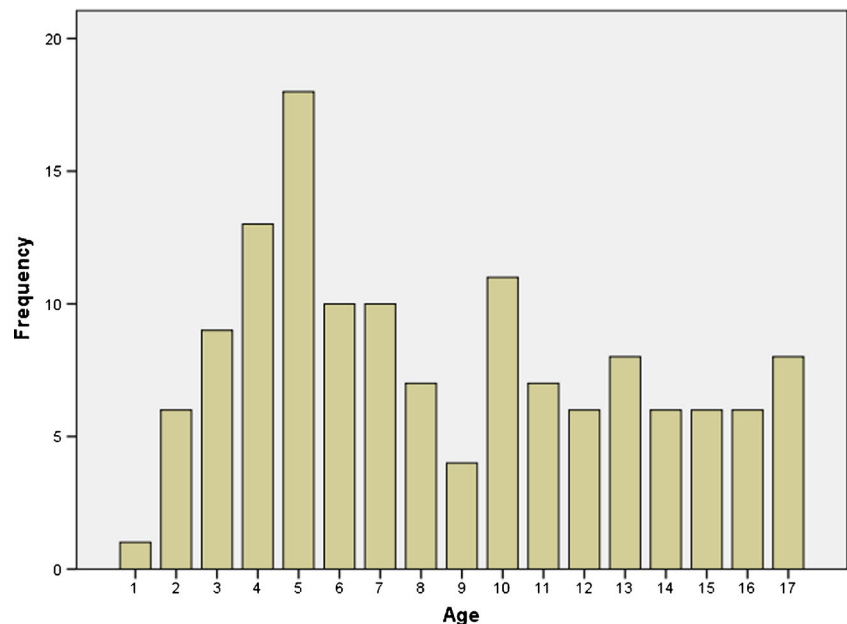
This retrospective study was approved by the Institutional Review Board Committee, Faculty of Medicine, Chulalongkorn University. All the polysomnographic studies done over a 4-y period (2011–2014) in children ≤ 18 y of age at the Excellence Center for Sleep Disorders, King Chulalongkorn Memorial Hospital in Thailand were reviewed. The patient's complaint was noted by the physician. Heavy breathing is another term that parents used for snoring. Sleep studies were performed with Compumedics (Australia) and Caldwell (USA) equipment. All polysomnographs were obtained using standard electroencephalographic monitoring, including frontal leads (F1, F2), central leads (C3, C4), occipital leads (O1, O2), and reference leads at the mastoids (M1, M2); electromyography; and electrooculography methodology. Peripheral capillary oxygen saturation was measured with a finger probe. Air flow was measured by two methods: a nasal pressure transducer and an oral-nasal thermocouple. The thoracic and abdominal respiratory movements were monitored by respiratory inductance plethysmography. The

body position was measured by a position sensor, which was attached to the anterior chest wall on the thoracic belt. Carbon dioxide was measured by end-tidal CO₂ monitoring or transcutaneous CO₂ monitoring. Sleep stages were scored in 30-s epochs according to the American Academy of Sleep Medicine (AASM) standard criteria. Apnea was defined using oral-nasal thermocouple excursion, and hypopnea was defined using nasal pressure transducer excursion. Apnea, hypopnea, and respiratory effort-related arousals were scored using the standard criteria from the AASM manuals from 2007 [7] and 2012 [8]. The 2012 AASM manual has been implemented in sleep laboratory of King Chulalongkorn Memorial Hospital since December 2012. The severity of OSA was classified as mild when obstructive apnea hypopnea index (OAH) was between 1 and 5/h, moderate when OAH was between 5 and 10/h and severe when OAH was more than 10/h. Central apneas and central hypopneas in rapid eye movement (REM) and post arousal were included in apnea hypopnea index (AHI) and were excluded from OAH.

Results

From January 2011 through December 2014, one hundred sixty-six sleep studies were conducted; 142, 7, and 17 studies were diagnostic, split-night and positive airway pressure (PAP) titration studies, respectively. In total, 136 diagnostic/split-night studies were performed to diagnose sleep disorders before tonsillectomy/adenoidectomy or mandibular distraction. The age of the children ranged from 1 to 17 y; the most frequent age was 5 y (Fig. 1). About two-thirds of the children were boy. The children's body mass index (BMI) ranged from

Fig. 1 Bar graph demonstrating the age distribution of children who underwent diagnostic/split-night polysomnography at a tertiary-care hospital (Age is presented in years; frequency is presented as percentage)



10.1 to 80.2 kg/m². Nineteen children (14 %), most of whom were teenagers, had a BMI of >30 kg/m². Two children with a BMI of >30 kg/m² were 3 and 8-y-old, respectively (Table 1).

The children presented with snoring (92.6 %), heavy breathing (0.7 %), witnessed apnea (14.7 %), excessive daytime sleepiness (10.3 %), hyperactivity (2.2 %), restless sleep (11.0 %), enuresis/nocturia (5.9 %), abnormal behavior (4.4 %), and poor weight gain (0.7 %) (Table 2).

OSA was the most common diagnosis with a prevalence of 92.7 %; 40.4 % of children were diagnosed with severe OSA. The prevalence of sleep-related hypoventilation was 15.4 %; 47.6 % of sleep-related hypoventilation was associated with severe OSA. The second most common diagnosis was periodic limb movement disorder with a prevalence of 20.6 %. Parasomnia and sleep bruxism were diagnosed in 2.9 % and 2.2 % of children, respectively. Narcolepsy was diagnosed with polysomnogram and multiple sleep latency test on the following day in 0.7 % of children (Table 3).

Seven of 136 diagnostic studies were conducted in children with neuromuscular disease (Duchenne muscular dystrophy, Minicore disease, myotonic dystrophy, polyneuropathy). Five patients had obstructive sleep apnea and one patient had sleep related hypoventilation [end tidal CO₂ (ETCO₂) values were more than 50 mmHg for 25 % of total sleep time]. Polysomnogram with end tidal CO₂ monitoring were useful in children with neuromuscular disease and led to subsequent positive airway pressure therapy.

Eleven diagnostic studies and one split-night study were performed to follow-up OSA after adenoidectomy and/or tonsillectomy. After adenoidectomy/tonsillectomy, mild, moderate, and severe OSA were diagnosed in five, two, and five patients, respectively. Only one patient had polysomnogram before and after adenotonsillectomy and AHI decreased from 8 to 3.5/h. Others had nocturnal pulse oximetry before adenotonsillectomy. One diagnostic study was conducted to follow-up OSA after postmandibular distraction and showed resolution of the OSA.

Seventeen PAP titration studies were performed. Four continuous PAP (CPAP) titration studies were conducted for OSA treatment. Twelve bi-level PAP (BiPAP) titration studies were

Table 1 Demographic data of children who underwent diagnostic/split-night studies for diagnosis of sleep disorders before tonsillectomy/adenoidectomy or mandibular distraction

| | |
|------------------------------------|-------------------------|
| Age, years | 1–17 (8.6 ± 4.6) |
| Sex | |
| Female | 33.1 % |
| Male | 66.9 % |
| Weight (kg) | 8.7–208 (42.9 ± 35.2) |
| Height (cm) | 65–192 (130.2 ± 25.9) |
| Body mass index, kg/m ² | 10.1–80.2 (22.0 ± 10.3) |

Table 2 Clinical presentation of children who underwent polysomnography for diagnosis of sleep disorders before tonsillectomy/adenoidectomy or mandibular distraction

| Clinical presentation | Percentage |
|------------------------------|------------|
| Snoring | 92.6 |
| Heavy breathing | 0.7 |
| Witnessed apnea | 14.7 |
| Excessive daytime sleepiness | 10.3 |
| Hyperactivity | 2.2 |
| Restless sleep | 11.0 |
| Enuresis/nocturia | 5.9 |
| Abnormal behavior | 4.4 |
| Poor weight gain | 0.7 |

performed in eight children with hypoventilation. Two patients had central hypoventilation from congenital central hypoventilation syndrome (CCHS) and brain stem glioma. Five patients had OSA and neuromuscular hypoventilation from Pompe disease, Duchenne muscular dystrophy, minicore myopathy, lipid storage myopathy, and myotonic dystrophy. One BiPAP/average volume-assured pressure support titration was conducted in the patient with CCHS.

Discussion

Sleep disorders have a significant impact on children, in terms of both cardiopulmonary [9] and neurocognitive [10] function. In Thailand, OSA is being increasingly recognized by pediatricians [6, 11, 12]. However, other sleep disorders have been under-recognized. This could be due to low awareness of sleep disorders in children secondary to the lack of sleep education in pediatric residency programs [13]. The peak age of

Table 3 Prevalence of sleep-disordered breathing in children who underwent diagnostic/split-night polysomnography for diagnosis of sleep disorders

| Sleep-disordered breathing | Prevalence (%) |
|----------------------------------|----------------|
| Obstructive sleep apnea | 92.7 |
| Mild (OAHl between 1 and 5) | 25.7 |
| Moderate (OAHl between 5 and 10) | 26.5 |
| Severe (OAHl greater than 10) | 40.4 |
| Primary snoring | 6.6 |
| Normal | 0.7 |
| Sleep-related hypoventilation | 15.4 |
| Periodic limb movement disorder | 20.6 |
| Parasomnia | 2.9 |
| Sleep bruxism | 2.2 |
| Narcolepsy | 0.7 |

children who underwent polysomnography in the present study was 3 to 6 y. Boys comprised two-thirds of the entire population. The main complaint was snoring. Other complaints were witnessed apnea, restless sleep, and excessive daytime sleepiness. Enuresis was noted in 5.9 % of patients. This information encourages pediatrician to look for OSA as a cause of secondary enuresis. In children, OSA can be the cause of failure to thrive. Only 0.7 % of index patients presented with poor weight gain. Polysomnography was also performed in patients with abnormal nocturnal behavior, who comprised 4.4 % of the study population.

The prevalence of OSA in children who underwent polysomnography at authors' hospital is much higher than that in other Asian countries (Thailand, 92.7 %; Singapore, 49.6 %) [14]. The factors that contribute to this difference are the limited availability and high costs of polysomnography in Thailand. The first line of investigation was nocturnal oximetry for planning adenotonsillectomy. Only selected patients underwent polysomnography. Another factor is the fact that Asians have more severe OSA than do Caucasians [15]. In the present study, proportion of patients with severe OSA was twice that of patients in Singapore. This may imply a greater influence of selective bias and under-recognition of OSA spectrum disorder. The prevalence of OSA in Thai children who underwent polysomnography was slightly higher in index study than in that by Preutthipan et al. [6] (92.7 % vs. 85.0 %, respectively). The peak age group was the same. However, the prevalence of OSA in adolescents in index study was higher than that in the previous study. Patients with OSA in the adolescent group in index study were obese or morbidly obese. These findings emphasize the need for pediatricians to screen for OSA symptoms in obese adolescent children.

Periodic limb movement disorder was the second most common sleep disorder in the present study; it was diagnosed based on polysomnography with periodic limb movements during sleep (sleep index of >5/h) in 20.6 % of patients. Sleep bruxism is another sleep-related movement disorder that is associated with psychological stress [16] or OSA [17]. In the present study, sleep bruxism was diagnosed based on polysomnography in 2.2 % of patients. Other sleep disorders were parasomnia and narcolepsy with a prevalence 2.9 % and 0.7 %, respectively.

The first line of OSA treatment in children is adenotonsillectomy. The AASM recommends follow-up polysomnography in patients with moderate to severe OSA [2]. In the present tertiary-care hospital, only 12 studies were performed during the 4-y study period to follow up patients after adenoidectomy or tonsillectomy. There is a gap in the quality of sleep practice between Thailand and the United States. Further research regarding the cost-effectiveness of polysomnography for follow-up of Thai children with moderate to severe OSA after adenotonsillectomy needs to be investigated. This Excellence Center for Sleep Disorders also has

experience with CPAP/BiPAP titration in children with craniofacial syndrome, neuromuscular disease, and congenital central hypoventilation syndrome.

The index study is limited by its retrospective nature in only one tertiary care hospital in Thailand. The prevalence of sleep disorders in index study cannot stand for the prevalence of sleep disorders in Thai children population. However, it reflects some part of diagnosis and management in children with sleep disorders in Thailand.

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Contributions MV: Conception and design, acquisition, analysis, interpretation of data and drafted the article; TD: Conception and design, revised it critically for important content and will act as guarantor for the paper.

Compliance with Ethical Standards

Conflict of Interest None.

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