ARTICLE

Understanding the Relationship Between Asthma and Sleep in the Pediatric Population

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ABSTRACT

The Centers for Disease Control and Prevention reports that 9.5% of children have been diagnosed with asthma. Sleep disturbances affect 20% to 30% of the pediatric population. The prevalence of nocturnal symptoms of asthma is high, and most children regularly experience nighttime symptoms. Sleep is important for growth and development, and untreated sleep disturbances have adverse effects on school performance, mental health, physical health, and functioning. This review will explore the relationship between asthma and sleep disturbances. Clinicians need to assess children with asthma for sleep disturbance. J Pediatr Health Care. (2016) ■, ■-■.

KEY WORDS

Pediatrics, asthma, sleep disturbance

Asthma is the most prevalent chronic illness experienced by American children today. It is estimated that approximately seven million children (9.5%) younger than 18 years have asthma (Centers for Disease Control and Prevention [CDC], 2013). The CDC reports higher rates of asthma among non-Hispanic Black children (14%) and multi-race children (13.2%) compared with White children (7.4%; CDC, 2013). Among children younger than 15 years, asthma is the third-leading cause of hospitalizations (American Lung Association [ALA], 2014). Collectively, children with asthma miss an estimated 14.4 million days of school each year, making it one of the most frequent reasons for school absenteeism (ALA, 2014). Furthermore, in 2007, the health care costs associated with asthma were estimated to be $56 billion, with indirect cost accounting for $5.9 billion (Barnett & Nurmagambetov, 2011). The cost of asthma per person is $3,259, which is up from $1,005 in 2004 (Barnett & Nurmagambetov, 2011). Since 1999, the number of deaths related to asthma has decreased by 8.5%; nonetheless, 3,630 deaths were still attributable to asthma, including 218 children younger than 18 years of age (CDC, 2015).

Sleep is an important part of promoting healthy living. In pediatrics, approximately 20% to 30% of children are affected by a sleep disturbance (Gerber, 2014; Singareddy et al., 2009; Teng, Bartle, Sadeh, & Mindell, 2011). Sheares and colleagues found that the prevalence of sleep disturbance in a minority urban, early school age population was 94%, and they suggested that sleep disruptions in urban minority populations were more prevalent than previously thought, underreported by parents, and affected by low income, overcrowding, exposure to tobacco, community violence, maternal depression, and poorly controlled asthma (Sheares et al., 2013). Consequences of sleep disorders in children are altered immune function, anxiety, attention deficit problems, behavioral issues, depression, hormone imbalance, risk factors affecting the cardiovascular and metabolic systems, poor academic performance, and substance abuse

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(Beebe, 2011; Gregory & Sadeh, 2012; National Institutes of Health [NIH], 2011; Roberts, Roberts, & Duong, 2008). Persistent nocturnal asthma symptoms and sleep disorders have been reported in about 59% of children with asthma (Fagnano, Bayer, Isensee, Hernandez, & Halterman, 2011). Nighttime wakening and daytime sleepiness is a chronic problem in children with asthma (Li et al., 2013; van Maanen et al., 2013), and a sleep assessment is an important part of every well-child visit and integral part of caring for children with asthma (Li et al., 2013).

The national asthma guidelines recommend periodic assessment of key areas of quality of life related to nighttime sleep disturbances (National Heart, Lung, and Blood Institute [NHLBI], 2007). The goal of asthma therapy is to improve quality of life and reduce symptoms, exacerbations, and asthma-related deaths (NHLBI, 2007). To reduce impairment and risk for children with asthma, identification and control of nocturnal symptoms are important to improve pulmonary function and quality of sleep.

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The goal of this review is to explore the relationship between asthma and sleep disturbance in children. Because of the high morbidity and mortality rates related to asthma and the economic and social implications, it is imperative that health care providers have an understanding of the relationship between pediatric asthma and sleep. Thus the purpose of this review is to (a) describe the historical perspective of asthma and sleep, (b) review the pathophysiology of asthma and sleep, (c) critically review the literature on sleep problems and asthma in children, and (d) discuss the role of the advance practice registered nurse (APRN) in managing these two co-occurring problems. In addition, implications for future research to improve our understanding of the relationship between asthma and sleep and its treatment will be discussed.

SLEEP AND ASTHMA: HISTORICAL PERSPECTIVES

The word *asthma* is derived from the Greek word *aazein*, meaning to exhale with an open mouth or panting, which included many conditions. Asthma was first described in the second century by Aretaeus, a physician from Greece (Karamanou & Androutsos, 2011). Aretaeus recognized the relationship between asthma and exercise, thick secretions caused by coldness and humidity, the increased incidence in women, and that children recovered faster from the breathing problems than did adults (Karamanou & Androutsos, 2011). In the 1860s, Dr. Salter discussed the role of asthma and the relationship with viral respiratory infections. Dr. Salter described asthma as having pathologic changes in the respiratory tract and disordered physiology (Cohen, 1997). He understood the role of infection, heredity, allergens, environment, weather, diet, emotions, and the variations in daytime and nighttime symptoms (Cohen, 1997). In the 19th century, treatment was smoking a specific Indian herb call Datura stramonium (thorn apple) or "asthma cigarettes," which contained an atropine-like alkaloid and acted as a bronchodilator (Holgate, 2011). In the 1920s, asthma was better defined, but treatment was limited to "asthma cigarettes" and removal of allergens (von Mutius & Drazen, 2012). Inhaled therapy was introduced in 1940s with epinephrine as the drug of choice (von Mutius & Drazen, 2012). Spirometry was developed in the 1840s but not used until the late 1940s and early 1950s. Forced exhalation measurements and the ability to show a response to bronchodilators helped with the diagnosis of asthma (von Mutius & Drazen, 2012). In 1950, glucocorticoid steroids were introduced as a systemic therapy followed by inhalation therapy as we know it today (von Mutius & Drazen, 2012). Therapeutic options have increased during the past couple of decades, but the disease is a more complex disorder than was once thought (Holgate, 2011).

In the early centuries, interest in sleep was related to dreams (Todman, 2007). Insomnia was first recorded in the ancient Egyptian texts, with the use of opium to treat this condition (Todman, 2007). In 1913, a French research and author, Henri Pieron, described sleep as a physiological entity, and his book was considered the first of modern times.

Electroencephalography was developed in 1929 and was used to examine brain activity during sleep. Dr. Nathaniel Kleitman, the father of American sleep studies, began his work in the 1920s on sleep rhythms (Colten & Altevogt, 2006). In 1953, Dr. Kleitman and colleagues first observed rapid eye movement during sleep and Dr. Dement went on to describe the stages of sleep (Colten & Altevogt, 2006). Since the 1950s, researchers of other medical disciplines have become interested in the effect of sleep on different organs. In 1993, The National Center of Sleep Disorders Research, which is part of the NIH, was developed to conduct and support research related to understanding sleep and sleep disturbances.

PHYSIOLOGY AND PATHOPHYSIOLOGY OF SLEEP AND ASTHMA

Sleep is an essential part of promoting health. In pediatrics, sleep is needed for adequate growth and development. Circadian rhythm begins to regulate in the