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Commentary

Sleep in children and adolescents with chronic pain

Tonya M. Palermo and Irina Fonareva

Links between the regulation of sleep and pediatric pain are complex and bi-directional: pain may disrupt sleep (Palermo, 2000) and, in turn, sleep loss may enhance pain sensitivity (see Lewin & Dahl, 1999 for a conceptual review). Research has demonstrated far-reaching consequences of sleep disruptions in healthy children including increased school absences and academic and attentional difficulties (Fallone et al., 2002; Wolfson & Carskadon, 1998). In adolescents with chronic pain, disturbed sleep has been associated with significant impairments in a broad range of physical and social activities along with reductions in overall health-related quality of life (Palermo & Kiska, 2005). In this commentary, we review the literature in this area organized by the primary method of sleep assessment: subjective self-report, polysomnography, and actigraphy. Due to the paucity of literature, we consider chronic pain conditions together, recognizing that future research may demonstrate differences in the nature and role of sleep disturbance as a function of the type of chronic pain problem.

Subjective self-report

Subjective sleep measures such as annotated diaries and survey instruments assessing sleep behaviors (LeBourgeois et al., 2005) and disorders (Owens et al., 2000) are commonly used to describe sleep-wake disturbances. Though limited by reporting biases, subjective sleep measures have provided valuable population-based data on the

associations between chronic pain and sleep complaints. For example, in the epidemiological study by Roth-Isigkeit and colleagues (2005), over half of children with chronic pain reported some sleep difficulties on a global single item measure of sleep problems. Self-reported sleep problems have also been documented in clinical populations of children and adolescents with juvenile rheumatoid arthritis (JRA; Bloom et al., 2002), headache (Bruni et al., 1997; Miller et al., 2003), and complex regional pain syndrome (Meltzer et al., 2005). Most commonly, youth with chronic pain describe difficulties falling asleep, frequent night and early morning awakening, and excessive daytime sleepiness.

Polysomnography

Polysomnography (PSG), or an overnight sleep study, is the "gold standard" for assessing physiological sleep. Comprehensive recordings including electroencephalogram (EEG), electrooculogram (EOG), and electromyogram (EMG) along with other monitoring are combined to determine the stage architecture of sleep and diagnose the full spectrum of intrinsic sleep disorders (e.g. sleep disordered breathing). Published research using PSG in children with chronic pain is scant, likely, in part, to the high cost of performing PSG. Moreover, PSG provides inadequate diagnosis of behavioral and circadian sleep problems that are relevant to children with chronic pain.

One study, using PSG to assess sleep in 21 patients with polyarticular JRA and 20 healthy controls, demonstrated higher indices of periodic leg movements, arousals, and increases in alpha activity in non-REM sleep in children with JRA compared to controls (Passarelli et al., 2006). Significant relationships between PSG sleep fragmentation and clinical symptoms including pain intensity and functional impairment were also observed. Similar sleep fragmentation and polysomnographic anomalies have been described in children with fibromyalgia (Roizenblatt et al., 1997; Tayag-Kier et al., 2000).

Actigraphy

Actigraphy involves wearing a watch-like device that records body movements to estimate sleep and wake states (Ancoli-Israel et al., 2003). Although not suitable for determining sleep architecture or diagnosing sleep disorders, actigraphy allows for unobtrusive measurement over extended periods in the home environment and demonstrates excellent validity compared with concomitant PSG, with agreement of up to 95% (Sadeh et al., 1995). Typical protocols require wearing actigraphy devices for 7-10 days to establish reliable sleep estimates. Two actigraphic studies assessing sleep in children with chronic pain have been published. Bruni and colleagues (2004), using a 2-week actigraphy protocol, compared the sleep of 17 healthy controls and 18 children with migraines. Although nocturnal motor activity was reduced preceding migraines, sleep was similar between the groups during the interictal period with the exception of sleep onset latency. Haim and colleagues (2004) compared sleep patterns in 25 children with recurrent abdominal pain and 15 healthy controls using actigraphy over 7 days. Although children with abdominal pain complained about disturbed sleep on self-report, the groups were similar on actigraphic sleep measures.

Summary

Despite recent interest in describing sleep in children with chronic pain, to date, the literature is quite limited. This is in contrast to the literature on sleep in adults with chronic pain that contains prevalence and impact data and identifies insomnia

related to chronic pain as a costly form of illness (Smith & McGhan, 1997; Stoller, 1994). Moreover, treatments for secondary sleep disturbances have been developed and tested in adult chronic pain populations (e.g. Morin et al., 1989).

Our review highlights that, by subjective report, over half of children and adolescents with chronic pain experience sleep disturbances (such as insomnia) that potentially diminish normal daily function, mood, and quality of life. Studies suggest that youth with chronic pain experience sleep disturbances more frequently compared to their healthy peers, although the data using different methodologies to establish this finding are limited.

Future directions

Research on sleep in children with chronic pain will be enhanced by overcoming significant limitations in existing studies, such as an overreliance on subjective data and infrequent use of objective methodologies, which may provide different information about sleep. For example, PSG can identify specific abnormalities in the continuity of sleep as well as in the sleep architecture, such as alpha-delta intrusion, a sleep abnormality noted in adult pain patients (e.g. Roizenblatt et al., 2001). Virtually no data are available on the etiology of sleep disturbances in children with chronic pain. The symptoms of poor sleep may be due to underlying problems with inadequate sleep hygiene, fragmented sleep, circadian abnormalities, psychophysiological insomnia, or other etiologies. Lack of information on etiology has hindered the development of effective methods for managing sleep problems in children with chronic pain. There is a corresponding lack of data on demographic, behavioral, or psychological predictors of disturbed sleep. Palermo and Kiska (2005) found that depressive symptoms predicted the severity of sleep disturbances in adolescents with chronic pain, highlighting the important role that depression may play for these youth.

Likely due to limited knowledge of etiological factors, there has been only one published treatment study targeting sleep disturbances in children with chronic pain. This study assessed the benefits of sleep hygiene education in a group of children with migraine headaches and sleep problems (Bruni et al., 1999). After sleep hygiene education, children

showed reduction in the frequency and duration of their migraines compared to a control group. Treatment research is essential to demonstrate the clinical efficacy of standard behavioral and pharmacological strategies for treating children's sleep disturbances linked to chronic pain. Effective treatment of sleep disturbances may result in corresponding improvements in pain symptoms.

Last, there are compelling reasons to focus specifically on the sleep problems of adolescents with chronic pain. Many changes occur during adolescence, including a decrease in sleep duration (Iglowstein et al., 2003), a delay in the timing of sleep (Carskadon et al., 1998) and an increasing discrepancy between weekday and weekend sleep patterns (Wolfson & Carskadon, 1998). Reportedly, up to 16% of adolescents have clinically significant insomnia (Morrison et al., 1992; Ohayon et al., 1998; Roberts et al., 2004). As the sleep problems

are amplified with onset of adolescence, there may be particular detrimental effects on adolescents' ability to manage chronic pain.

Sleep is a newly emerging area in pediatric chronic pain research that holds promise for furthering our ability to understand and treat pain in children.

Tonya M. Palermo, PhD

Assistant Professor, Department of Anesthesiology & Peri-Operative Medicine, Oregon Health and Science University, Portland, Oregon

email: palermot@ohsu.edu

Irina Fonareva, BA

Research Associate, Department of Anesthesiology & Peri-Operative Medicine, Oregon Health and Science University, Portland, Oregon

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