

Nursing care considerations for dialysis patients with a sleep disorder

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Abstract

Sleep disorders are common in patients with kidney disease. The relationship between sleep disorders and kidney disease is complex and bidirectional. Many renal disease-related factors such as anaemia, fluid and uraemic toxin accumulation are found to cause poor sleep quality. Inadequate sleep and reduced sleep time increases risk of hypertension and proteinuria, and exaggerates kidney failure. The consequences of sleep disorders such as fatigue and depression have a profound impact on the patient's quality of life and survival, yet sleep is not routinely assessed in current renal practice.

The purpose of this paper is to explain the definition and clinical symptoms of different types of sleep disorders that are commonly reported by patients with kidney disease. The potential causes of each sleep disorder and the risk factors associated with kidney failure are also a focus of this paper. We have reviewed commonly used screening tools and summarised some useful strategies that can be initiated by a nurse when caring for a patient with kidney disease and a co-existing sleep disorder

Keywords

Haemodialysis, sleep disorders, sleep, dialysis.

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Introduction

Evidence suggests that more than 60% of patients with end-stage kidney disease (ESKD) have a sleep disorder (Fonseca *et al.*, 2016). Common sleep disorders identified in patients with a kidney disease include insomnia, restless legs syndrome (RLS), periodic limb movement (PLM) and sleep-disordered breathing (SDB) (Ezzat & Mohab, 2015). Consequences of sleep disorders, such as fatigue and depression, can profoundly impact patients' mental and physical function, quality of life (QoL) and survival (Davison *et al.*, 2015; Harris *et al.*, 2012; Jhamb *et al.*, 2009; Unruh *et al.*, 2006).

A recent study indicated that short sleep duration, and poor sleep quality increase risk of death (HR:1.50; 95% CI: 1.08–2.10) and cardiovascular mortality (HR:1.56; 05% CI: 0.72–3.37) in patients with chronic kidney disease (CKD) (Ricardo *et al.*, 2017). A report from the Sleep Heart Health Study also indicated that patients who have mild to severe SDB are twice as likely to have heart failure and 1.5 times likely to have coronary heart disease (Shahar *et al.*, 2001). Even in the absence of a diagnosed sleep disorder, reduced sleep hours overall is associated with proteinuria (OR:1.57, $P < 0.05$) (Chan *et al.*, 2016), and non-dipping pattern in hypertensive CKD patients (Zhang *et al.*, 2017), which are the main causes of a rapid decline in kidney function. For these reasons, poor sleep quality is increasingly recognised as a key risk factor of CKD (Chu *et al.*, 2016; McMullan *et al.*, 2016).

The aim of this paper is to increase dialysis nurses' awareness and knowledge when caring for dialysis patients with a sleep disorder. To achieve this, firstly, we explain the definition and clinical symptoms of different types of sleep disorders. Secondly, we discuss the aetiology of kidney disease such as circadian change and sleep disorders, and the potential risks that link CKD/ESKD patients to poor sleep. Finally, we outline some commonly used assessment tools and explain how these tools can be incorporated into a routine nursing assessment to enable holistic care of dialysis patients.

A literature search was undertaken using the Ovid database, Embase and Medline from 1996 to the present. Keywords used included: sleep wake disorder, sleep, sleep-disordered breathing, sleep apnoea, kidney disease, renal replacement therapy, dialysis, or their corresponding synonyms in MeSH term, with limits on English language and adult (age ≥ 18 years). The focus of this review is on dialysis patients; hence the studies on transplant patients were excluded.

Common types of sleep disorders in kidney patients

Insomnia is the most common sleep disorder reported by dialysis patients (Merlino *et al.*, 2006). The International

Classification of Sleep Disorders describes insomnia as having difficulty initiating or maintaining sleep, lack of opportunity to sleep and presence of daytime sleepiness, as part of the overall constellation of insomnia (Sateia, 2014). In haemodialysis patients, insomnia is reported at a prevalence of 49–83% (Al-Jahdali *et al.*, 2010; Ibrahim & Wegdan, 2011), with similar rates reported in peritoneal dialysis patients (Al-Jahdali, 2011; Losso *et al.*, 2015).

The aetiology of insomnia in patients with chronic kidney disease is often multifactorial; it includes biological and psychological factors. A study revealed that as kidney function worsens there is less melatonin secretion (Koch *et al.*, 2010). Melatonin is a hormone that regulates circadian rhythms, which is the important component of sleep rhythm (Xie *et al.*, 2017). Reduced or diminished melatonin can delay sleep onset and result in insomnia. The mechanism of melatonin depletion in kidney patients remains unknown; however, plausible mechanisms have been proposed. Firstly, some medications used in CKD patients may interfere with the secretion and synthesis of melatonin, such as beta blockers that are commonly used to prevent cardiovascular disease, and inhibit the release of melatonin (Xie *et al.*, 2017). Secondly, evidence suggests that anaemia, a common consequence of kidney failure, interferes with melatonin regulation (Vaziri *et al.*, 1996). Besides melatonin depletion, poor sleep routine and circadian changes may also be factors that contribute to insomnia. Studies have found that patients with fatigue and depression are more likely to have frequent daytime naps, which can result in poorer nighttime sleep (Joshwa *et al.*, 2012). The prevalence of fatigue and depression in the kidney population is high. Excessive daytime sleep can affect sleep hygiene and circadian rhythms, and result in poor sleep quality. In dialysis units, it is not uncommon for patients to sleep during a dialysis treatment, and this phenomenon could explain why patients who dialyse in the morning were found to have worse sleep at night, compared with those who dialyse in the afternoon (Merlino *et al.*, 2006).

Diagnosis of insomnia in patients with a kidney disease is often challenging, as many present with symptoms of fatigue and sleepiness, which are commonly related to the progression of kidney disease and dialysis treatment, not necessarily a sleep disorder. Therefore, clinical assessment of insomnia in this population should not solely rely on one-off results from the questionnaire, but a combination of clinical history and a sleep diary to help in assessing and quantifying the severity of sleep-related symptoms (Pierratos & Hanly, 2011).

RLS and PLM have a similar clinical presentation involving an irresistible urge to move and cause disturbed sleep (Benca, 2012a). The main factors that distinguish RLS from PLM is the primary involvement of the lower limbs in RLS, whereas PLM

presents with repetitive and highly stereotyped limb movements that are not limited to the lower limbs (Benca, 2012b). Both diseases affect approximately 25% of the dialysis population (Novak *et al.*, 2015). Although the risk factors associated with RLS and PLM remain unknown, and may be different between haemo and peritoneal dialysis patients, the prevalence and severity of the disorders are similar between the two populations (Merlino *et al.*, 2012). Higher limb movement index is associated with greater reduction in survival. A study of 29 haemodialysis patients in a 20-month survival follow-up found that the survival rate was almost double (90% versus 50%) in patients with less periodic limb movements during the night (> 20/h vs <20/h) (Benz *et al.*, 2000).

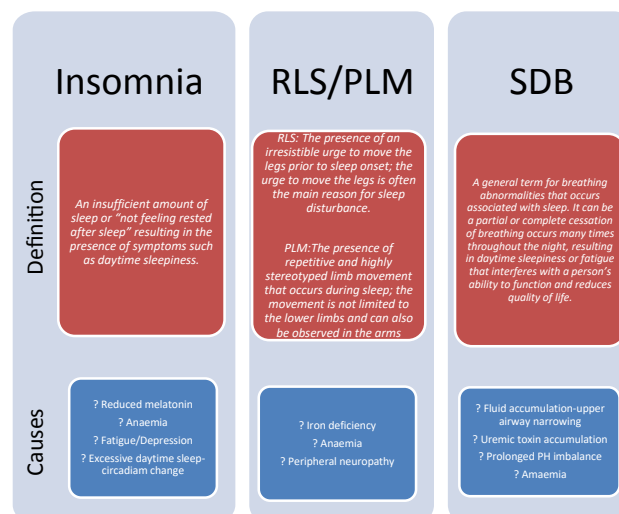
The cause of RLS or PLM in patients with chronic kidney disease is often linked to iron deficiency, anaemia or uraemic toxin, but the mechanism still requires elucidation (Novak *et al.*, 2015). Correct anaemia management including erythropoietin and iron treatment have shown improvement in sleep quality in some studies (Pierratos & Hanly, 2011). Clinical assessment of RLS can be performed using a validated questionnaire such as International Restless Legs Syndrome Study Group Rating Scale (Walters *et al.*, 2003) to subjectively determine the severity of the disease; however, the diagnosis still relies on objective polysomnography, often known as a sleep study. In dialysis patients, the risk of developing vascular disease and peripheral neuropathy is not high; therefore, clinical diagnosis should not only involve polysomnography but also a neurology assessment to avoid overestimation of the disease (Calvino *et al.*, 2015).

SDB is a broad term that describes all breathing abnormalities occurring during sleep, such as sleep apnoea (both obstructive and central), sleep-related hypoventilation, and sleep-related hypoxaemia (Sateia, 2014). The prevalence of SDB in dialysis patients is reported as high as 82% (El-Aatty *et al.*, 2015), significantly higher than that of the general population (between 3% and 7%) (Ohayon, 2011).

Evidence suggests that fluid accumulation and uraemic toxins may play an important role in contributing to the high prevalence of SDB. A cross-sectional study found that haemodialysis patients have a 12% smaller pharyngeal size compared with patients with no renal disease (Beecroft *et al.*, 2007). The pharyngeal narrowing identified in haemodialysis patients was thought to be the result of fluid accumulation and/or systemic inflammation (Chu *et al.*, 2018). Elias *et al.* studied 20 haemodialysis patients and found that fluid accumulation in the body will redistribute to the pharynx when lying down, causing high pharyngeal water content and resulting in obstructive sleep apnoea in haemodialysis patients (Elias *et al.*, 2013). Accumulation of uraemic toxins, particularly the larger molecules, may cause systemic inflammation and destabilise

chemoreceptors (Chu *et al.*, 2018). Chemoreceptors are critical in the control of breathing, and over-stimulation of these cells (due to systemic inflammation) can result in periodic breathing and central sleep apnoea (Chu *et al.*, 2018; Parkes, 2013). Clinical assessment of obstructive sleep apnoea (OSA) can be done using the Berlin and STOP-BANG questionnaire; however, the diagnosis of SDB requires polysomnography to determine the type of SDB (Douglas *et al.*, 2017).

Figure 1: Definition of different types of sleep disorders (Sateia, 2014) and potential causes. Red boxes relate to definition and blue boxes relate to causes.



Risk factors

Possible risk factors affecting sleep quality in ESKD patients have been extensively reviewed, and the common factors reported include: male gender, advanced age, presence of RLS, high caffeine intake, alcohol, cigarette smoking, hyperphosphataemia, anaemia, low plasma albumin concentration and inadequate dialysis (Al-Hahdali, 2012; Al-Jahdali, 2011; Chu *et al.*, 2018; Gusbeth-Tatomir *et al.*, 2007). Knowledge of the risk factors is important to assist with development of preventative strategies or interventional studies; however, currently there are some existing controversies.

Caffeine is believed to have an effect on sleep hygiene, and recommendations to avoid intake prior to bedtime are common (Clark & Landolt, 2017). In previous studies, caffeine was found to be a risk factor for sleep-wake complaints; especially more than 400 mg per day, which is a risk factor for poor sleep quality (Drake *et al.*, 2013). Interestingly, however, caffeine intake did not have an effect on SDB. In a cross-sectional study by Chen *et al.*, patients with high caffeine intake were less likely to have SDB ($P=0.58$) and RLS/PLM ($P=0.233$); and reported better sleep quality (Chen *et al.*, 2006). Although the amount of caffeine and the time that it was consumed were not specifically indicated in this study, the authors suggest that different types of sleep disorders have different pathogenesis and avoiding caffeine intake may not be the answer for all.

In addition, if caffeine intake is only related to sleep–wake complaints, not a specific type of sleep disorder such as SDB; it may be reasonable to assume that high caffeine intake is the consequence of daytime sleepiness, not the cause of a sleep disorder. As patients with daytime sleepiness are more likely to have consumed a higher amount of caffeine to stay awake, the positive correlation may be the result of human behaviour not of disturbed sleep.

Another controversy is the gender difference in sleep disorders. Male gender is often associated with poor sleep, particularly the presence of SDB (Ahmad *et al.*, 2013; Argekar *et al.*, 2007; Chen *et al.*, 2006). Conversely, in the cross-sectional study by Menon *et al.*, female gender was more likely to have poor sleep compared with male (94% vs 49%, $p=0.000$) (Menon *et al.*, 2015). The differences between males and females, in hormones, body fat and physical attributes can contribute to differences in sleep disorders (Mallampalli & Carter, 2014); for example, insomnia is more common in females, due to changes in hormones (menstrual cycle or menopause), and SDB is more often diagnosed in males due to larger pharyngeal length (Eckert & Malhotra, 2008).

Sleep assessments — commonly used questionnaires

There are many validated sleep-related questionnaires developed to assist clinical screening and assessment of patients with potential sleep disorders. Commonly used tools include the Pittsburgh Sleep Quality Index (PSQI) (Buysse *et al.*, 1989), Epworth Sleepiness Scale (ESS) (Johns, 1991), Berlin Questionnaire (Netzer *et al.*, 1999), and the STOP-BANG (Chung *et al.*, 2014) questionnaire. Each tool has a different purpose and functionality in identifying sleep problems (Figure 2).

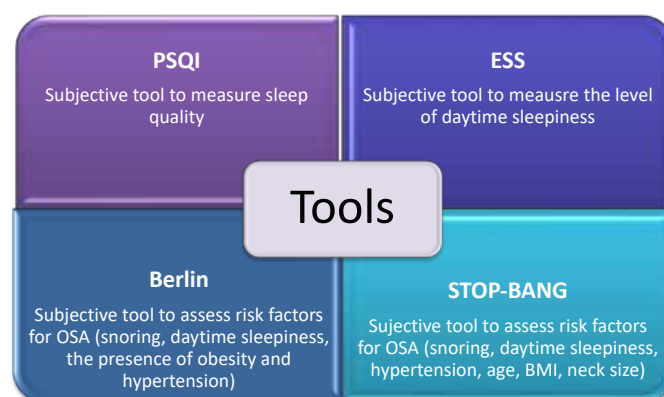
The PSQI is an effective tool to measure the quality and patterns of sleep by measuring seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction over the last month period (Buysse *et al.*, 1989). It is a validated tool that has a sensitivity of 89.6% and specificity of 86.5% to screen patients for poor sleep quality (Buysse *et al.*, 1989). It has been widely used in the dialysis population as a subjective screening tool to identify patients with poor sleep quality.

The function of the ESS is to assess the level of daytime sleepiness. A score above 10 (out of a total score of 24) indicates daytime sleepiness which is often believed to be associated with poor sleep (Johns, 1991). Excessive daytime sleepiness is often present in adults with sleep disorders, particularly in SDB patients. However, Nicholl *et al.* found that excessive daytime sleepiness is less in SDB patients with

kidney disease and the application of ESS as a screening tool for SDB in this cohort may be less accurate in detecting the presence of SDB (Nicholl *et al.*, 2012).

The Berlin and STOP-BANG questionnaires have been designed specifically for SDB, particularly obstructive sleep apnoea (OSA). Both use risk factors for OSA such as snoring behaviour, daytime sleepiness and the presence of obesity and hypertension to assess the likelihood of SDB. Although both Berlin and STOP-BANG have a high sensitivity to predict OSA in the general population (Chung *et al.*, 2016), when used in the haemodialysis population, the results need to be carefully interpreted to avoid overestimation due to the high prevalence of hypertension in this cohort. Nicholl *et al.* completed a Berlin and STOP-BANG questionnaire on 172 patients with kidney disease (CKD: $n=109$; ESKD: $n=63$), and found that although the sensitivity of these two tools is high, the specificity is low; therefore, an objective measure such as overnight oximetry should be considered for high-risk patients in this cohort (Nicholl *et al.*, 2013).

Figure 2: Summary of existing screening tools for sleep disorders



Nursing care considerations

Many dialysis units in Australia are located in rural or remote areas where physician support is limited. Therefore, dialysis nurses have a primary role in conducting multidimensional assessments of patients, to understand the disease processes and ensure the co-morbidities and symptom burden from co-morbidities are adequately identified and managed. This requires a unique set of skills and expert knowledge to enable the delivery of person-centred care to patients with CKD.

Sleep disorders have an enormous impact on the health status of patients with kidney disease. A thorough assessment to identify the symptom burden, followed by patient education in self-management and symptom management may improve the symptom burden of sleep disorders in ESKD patients. Dialysis nurses are in a prime position to conduct sleep quality assessment and initiate interventions that may improve the sleep quality of patients, particularly as many non-pharmacological approaches are found to be useful, in

managing insomnia or RLS (Aliasgharpour *et al.*, 2016; Scherer *et al.*, 2017). There are numerous strategies that a dialysis nurse can implement, some of which include an awareness of sleep disorders in the dialysis population, the identification of patients at high risk of a sleep disorder, the incorporation of assessments for sleep quality into nursing care, and ensuring referral for at-risk patients to the appropriate services.

Identifying high-risk patients

Many dialysis units have adapted “primary nursing” care models where a dialysis nurse is expected to have responsibility and autonomy for the nursing assessment, planning, implementation, evaluation, and outcomes of an assigned group of patients (Dobson & Tranter, 2008). To enhance this assessment, planning and intervention, an assessment of a patient’s baseline sleep quality using a tool such as the PSQI is recommended in the initial assessment of their primary patients. While there is a lack of evidence linking poor sleep quality to a specific dialysis-related clinical indicator such as fluid status or dialysis adequacy (Arzt & Eckert, 2017), and given the high prevalence of sleep disorders in the dialysis population, assessing sleep quality in every dialysis patient is a reasonable approach. Once the initial assessment is completed, a routine review of the patient’s sleep quality as part of ongoing care should be embedded into practice, particularly for those patients who have been identified as having poor sleep quality at the initial assessment. For these patients, the ESS can be used to capture a patient’s level of sleepiness and guide the need for further investigation of a sleep disorder.

Nursing care

Nursing management of those patients at risk of an identified sleep disorder should focus on patient education and appropriate discussions with the multidisciplinary team to ensure further investigation, where required. For patients with insomnia, the education should focus on sleep hygiene, and avoiding daytime sleep (Saeedi *et al.*, 2014). Sleep hygiene is defined as behaviours that a person can do to help promote good sleep (ASA, 2017). Good sleep hygiene advice for haemodialysis patients has been reported previously and is summarised in Table 1. Alternatively, melatonin treatment has shown benefit in improving sleep quality in haemodialysis patients (Edalat-Nejad *et al.*, 2013).

For patients with SDB, nursing education should focus on the maintenance of a healthy lifestyle, particularly in weight control, and avoidance of stimulants and excessive interdialytic weight gain (Pierratos & Hanly, 2011). Weight loss is an effective modifiable factor to improve SDB, especially obstructive sleep apnoea. Studies have shown that even with a 10% weight reduction, a change of the apnoea and hypopnoea index would decrease by 26% (Cowan & Livingston, 2012).

Table 1: Summary of sleep hygiene for haemodialysis patients (Aliasgharpour *et al.*, 2016; Taha & Ali, 2015)

1.	Avoid caffeinated beverages, alcohol and nicotine at least six hours prior to bedtime
2.	Establish regular bedtime routine and morning awakening, even on weekends
3.	Avoid daytime naps
4.	Use bed only for sleep, not reading or watching television
5.	Remove clocks in the bedroom
6.	Have regular mealtimes; do not go to bed hungry or with a full stomach
7.	Try to clear the mind and do not to take worries to bed
8.	Exercise regularly, but not within three hours prior to bedtime
9.	Regular stretching exercises on dialysis — may be useful for RLS Useful exercise activities on dialysis can be found on: Kidney Health Australia website: Exercise on Dialysis: Instruction Manual (Bennett <i>et al.</i> , 2015)

Cognitive behaviour therapy (CBT), a structured program led by trained psychiatrists/psychologists to review, assess and assist patients to change/replace bad sleep routine is another alternative for management of insomnia in those patients who have no success in practising sleep hygiene independently (Chen *et al.*, 2008). CBT is thought to be effective in improving insomnia without the need for medication (Chen *et al.*, 2011). A randomised control trial of 72 haemodialysis patients found an overall improvement of sleep quality in patients who received a six-week CBT program. The sleep quality was measured by PSQI, with the CBT and control groups scoring 9.6 versus 11.8 ($P=0.001$) respectively. Sleep efficiency also improved in CBT group (85.8%) compared with the control group (78.2%) ($p<0.001$) (Chen *et al.*, 2011).

Referrals

An appropriate referral is important for those patients who suffer consequences of poor sleep such as fatigue, sleepiness and depression. The renal supportive care (RSC) programs that specialise in the assessment and treatment of renal-specific symptoms by incorporating palliative medicine into the care of the renal patient is an appropriate service in managing patients with difficulty sleeping or any symptoms that relate to poor sleep (Crail *et al.*, 2013). Difficulty sleeping, pain, depression and pruritus are common symptom burdens in patients with ESKD (Crail *et al.*, 2013). The RSC team can address these symptoms by introducing pharmacological interventions, or referring to a sleep physician for further review, diagnosis and assessment.

Conclusion

Current evidence suggests that sleep disorders are among the most common conditions experienced by dialysis patients (Davison *et al.*, 2015). The consequences associated with sleep disorders can have a profoundly negative impact on a

patient's mental and physical function, QoL, cardiovascular health and survival (Harris *et al.*, 2012; Jhamb *et al.*, 2009; Unruh *et al.*, 2006). Despite the high prevalence, it is largely unrecognised and untreated in this cohort. Therefore, it would be advantageous for patients with kidney disease, regardless of stage, to undergo regular screening for sleep disorders. This paper has explained the clinical presentations, and the risks associated with sleep disorders. We also described the assessment tools that can be introduced into routine patient reviews, highlighted the opportunities for screening, and actions that can be initiated by nurses to improve sleep quality in dialysis patients.

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