



## Study on Muscles cramp and sleep disturbances among hemodialysis patients

<sup>1</sup>Gulshan Roy Chowdhury and <sup>2</sup>Dr. Mrs. Jyoti Sarin

<sup>1</sup>Ph.D Scholar of MM (Deemed to be university) & Lecturer, College of Nursing, ABVIMS & Dr. R.M.L.Hospital,

<sup>2</sup>Director & Dean, MM (Deemed to be university) MM College of Nursing, Mullana, Ambala. gulshan1410@gmail.com, sarinjyoti@yahoo.com

### Abstract

Muscle cramps are often experienced by the patients on hemodialysis that result in discomfort, shortened treatment times, and inadequate dialysis dose.

Up to 50% people with chronic renal failure undergoing dialysis suffer from muscle cramps, especially involving the lower limbs. The cramps can happen during dialysis or at home. The cramps in this type of patient are linked to depression, a decline in quality of life, and sleep disorders. The etiology of cramps in hemodialysis patients is not clear.

Muscle Cramping of the hands, feet, and legs is fairly common among patients on hemodialysis. Muscle Cramps are also associated with low bloodpressure. However, some Muscle cramping continues even after a normal bloodpressure. When patients are below dry weight, they also experience muscle cramps. The severe muscle cramps are experienced near the end of the dialysis and persisting for a time after dialysis is often due to dehydration. <sup>(1)</sup>

The most frequent sleep disorders seen in patients on dialysis are conditioned insomnia, excessive daytime sleepiness, obstructive or central sleep apnea, as well as restless legs syndrome (RLS) and periodic limb movement disorder. Many uremic and non-uremic factors are thought to participate in the pathogenesis of sleep disorders in these patients. The treatment of sleeping disorders includes non-pharmacological and pharmacological measures that can improve the functionality and quality of life in patients on dialysis. <sup>(2)</sup>

### Key Words:

Muscle Cramps, Nocturnal Muscle Cramps, Restless Leg Syndrome, Quality of Life, Intra-dialysis stretching exercise.

## **Introduction**

Muscle cramps are a common complication of hemodialysis treatments, occurring in 33 to 86 percent of patients; resulting in the early termination of a hemodialysis session and are therefore an important cause of under-dialysis.

Muscle cramps may be caused by changes in plasma osmolality and/or extracellular fluid volume. Increasing dialysis treatment time to reduce ultrafiltration rate, minimizing intra-dialytic weight gains, avoiding hypotension and using sodium modeling may reduce cramps during dialysis treatments.

Administration of hypertonic saline or dextrose and local heat and massage of the affected muscle may treat cramps occurring during dialysis treatment. <sup>(3)</sup>

The top 3 prioritized physical symptoms of insomnia, muscle cramps, and fatigue were analyzed in a recent study from the standpoint of their current state, barriers, and knowledge gaps impeding progress and a possible path forward. <sup>(4)</sup>

A case study by Appanraj. R, et.al (2015) on 20 patients concludes that by assuring the dry weight and monitoring the sodium frequently the episodes of muscle cramps can be controlled. <sup>(5)</sup>

Fiona Blytne, Vivienne Chuter and Joshua Burns (2012) conducted a study to know about the night time muscle cramps. A survey was conducted to know the patient experience, treatment modalities and help seeking behavior. Leg cramps during the night time was experienced by almost all of the hemodialysis patients. Night time cramps are more severe than the day time cramps and can't be relieved by means of current therapies. <sup>(6)</sup>

Allen RE, Kirby KA., 2012 conducted a study regarding the effect of nocturnal leg cramps. Cramps arise mainly due to the associated disease conditions such as lumbar canal stenosis, hemodialysis, vascular disease and other related medical conditions. Almost about 60% of the adults are affected by the muscle cramps during the bed time. The treatment modalities mainly given for the muscle cramps are administering magnesium, vitamin B<sub>12</sub>, calcium channel

blockers. Non-pharmacological therapies like stretching can also be used for reducing muscle cramps. By the study it is clear that nocturnal leg cramps are common in adults. <sup>(7)</sup>

Nocturnal calf muscle cramps are associated with substantially reduced quality of sleep and reduced physical aspects of health-related quality of life. <sup>(8)</sup>

Keeping in mind the importance of this topic, a review was conducted to characterize the frequency, severity, and timing of dialysis-related cramps and the various types of sleep disturbances in hemodialysis patients. Dialysis-related cramps can be extremely painful and can compromise the efficacy of hemodialysis therapy. Moreover sleep disturbances can have adverse affect on such patients. So the treatment modalities of muscle cramps and sleep disturbances are also reviewed to focus on the point that patients on maintenance hemodialysis can lead a comfortable life.

### **Muscle cramps among haemodialysis patients**

Muscle cramps are painful, sudden and involuntary muscle contractions that typically occur in lower extremities. Cramps can occur during hemodialysis sessions, in between the sessions, and during sleep also.

Though pathogenesis and exact mechanism of hemodialysis associated muscle cramps are still unknown, one or more of the following factors including hypovolemia, hyponatremia, tissue hypoxia, hypomagnesemia, carnitine deficiency and elevated serum leptin levels may be involved in the development of intra-dialysis muscle cramping. <sup>(9)</sup>

The etiology of muscle cramps in maintenance hemodialysis patients is poorly understood and no clear evidence-based prevention or treatment strategies are there. Several factors including a low concentration of serum magnesium may play a role. The prevalence of hypomagnesemia (concentration of  $<0.7$  mmol/L) in maintenance hemodialysis patients ranges from 10% to 20%. A low dietary intake of magnesium, use of medications that inhibit magnesium absorption (e.g. proton pump inhibitors), increased magnesium excretion (e.g., high-dose loop diuretics), and a low concentration of dialysate magnesium are the causes of hypomagnesaemia. Out of various therapies been explored (eg, quinine, carnitine, vitamin E, gabapentin, biotin, exercise, and massage), most have limited effectiveness and some may be unsafe for kidney failure patients. <sup>(10)</sup>

The psychological impact of cramps is often overlooked. Patient's mood and quality of life is significantly affected by cramps. They are manifested by HD patients as a particularly severe individual symptom, also linked with depression and poor quality of life. <sup>(11)</sup>

Sleep and health-related quality of life, depression and anxiety are some of the adverse effects of cramps. Intra-dialysis massage appears to be an effective way to address muscle cramping.

In a Cochrane review in 2012, Blyton et al. examined other non-pharmacological interventions to help cramp symptoms. These included: using night splints; avoiding heavy covers on the bed, and making changes to sleeping position. changes to footwear; taking horse chestnut seed extract; Nocturnal calf muscle cramps are associated with substantially reduced quality of sleep and reduced physical aspects of health-related quality of life. Intradialytic stretching exercises during the last two hours of haemodialysis help to reduce and prevent the muscle cramps. <sup>(12)</sup>

According to Morris, (2014) there was a significant difference in the mean level of muscle cramps before and after intervention. It was found that in the pre test 53.3% had severe muscle cramps, 46.7% had a moderate muscle cramps and after performing the intra dialytic stretching exercise it was found that 40% had no muscle cramps, 24.4% mild and 35.6% had moderate muscle cramps. <sup>(13)</sup>

A study supported by Lekha. J. Abraham.et.al (2017) was done on the effectiveness of Intra-dialytic stretching exercise on prevention and reduction of muscle cramps among patients undergoing haemodialysis in Coimbatore. She concluded that stretching exercise during the haemodialysis prevent the occurrence of muscle cramps and improves the quality of life among these patients. <sup>(14)</sup>

Patient in the intervention group reported cramping at home decreased by 1.3 episodes per week compared to 0.2 episodes per week in the control group ( $p=0.005$ ). Patient reported cramping during dialysis decreased by 0.8 episodes in the intervention group compared to 0.4 episodes in the control group ( $p=0.44$ ). Intradialytic massage found to be an effective way to address muscle cramping. <sup>(15)</sup>

The importance of performance of stretching exercises for patient before dialysis to prevent cramps is recommended. There is clearly a need for effective education regarding recognition of individual patient need & appropriate intervention strategies in muscle cramps in dialysis patient

& nurses, in partnership with patient, relatives & other health professional can help to empower the individual to manage their cramps. <sup>(16)</sup>

Hallegraeff et al. identified that nightly stretching before going to sleep reduces the frequency and severity of nocturnal leg cramps in older adults. <sup>(17)</sup>

Application of Sequential compression devices (SCD) to LE may prevent the generation of LE HD-related cramping in a select group of patients. (SCD) improve venous return (VR). <sup>(18)</sup>

In a Survey on Dialysis-Related Muscle Cramping, a combination of decreasing fluid removal, raising the lower extremities, and massaging the extremities was found to alleviate dialysis cramps. <sup>(19)</sup>

### **Sleep disturbances in hemodialysis patients**

In the general population, prevalence of insomnia ranges from 4% to 29%. Whereas in the ESRD population, approximately 50%-75% of patients experience symptoms of insomnia. Chronic pain, stress, older age, dialysis shift, melatonin, and high PTH, all contributes in the development of insomnia in ESRD patients, although the mechanisms are not yet fully known.

A higher prevalence of sleep disorders has been associated with female gender in HD patients in other studies. <sup>(20)</sup>

For overall physical and mental well-being sleep is important. Sleep disturbances can include irregularity in sleeping habits, difficulty falling asleep, early morning awakening, and frequent awakening at night, sleep apnea and restless leg syndrome. Sleep disturbances among dialysis patients are found to be related to duration of dialysis therapy, high levels of urea and/or creatinine, pain, disability and somatic complaints such as pruritus and bone pain. <sup>(21)</sup>

Insomnia is common in HD patients and is frequently associated with other disorders of sleep.

A cross-sectional study (2017) was conducted to determine the prevalence and risk factors of insomnia in chronic hemodialysis (HD) patients. Female sex and duration on dialysis are the two risk factors were found. Insomnia does not appear related to any biochemical or dialysis parameters. Increased attention should be given to the management of dialysis patients regarding the diagnosis and management of insomnia and associated sleep disorders. <sup>(22)</sup>

A study (2020) underlined that among renal (i.e. causes of ESRD and previous kidney transplantation) and dialytic parameters (i.e. type and time on dialysis), only dialysis shift was associated with sleep disorders. This association is due to the link between the morning shift and insomnia. <sup>(23)</sup>

Daniel, et.al. (2020) concluded the prevalence of sleep disturbances and depression was higher among the maintenance hemodialysis patients receiving dialysis for more than 2 years and also with a frequency of twice a week. It may be inferred that by increasing the frequency and the dosage of dialysis in patients the quality of sleep can be adequately improved and thereby it may lower the depressive state in patients. <sup>(24)</sup>

The patient often develops an imbalance in various metabolites and bioelements as a consequence of CKD or ESRD and dialysis. In addition, patients also develop anemia due to various reasons including blood loss directly from the dialysis, a decrease in the levels of erythropoietin and frequent blood tests. As iron is bound to hemoglobin, a decrease in the count of red blood cells leads to a decrease in hemoglobin levels thereby causing a decrease in the levels of iron, which have been implicated as the primary cause of RLS (Restless Leg Syndrome) and is directly linked to CKD and dialysis. <sup>(25)</sup>

Samara, et.al (2019) recommended implementing the appropriate interventions to address the problem of poor sleep quality among dialysis patients. Such intervention may include sleep hygiene education, physical exercise, and cognitive-behavioral therapy, among other pharmacological and non-pharmacological modalities. <sup>(26)</sup>

Insomnia in patients on maintenance dialysis can also be exacerbated by other commonly co-occurring sleep disorders such as sleep apnea and restless leg syndrome.

Pain is poorly managed in patients with kidney disease. Non-pharmacological and non-opioid analgesics should be first-line approaches for pain management. Opioid use should be minimized with careful monitoring and dose adjustment. In a recent review, evidence supports the use of physical activity and other non-pharmacologic therapies, either alone or with pharmacological therapies, for pain management. Non-opioid analgesics, including acetaminophen, topical analgesics, gabapentinoids, serotonin–norepinephrine reuptake inhibitors, and TCA may be

considered based on pain cause and type, with careful dose considerations in kidney disease. NSAIDs may be used in CKD and ESKD for short durations with careful monitoring. <sup>(27)</sup>

## **Conclusion**

Sleep disturbances are extremely common in hemodialysis patients. Subjective sleep complaints are sleep apnea syndrome, restless legs syndrome, and periodic limb movement disorder are much more prevalent than in the general population and reported in up to 80% of those surveyed. Therefore, the purpose of this article is to present an up-to-date review of the literature regarding sleep disturbances in hemodialysis patients with special emphasis on the numerous factors including muscle cramps potentially contributing to these problems. Non-pharmacological and pharmacological measures are included in the therapy of sleeping disorders and muscle cramps that can improve the functionality and quality of life in patients with ESRD (End Stage Renal disease).

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