

# A Review On Muscle Cramps In Dialysis Patients During Hemodialysis

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## Abstract

Muscle cramps are the common and distressing complication experiences by dialysis patients during hemodialysis. These muscle cramps can significantly impact patient's quality of life and may lead to treatment interruptions and non-adherence. This review aims to provide an in-depth analysis of the prevalence, risk factors, etiology, pathophysiology and management strategies related to muscle cramps during hemodialysis.

Muscle cramps is one of the most prevalent complication and an important difficulty for patients. The frequency of muscle cramps is about 35-86% during hemodialysis. Excessive ultrafiltration, intradialytic hypotension, electrolyte-mineral disturbances, hypo-osmolality are the most frequent causes. Cramps are very common in hemodialysis (HD) patients. Muscle cramps can be treated by isotonic-hypertonic saline or hypertonic dextrose solutions. Muscle cramps can be prevented by correcting hypotension, sodium profiling, use of Vitamin E & C.

**Keywords:** Muscle cramps, Hemodialysis, Chronic kidney disease, Dialysis.

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## I. Introduction

Dialysis is a form of renal replacement therapy. The kidney's role of filtration of the blood is supplemented by artificial equipment to remove excess water, solutes, and toxins. Dialysis ensures maintenance of homeostasis (a stable internal environment) in people experiencing a rapid loss of kidney function, known as acute kidney injury (AKI), or a prolonged, gradual loss in renal function, called chronic kidney disease (CKD, previously end-stage renal disease ESRD). It may serve to tide over an acute decline in renal function, by time until a kidney transplant is performed, or be lifelong for those who are not candidates for transplant. Approximately 2.5 million people worldwide received chronic renal replacement therapy (RRT) in 2010. It is the mainstay in end-stage renal disease management, a renal condition with a rising global burden attributed mainly to diabetes mellitus (45%) and hypertension (30%). There are three primary types of dialysis: hemodialysis, peritoneal dialysis, and hemofiltration. (1)

Muscle cramps is one of the most frequent complications that can be seen during hemodialysis (HD) and so painful. They can occur in 35-86% of HD patients. They are found in lower extremities and are severe enough to compromise hemodialysis treatment. In a study, intradialytic cramps were the commonest symptoms and reported (74%) with hypotension (76%). The causes of muscle cramps during hemodialysis are still unknown. Many treatment approaches of muscle cramps during hemodialysis have been proposed, but most have been associated with severe side effects. We aimed to review the causes, treatment and the prevention methods of muscle cramps. (2)

## Etiology

The most frequent causes of dialysis muscle cramps include rapid or excessive fluid removal, intradialytic hypotension (low blood pressure during dialysis), and electrolyte disturbances. Factors associated with dialysis cramps include:

**Excessive weight gains between dialysis treatments:** The excessive fluid must be taken off at the next dialysis session, and need a higher ultrafiltration (UF) rate to achieve dry weight (normal weight with no additional fluid). If the body can't handle the higher UF rate, muscle cramps can occur.

**Overly aggressive fluid removal:** Cramps can also occur if too much fluid is removed during the hemodialysis treatment.

**Cutting dialysis sessions short or skipping treatments:** Reduced time on dialysis can lead to excessive fluid gains, requiring high UF rates, which can cause cramps.

**Too much salt (sodium):** High sodium foods in the diet can cause increase in thirst and excessive fluid gains between treatments, required a higher UF rates.

**Low blood volume:** This happens when patients take large amount of fluid off during the dialysis treatment. The most common cause of this is drinking a lot of fluid between dialysis treatments. It can also happen if, excess fluid remains off at previous dialysis session. (3)

### **Signs of oncoming muscle cramps**

The following are the signs of oncoming muscle cramp: Muscle twitches, Firm or tender muscle, Pain in an area that cramps.

### **Management**

**Hypertonic solutions:** Hypertonic solutions of dextrose, mannitol, and saline effectively relieve hemodialysis-associated cramps. The concern that post-dialysis retention of mannitol and saline may lead to increased thirst, interdialytic weight gain, and elevated blood pressure has not been validated. In a study, the three solutions were found to be equally safe and effective. Muscle cramps can be treated with 50 ml (126 mOsm) 50% dextrose water, 100 ml (138 mOsm) 25% mannitol, and 10-15 ml (~ 126 mOsm) 23.5% saline or lower concentrations as available.

**Mannitol:** It has been indicated that; mannitol infusion beneficial for reducing muscle cramps during HD via its effect on body fluids distribution. The efficacy of mannitol infusion is similar to dextrose solution and any side effects were not shown.

**Drug therapy:** Both quinine (325 mg at bedtime) and vitamin E (400 IU at bedtime) reduce the incidence and severity of leg cramps. The effect of these drugs is observed early (within 2 weeks of therapy) and has been found to be sustained in short term studies. The two drugs have similar efficacy, but is not known if their effects are additive or if subjects unresponsive to one agent respond to the other. The drug is cleared primarily by the liver and toxicity, while serious, is rare in the doses usually prescribed.

**Vitamin E:** Vitamin E (200 IU) has been recommended to taken at nights to decrease muscle cramps during HD. In a study, the frequency of muscle cramps decreased significantly during vitamin (vit) E therapy with the reduction of 68.3%. In a study, treatment with the combination of vit E and vit C was safe and effective in reducing HD cramps.

**Vitamin C:** It has been shown that vitamin C levels are lower in HD patients than in healthy controls due to their vitamin C restricted diets. Combination therapy was significantly more effective than treatment with either vitamin E or C given alone. Prolonged vitamin therapy may be associated with serious adverse effects. Vitamin C therapy is known to produce hyperoxaluria, oxalate containing urinary stones, and renal damage. The safety of prolonged therapy is evaluated in HD patients. (4)

**Quinine:** Quinine decreases the excitability of the motor end plate and reduces muscle contractility. Most patients consider quinine as beneficial for their leg cramps, but Quinine should be used in a small doses and cautiously, especially in the elderly patients with renal failure, and should be avoided in patients with liver disease. Quinine is known to have toxicity on hematologic, renal neurologic, cardiac, and endocrine systems and it is recommended as 325 mg at nights or 2 hours before HD sessions, for 10 days. (5)

**L-carnitine supplementation:** Several studies have indicated that correcting carnitine deficiency may have a salutary effect on the musculoskeletal symptoms associated with hemodialysis. A study in a large sample of long-term hemodialysis patients, showed a decrease in the incidence in intradialytic cramps with L-carnitine supplementation intravenously at the end of a dialysis session.

**Modulated dialysis:** The frequent association of hypotensive episode and the occurrence of cramps has encouraged the examination of the effects of maneuvers aimed at alleviating the former on the incidence of the latter. Sodium modeling and blood volume controlled ultrafiltration have reduced the incidence of both hypotension and muscle cramps.

**Profiling Sodium:** HD administration with decreasing Na concentration can be beneficial for preventing muscle cramps. For example, HD can begin with 146-150 mEq/L Na<sup>+</sup> and then can be reduced to 135-140 mEq/L at the end of the HD session. Higher dialysate sodium concentrations also reduce the incidence of muscle cramps with hypotension during HD. Profiling of dialysate sodium and bicarbonate also reduces cramping significantly. In a study, a significant decline in the occurrence of cramps, in the mean interdialytic weight gain and a tendency to reduce the number of hypotensive episodes were detected in patients using variable sodium profiling.

**Physiotherapy:** It is known that, immediate relief from cramp may be obtained by passively stretching the affected muscle. The use of regular stretching exercises to prevent muscle cramps was proposed before and it was concluded that, stretching of the muscle with cramp and massage can be beneficial for muscle cramps in HD patients. (6)

### **Prevention**

**Longer or more frequent treatments:** If prescribed by the doctors, extending dialysis time or receiving therapy more frequently each week can lower the UF rate, helping decrease the risk of cramping.

**Complete the dialysis sessions as prescribed:** Completing the full dialysis sessions as prescribed can help manage the fluid and prevent fluid overload.

**Manage fluid gains between treatments:** Following the plan for daily intake of liquids to prevent fluid overload, also called hypervolemia.

**Manage sodium intake:** Limit sodium (salt) intake to 2,000 mg or less. Too much sodium can make it harder for the kidneys to balance the sodium and water in the body. That can mean feeling thirsty, which can lead to fluid weight gain.

**Consider home dialysis:** Peritoneal dialysis (PD) and home hemodialysis (HHD) are home dialysis modalities that can be prescribed by the nephrologist. Because they are administered more frequently than in-centre hemodialysis, PD and HHD can help the body regulate fluid better, and may reduce the potential for muscle cramping. (7)

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. (8)

Fiona Blytone, 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 behaviour. Leg cramps during 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 relievable means of current therapies. (9)

Allen RE, Kirby KA., 2012 conducted a study regarding the effect of nocturnal leg cramps. Cramps arises mainly due to the associated conditions such as lumbar canal stenosis, hemodialysis, vascular disease and other related medical condition. Almost about 60% of the adults are affected by the muscle cramps during the bed time. The treatment modalities mainly given for muscle cramps are administering magnesium, vitamin B12, calcium channel blockers. Non-pharmacological therapies like stretching can also be used for reducing muscle cramps. By the study it is clear that nocturnal cramps are common in adults. (10)

Nocturnal calf muscle cramps are associated with substantially reduced quality of sleep and reduced physical aspects of health-related quality of life. (11)

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 effect 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.

The psychological impact of cramps is often overlooked. Patients 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. (12)

In a Cochrane review in 2012, Blyton et al. examined other non-pharmacological interventions to help cramp symptoms. These include: using night splints: avoiding heavy covers on the bed, and making changes to sleep 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 hemodialysis help to reduce and prevent the muscle cramps. (13)

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 intradialytic stretching exercise it was found that 40% had no muscle cramps, 24.4% mild and 35.6% had moderate muscle cramps. (14)

A study supported by Lekha. J. Abraham, et al. (2017) was done on the effectiveness of intradialytic stretching exercise on prevention and reduction of muscle cramps among patients undergoing hemodialysis in Coimbatore. She concluded that stretching exercise during the hemodialysis prevent the occurrence of muscle cramps and improves the quality of life among these patients. (15)

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 decreases 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. (16)

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. (17)

Hallegraeff et al. identified that nightly stretching before going to sleep reduces the frequency and severity of nocturnal leg cramps in older patients. (18)

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). (19)

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 be alleviate dialysis cramps. (20)

## II. Conclusion

In conclusion, muscle cramps during HD are important difficulties and situations disturbing the quality of life of the patients. There are many new advances to treat and prevent this common clinical problem such as minimizing interdialytic weight gain, prolonging dialysis session time to reduce ultrafiltration, using sodium profiling, and avoiding hypotension may reduce cramps during dialysis. They may be treated with bolus hypertonic saline or dextrose and local heating and massage of the cramped muscle. Prevention of cramps include use of Vitamin C, Vitamin E, and Quinine.

Night time cramps were more severe than the day time cramps.

Stretching exercise on hemodialysis reduces the prevalence of muscle cramps during hemodialysis.

Nightly stretching before going to sleep reduces the risk of muscle cramps in dialysis patients.

**Ethical Permission:** It's a review article. So no need to sort the ethical clearance.

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