

Management of Hypokalemia in Peritoneal Dialysis Patients

Potassium is the second most abundant cation in the body after sodium and the major intracellular cation. It is essential for normal cellular function and processes. Potassium balance is regulated through dietary intake, homeostasis mechanisms within the body, and elimination by the kidneys.¹ In end-stage renal disease (ESRD), hyperkalemia is frequently seen due to decreased renal excretion of potassium.² However, in peritoneal dialysis (PD) patients, continuous potassium losses via the dialysate dwells, inadequate dietary intake of potassium-rich foods, and pre-existing malnutrition may lead to the development of hypokalemia (serum potassium level < 3.5 mmol/L).³ A study of all PD patients in the province of British Columbia (BC) demonstrated that the 1-year prevalence of hypokalemia was 46% among the PD patients who had a serum potassium level checked and 26% of all PD patients were prescribed a potassium supplement.

Hypokalemia often occurs in the presence of magnesium deficiency and the two conditions together can lead to a host of serious complications including death if left untreated. Low serum potassium levels may affect neuromuscular, cardiovascular, metabolic as well as renal function resulting in skeletal muscle weakness, tetany, cramps, and in more severe cases, flaccid paralysis. Ileus, constipation and urinary retention may be seen if there is smooth muscle involvement. Cardiovascular abnormalities include electrocardiogram changes and arrhythmias, abnormal contractility, and potentiation of digoxin toxicity.⁵ Symptoms of hypokalemia may not be noted until the serum potassium level drops below 3.0 mmol/L.⁶

Hypokalemia can contribute to significant morbidity and mortality in PD patients. Although convincing clinical data is lacking, low potassium levels may be a risk factor for the development of PD peritonitis.⁷ In a study by Lee et al⁸ of 3230 adult patients with ESRD of whom 2078 were on hemodialysis (HD) and 1152 on PD, low serum potassium levels, which was defined as a level < 4.5 mmol/L, occurred more commonly in PD than in HD patients and was found to be an independent predictor of survival in overall dialysis, especially in PD patients. Thus, the authors concluded that the management of dialysis patients should be focused on reducing the risk of hypokalemia in addition to reducing that of hyperkalemia.

The first step in the management of hypokalemia is to identify and treat the underlying cause of the low serum potassium level. If the patient is on a cation exchange resin such as Kayexalate® (sodium polystyrene sulfonate) or Calcium Resonium® (calcium polystyrene sulfonate), these medications should be stopped. The dietitian should be contacted for a thorough review of the patient's dietary potassium intake. For the treatment of mild hypokalemia, i.e. serum potassium level of 3.0 to < 3.5 mmol/L, dietary intervention should be trialed first. However, for moderate-to-severe hypokalemia, i.e. serum potassium level < 3.0 mmol/L, or if the patient is symptomatic, then potassium supplementation may be required along with dietary intervention.

Non-Pharmacological Management

Non-Pharmacological Strategies (serum potassium < 3.5 mmol/L)

Refer patients to dietitian for high potassium nutrition teaching:

- Encourage inclusion of high potassium fruits and vegetables (BC Renal Basic and Advanced Potassium List)
 - <http://www.bcrenalagency.ca/resource-gallery/Documents/Potassium%20and%20Your%20Kidney%20Diet-Basic.pdf>
 - <http://www.bcrenalagency.ca/resource-gallery/Documents/Potassium%20and%20Your%20Kidney%20Diet-%20Advanced.pdf>
- Ensure patients aim for 3000 mg per day of potassium from dietary sources plus additional high potassium foods based on individualized patient needs
- Provide education on medication and food equivalents, i.e. potassium chloride 20 mEq/mmol or 1500 mg equates to the inclusion of potassium foods that total 780 mg
- Check serum potassium level after one month and move to pharmacological strategies if hypokalemia persists

Pediatric Management of Hypokalemia:

0.125-0.25 mEq/kg/dose PO BID- check potassium level in 3-5 days*

*Review potassium content in all dietary sources

Potassium chloride formulations available:

Tablet: Slow-K (8 mEq), Jamp-K (20 mEq)

Elixir: 1.3mEq/mL (KaoChlor)

Injection: 2mEq/mL

Pharmacological Management

The oral route of potassium supplementation is generally preferred. However, in the setting of severe hypokalemia, i.e. serum potassium level < 2.5 mmol/L, which may be life-threatening, especially in a patient who has known cardiac disease, intravenous potassium administration may be more appropriate.⁴ The intraperitoneal route may be considered in patients who have chronic hypokalemia and are intolerant to oral potassium supplementation.³ Oral potassium is mostly well tolerated although there have been reports of gastrointestinal-related side effects such as abdominal cramps or discomfort, diarrhea, and nausea/vomiting.

Potassium chloride (KCl) should be prescribed first-line as it is the most cost-effective potassium supplement. It is available as an 8 mEq tablet (Slow-K[®]) or a 20 mEq tablet (K-Dur[®]). KCl 8 mEq tablets are better tolerated by most patients as the size of the pills makes it easier for them to swallow than the KCl 20 mEq tablets. However, if pill burden is an issue, then the KCl 20 mEq tablets could be prescribed instead. For patients who are unable to swallow tablets whole, KCl liquid 20 mEq/15 mL or potassium bicarbonate plus potassium citrate (K-Lyte[®]) 25 mEq effervescent tablets may be ordered. K-Lyte[®] is a partial BC Pharmacare benefit subject to low cost alternative pricing whereas KCl liquid is a full BC Pharmacare benefit, therefore, if possible, KCl liquid should be trialed first. Costs of the various potassium supplements are outlined in Table 1 below.

Depending on the severity of the hypokalemia, the usual starting dose of KCl is 8-16 mEq/day (Slow-K[®]) or 20 mEq/day (K-Dur[®]) for mild hypokalemia (serum potassium level of 3.0 to < 3.5 mmol/L). For patients with swallowing difficulties, KCl liquid 10-20 mEq/day or K-Lyte[®] 25 mEq/day are possible alternatives. For patients with moderate-to-severe hypokalemia (serum potassium level < 3.0 mmol/L), KCl 16 mEq po bid (Slow-K[®]) may be prescribed or if a higher dose is required KCl 20-40 mEq po bid (K-Dur[®]) may be a better option. In patients with moderate-to-severe hypokalemia, repeat serum potassium levels should be ordered within 1-2 weeks and the dose of the potassium supplement titrated based on the bloodwork result.

Table 1: Potassium Supplement Unit Costs

Potassium Supplement	Unit Cost
KCl 8 mEq/tablet (Slow-K [®])	\$0.04/tab (Full Pharmacare benefit)
KCl 20 mEq/tablet (K-Dur [®])	\$0.22/tab (Full Pharmacare benefit)
KCl liquid 20 mEq/15 mL	\$0.63/15 mL (Full Pharmacare benefit)
Potassium bicarbonate + potassium citrate 25 mEq/tablet (K-Lyte [®])	\$0.65/tab (Partial Pharmacare benefit subject to low cost alternative pricing)

Note: pricing obtained from Macdonald’s Renal Pharmacy

References

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