PART FIVE

# Pediatrics

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# Potassium Management in Pediatric Peritoneal Dialysis Patients: Can a Diet With Increased Potassium Maintain a Normal Serum Potassium Without a Potassium Supplement?

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*Hypokalemia can result from an absence of cellular redistribution accompanied by low serum potassium levels, which can be secondary to inadequate dietary intake, external losses (for example, through the gut or skin), or renal losses. However, low serum potassium secondary to low potassium ingestion usually occurs after an extended period of low oral potassium intake. Also, increased renal potassium excretion can be the result of magnesium deficiency. As compared with pediatric patients on hemodialysis, patients on peritoneal dialysis (PD) are at increased risk of hypokalemia because of the greater filtration of potassium in PD. At the same time, 90% of pediatric dialysis patients under the age of 8 years are on PD.*

**Key words**
Hypokalemia, potassium

## Introduction

Hemodialysis (HD) patients receive dialysis treatment 3 times weekly; peritoneal dialysis (PD) patients receive daily treatment. Potassium levels in HD patients usually run within normal limits (Table I) and sometimes above 5.5 mEq/L. However, in patients on PD, serum potassium levels usually run within normal limits or below 3.5 mEq/L. In PD patients, potassium levels rarely exceed 5.5 mEq/L; such levels are usually secondary to poor dialysis.

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Hypokalemia can result from many different causes:

- Absence of cellular redistribution accompanied by low serum levels (which can be secondary to inadequate dietary intake after an extended period of low oral potassium intake)
- Malnutrition (in addition, much of the potassium in food is found in fruits and vegetables, which many U.S. children lack in their diets)
- Prolonged gastrointestinal losses (for example, from diarrhea, vomiting, or gastric suction)
- Diabetic acidosis, which draws potassium into the intracellular fluid
- Magnesium deficiency

Hypokalemia has risks and symptoms. Pediatric dialysis patients with low serum potassium may experience muscle weakness, abdominal distention, and irregular heart contractions. Hypokalemia can lead to central nervous system changes, with confusion and affective disorders. When emesis occurs without fluid replacement, the large acid losses can lead to metabolic alkalosis. Symptoms of metabolic alkalosis include labored breathing, headaches, drowsiness, irritability, nausea, and rapid heart rate.

TABLE I Serum potassium levels

| | *K (mEq/L)* |
|---|---|
| Hypokalemia | <3.5 |
| Normal | 3.5–5.5 |
| Hyperkalemia | >5.5 |

**Patients and methods**

The population for the present study consisted of 5 pediatric patients aged 3 – 18 years with a history of hypokalemia. All patients were receiving continuous cycling peritoneal dialysis. No patient had a history of diarrhea or gastrointestinal losses, and all patients reported a normal appetite. The dialysate used by these patients contained no potassium, and the dialysate electrolyte content remained constant throughout the study. None of the patients was taking a potassium supplement. Before initiation of the study, these patients did not consume a significant quantity of fruits and vegetables daily, and their daily potassium intake ranged from 780 mg to 1521 mg.

Patients and their parents were counseled on a high-potassium diet: 29 – 87 mg/kg body weight or 986 – 4273.2 mg, which is the requirement for pediatric PD patients. A meal plan was created from the Kansas *Diet Manual* (a reference of the Kansas Dietetic Association), dividing the food into categories based on content. The potassium-based food categories, which were developed before the National Renal Diet publication, were low potassium (5 – 150 mg), medium potassium (150 – 250 mg.), high potassium (250 – 500 mg), and very high potassium (>500 mg). To increase the amount of potassium consumed, portion sizes were emphasized. The meal plan encouraged 2 – 3 choices from each of the medium-potassium through very-high-potassium food lists, and 1 – 2 foods from the low-potassium food list (Table II). The high-potassium diet was reinforced on a monthly basis. Patients, together with their parents, provided their dietary recalls verbally, which the dietitian recorded monthly over a 6-month period. Serum potassium levels were monitored monthly. The Kansas *Diet Manual* was used to calculate potassium intakes from the patients' diet recalls.

**Results**

The mean daily potassium intake before counseling was 1150 mg, and the mean daily potassium intake after counseling was 1608.5 mg, for an increase in mean daily potassium intake of 458.5 mg. The food sources that contributed to the increase in potassium intake were orange juice, bananas, canned peaches, french fries, lima beans, potatoes, fruit punch. No reasons other than patient preference were identified as to why some patients increased their potassium intake more than others.

The diet recalls revealed that all patients increased their dietary potassium intake by 11% – 64%. Table III shows the results. Mean serum potassium before counseling was 3.2 mEq/L, and mean serum potassium after counseling was 4.05 mEq/L, for an overall change in mean serum potassium of 0.85 mEq/L.

This small clinic-based study indicates that, without potassium supplementation, small increases in dietary potassium can bring serum potassium levels into the normal range even if potassium intake is less than the stated requirement (986 – 4373 mg) for pediatric PD patients.

**Discussion**

All pediatric patients starting PD should be cautioned on the risks of developing hypokalemia. Using low-, medium-, high-, and very-high-potassium food lists, patients starting PD should be counseled by pediatric renal nutrition professionals concerning a high potassium diet, which should provide 29 – 87 mg potassium per kilogram of body weight,.

Some high-potassium foods are also high in phosphorous. Examples include ice cream, pudding, corn, lentils, yogurt, milk, beans (except wax and green beans), and peanut butter and nuts, all of which are popular with children. When counseling pediatric patients that have a low serum potassium (and their parents), renal professionals should caution about these foods.

Serum potassium levels that fail to increase or that continue to decrease may be the result of any of these factors:

- Noncompliance with diet
- Extrarenal losses (gastrointestinal, acidosis, excess sweating)
- Use of diuretic therapy

Alternatives to dietary management for correcting hypokalemia include increasing the potassium content of the peritoneal dialysate or recommending potassium supplements. Potassium chloride supplements such as Klor-Con (Upsher-Smith Laboratories, Minneapolis, MN, U.S.A.) or K-Dur (Key Pharmaceuticals, Kenilworth, NJ, U.S.A.) can be discussed with a nephrologist.

Once pediatric patients have achieved a normal serum potassium level, they and their parents need to be encouraged to continue compliance with a high

TABLE II Potassium content of typical foods

| *Low (5–150 mg/serving) Choose 1–2 daily* | *Medium (150–250 mg/serving) Choose 2–3 daily* | *High (250–500 mg/serving) Choose 2–3 daily* | *Very high (>500 mg/serving) Choose 2–3 daily* |
|---|---|---|---|
| Apples | Apricots, fresh | Apricots, dried | Beans |
| Apple juice | Beets | Acorn squash | (except green |
| Bean sprouts | Broccoli | Banana | and wax) |
| Blackberries | Carrots | Cantaloupe | Nuts |
| Cabbage | Catsup | Corn on the cob | Papaya |
| Eggplant | Chickpeas | Grapefruit juice | Peanut butter |
| Fruit cocktail | Corn | Kiwi | Potato, sweet |
| Grapes | Grapefruit | Lentils | Potato, white |
| Leeks | Grape juice | Oranges | Tomato sauce |
| Lettuce | Molasses | Orange juice | |
| Onions | Okra | Parsnips | |
| Plums | Peaches | Pumpkin | |
| Popcorn | Pears | Spinach | |
| Rhubarb | Pineapple | Tomato | |
| | Tangerines | | |
| | Tortillas | | |
| | Watermelon | | |
| | Zucchini | | |

TABLE III Potassium intake and serum potassium levels

| *Period (months)* | *Patients (n)* | *Before K+ intake* | | *After K+ intake* | | *Average increase in K+ intake* |
|---|---|---|---|---|---|---|
| | | *Serum K+ level (mEq/L)* | *Intake (mg)* | *Intake (mg)* | *Serum K+ level (mEq/L)* | |
| 1–6 | 5 | 3.1–3.4 | 780–1521 | 1053–2164 | 3.4–4.7 | 40% |

potassium diet. Parents of these patients need to understand that, even though their child's potassium levels are currently within normal limits, the child is still at risk for hypokalemia if potassium intake declines.

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