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Five Things to Know About. . .

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Five Things to Know About Volume Overload in Peritoneal Dialysis

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Abstract

Volume overload in peritoneal dialysis (PD) is common and associated with significant morbidity and mortality. If left untreated, it can result in premature technique failure in patients receiving PD. Practitioners should be aware of common causes and formulate a stepwise approach in the management of volume overload.

Abrégé

La surcharge volumique est fréquente chez les patients traités par dialyse péritonéale (DP) et elle est associée à davantage de morbidité et de mortalité. Une surcharge volumique non traitée peut entraîner une défaillance technique prématurée chez les patients sous dialyse péritonéale. Il est important que les praticiens connaissent les causes communes de la surcharge volumique et qu'une approche par étapes soit formulée pour sa prise en charge.

Keywords

peritoneal dialysis, automated peritoneal dialysis, dialysis, volume overload

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1. Assessment of volume status in patients on peritoneal dialysis (PD) is crucial, and at times challenging.

Volume status evaluation is primarily based on clinical assessment. The target weight in PD is set at a weight which allows the patient to be symptom-free, normotensive, and clinically euvolemic, often determined after trial and error. Use of additional technologies such as bioimpedance analysis and lung ultrasound has gained popularity, but none have shown superiority to traditional clinical assessment.[1,2] As such, these tools can be used as an adjunct rather than single accurate measurement of volume status in PD.

To date, there is no formal definition of volume overload. Expert opinion typically classifies it as a constellation of symptoms that may include gradual increase in weight, elevated blood pressure, elevated jugular venous pressures, and inspiratory crackles on examination. The absence of edema does not rule out fluid overload, especially in young patients. Conversely, peripheral edema may be seen on examination, but it is not always associated with volume overload. Peripheral edema can be seen in patients who are on high doses of medications such as dihydropyridine calcium channel blockers, especially during warmer months. In addition, patients with hypoalbuminemia such as seen in advanced liver disease may have peripheral edema without true intravascular volume expansion.

2. Volume overload is common and associated with high mortality in patients on PD.

Accounting for the limitations of bioimpendance technology, observational data from European bioimpedance studies have revealed that nearly 1 in 5 patients on PD has severe volume overload.[3] Volume overload in PD is associated with decreased quality of life and increased cardiovascular mortality.[4-6] If left untreated, volume overload may lead to technique failure and a premature transition to hemodialysis (HD).[7] This has been further supported by recent observational data demonstrating that incident patients on PD with

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Table 1. Possible Strategies to Manage Volume Overload in PD.

Causes of volume overload	Intervention
Increased dietary salt and fluid intake	• Fluid and salt restriction • Optimize glycemic control
Reduced residual kidney function	• Maximize loop diuretics • Add adjunct thiazide or thiazide-like diuretics
Inadequate peritoneal ultrafiltration	• Rule out constipation • Ensure proper adherence to prescription • Rule out catheter flow dysfunction • Rule out hernias or leaks • Optimize PD prescription with cautious increase in concentration of dextrose-based solution as needed

Note. PD = peritoneal dialysis.

volume overload are at an increased risk of technique failure within 1 year of starting treatment.[8] Therefore, practitioners should be aware that volume overload is common in patients on PD and is associated with significant negative outcomes.

3. The causes of volume overload in PD are usually due to one or a combination of the following:

- Increased dietary salt and fluid intake
- Reduced residual kidney function
- Inadequate peritoneal ultrafiltration

The development of volume overload in PD is commonly attributed to a mismatch between the removal of fluid and dietary intake of salt and/or water. In the face of volume overload, clinicians should exclude dietary salt and water indiscretion, consider reduced residual urine volume, and identify reversible drivers of inadequate peritoneal ultrafiltration. These include constipation, PD nonadherence, suboptimal PD prescription, and mechanical PD complications such as catheter flow dysfunction, hernias, or leaks, leading to intraabdominal fluid sequestration. Extrarenal causes of fluid retention should also be considered if hypervolemia persists despite PD optimization. Table 1 highlights some of the common causes and suggested interventions that could be considered.

4. Management of volume overload in PD is multifactorial

The first step in managing volume overload in PD is to counsel patients on salt and fluid restriction. Dietary sodium intake of $<$2 g (87 mmol)/day and fluid intake of $<$1.5 L/day is recommended. Although fluid restrictive strategies may be helpful in achieving negative fluid balances, they become impractical and hard on patients when recommendations are to reduce fluid intake $<$ 1 L/day. In patients with residual kidney function of $>$ 100 mL/day, high doses of diuretics should be considered to optimize fluid removal.[9] Patients can receive loop diuretics with furosemide ranging from 240 to 320 mg/day in divided doses. Metolazone, a thiazide-like diuretic, can be added to further enhance fluid removal in this population. More recently, spironolactone has also emerged as an effective add-on diuretic therapy, useful to maintain normokalemia in patients on high-dose diuretics.[10]

As an ultimate strategy, PD prescriptions can be altered to maximize the osmotic effect and by extension fluid removal. The major disadvantage is that higher concentrations of dextrose solutions may lead to prolonged glucose exposure resulting in poor glycemic control and other deleterious effects on peritoneal membrane. If longer dwells ($>$6-8 hours) are required, then icodextrin should be used as an alternative to dextrose-based solutions to improve volume status, which may potentially lead to better technique survival.[11-13]

5. Patients with acute symptomatic volume overload on PD need not be transitioned immediately to HD

Critically ill patients need not be routinely transitioned to HD. In the presence of acute symptomatic volume overload, practitioners should first attempt to maximize PD ultrafiltration using a short-term prescription of frequent continuous hypertonic solutions of 4.25% dextrose, exchanged every 3 to 4 hours, delivered via either continuous ambulatory peritoneal dialysis or automated peritoneal dialysis.[14] This therapy can be paired with high-dose diuretics to further optimize fluid removal. Of note, although icodextrin is labeled as a 7.5% solution, it should never be used for acute symptomatic volume overload as it exerts a much smaller osmotic effect on small pores compared with dextrose-based solutions, resulting in a slower rate of fluid removal.

Transition to HD modalities or hybrid PD/HD therapy should be considered if there is refractory hypervolemia or suboptimal solute clearance with PD.

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