

Scrotal Edema Secondary to Fluid Imbalance in Patients on Continuous Peritoneal Dialysis

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In addition to local causes—for example, leak of dialysate into an inguinal hernia sac or into the anterior abdominal wall through the track of the catheter for continuous peritoneal dialysis (CPD)—scrotal edema in CPD patients may result from generalized volume retention. We present 2 CPD patients with scrotal edema, illustrating the diagnosis and management of the mechanisms of volume retention.

A man with hypertensive nephrosclerosis developed isolated scrotal edema 14 months after an uneventful course of continuous ambulatory peritoneal dialysis (CAPD). After repair of a ventral hernia and of a communicating hydrocele, he started continuous cycling peritoneal dialysis (CCPD), plus 2 daytime CAPD exchanges. After 4 months, he again developed isolated scrotal edema, which decreased at night. Peritoneal scintigraphy showed no dialysate leaks, and peritoneal equilibration test (PET) revealed high-average transport with a residual volume above, and an ultrafiltration volume below, the expected range. Abdominal radiography revealed migration of the CPD catheter. Malposition of the CPD catheter with positional retention of dialysate was diagnosed. The patient was treated with nightly peritoneal dialysis and no daytime exchanges. On this regimen, ultrafiltration improved and the scrotal edema disappeared with no recurrence for 5 months, at which point the patient underwent kidney transplantation.

A man with diabetic nephropathy developed poor dialysate return, volume gain, and pronounced edema of the scrotum, penis, and both legs soon after starting CAPD. Peritoneal scintigraphy was

negative, and abdominal radiography confirmed the appropriate position of the CPD catheter tip in the right lower abdominal quadrant. PET revealed high peritoneal solute transport, appropriate residual volume, and appropriate for the transport category, but relatively low (0.1 L), ultrafiltration volume. He was treated with a change in the CPD procedure to CCPD, plus 1 daytime icodextrin exchange and instruction to reduce salt intake. This patient has remained free of scrotal edema for 6 months.

In men on CPD, scrotal edema can develop from generalized volume gain secondary to either CPD catheter malfunction or imbalance between total fluid removal and salt and water intake. Proper interpretation of PET findings is critical in the evaluation of scrotal edema not resulting from internal dialysate leaks in CPD.

Key words

Scrotal edema, ultrafiltration failure, peritoneal transport

Introduction

In men on continuous peritoneal dialysis (CPD), scrotal edema may result from several mechanisms. The diagnostic methods and management of these mechanisms vary. The clinical presentation usually determines the sequence of diagnostic tests.

The first mechanism is local. Dialysate leak through a hernia or weak point in the CPD catheter track leads to dissection of fluid into the scrotal spaces (1,2). Clinical examination is of paramount importance for the detection of hernias, but also in the assessment of the extent of the edema. With a leak, the edema is typically limited. Imaging is used to evaluate the anatomy of internal dialysate leaks (3,4). This type of scrotal edema is usually addressed with surgical intervention.

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The second broad category of conditions leading to the development of scrotal edema in men on CPD is generalized fluid retention, which can be CPD catheter-related, secondary to peritoneal transport characteristics, a result of dietary habits, or a combination of two or more of the foregoing conditions. In this case, fluid retention results from an imbalance between salt and fluid intake and peritoneal plus urinary output, and the scrotal edema is usually associated with other clinical signs of fluid retention. A detailed protocol for evaluating CPD patients with large fluid gains, based on Twardowski's peritoneal equilibration test [PET (5)], has been produced (6). Patients with retention of dialysate in the peritoneal cavity because of CPD catheter malposition or malfunction are treated by mechanical intervention on the CPD catheter (1). Patients with ultrafiltration failure or excessive dietary salt intake are treated by changing the dialytic and dietetic prescriptions (7,8).

The elucidation of the mechanism of scrotal edema development in CPD patients can be complicated. Here, we present 2 patients in whom past medical history strongly suggested local causes, but evaluation by multiple diagnostic tests disclosed causes of scrotal edema that were treated by changes in the prescription of peritoneal dialysis.

Patients and methods

Case report: patient 1

A 53-year-old man with end-stage renal disease (ESRD) secondary to hypertensive nephrosclerosis commenced chronic hemodialysis (HD) in March 2006. In April 2006, he underwent partial pancreatectomy for a pancreatic mucinous cyst. In August 2006, he underwent a second major abdominal surgery for lysis of symptomatic adhesions and placement of a peritoneal dialysis catheter.

He was subsequently started on continuous ambulatory peritoneal dialysis (CAPD) with 5 daily exchanges using 2.5-L fill volumes alternating between 1.5% and 2.25% dextrose content. For the next 14 months, he did well on this regimen. The initial PET revealed high-average transport, with appropriate residual and drain volumes (Table I). Weekly total Kt/V urea was, on three occasions, between 2.11 and 2.25.

In November 2007, this patient developed weight gain with poor return of spent dialysate and scrotal sac enlargement that decreased at night. Physical

TABLE I Peritoneal equilibration test results

Patient	Residual volume (L)	D/P creatinine (4-h)	UF volume (L)
1(a)	0.15	0.68	0.20
1(b)	0.12	0.73	0.13
1(c)	0.55	0.73	-0.12
2	0.10	0.71	0.10
Expected range (5,6)	<0.25	0.66–0.81	0.04–0.32

D/P = dialysate-to-plasma ratio; UF = ultrafiltration.

examination revealed a ventral hernia and a left inguinal hernia with communicating left hydrocele. Edema of the penis or any other site outside the scrotum was not noticed. The hernia and hydrocele were corrected surgically. The patient was treated with HD for 6 weeks and then started peritoneal dialysis with 4 nightly cyclical exchanges, 2 daytime exchanges, and a 2.5-L fill volume alternating between 1.5% and 2.25% dextrose content. The change in the CPD prescription was of his own choice. Again, a PET revealed high-average transport with appropriate residual and ultrafiltration volumes (Table I), and weekly Kt/V urea was 2.18. He did well for about 4 months on this regimen.

In April 2008, the patient had a recurrence of poor fluid drainage in the daytime, with weight gain of approximately 4 kg and scrotal swelling. Physical examination revealed scrotal edema, no edema in other areas, and no hernias. Peritoneal scintigraphy using technetium sulfur colloid (3) was performed first because of his past medical history; this test disclosed no fluid leaks. Another PET revealed high-average transport, but this time the residual volume was elevated, and the ultrafiltration volume was below the expected range. Plain abdominal radiographs showed migration of the peritoneal catheter with the tip in the right upper abdominal quadrant. Positional catheter malfunction with retention of dialysate in the upright position was diagnosed. Prescription of laxatives did not change the position of the catheter. The patient refused further manipulations and was treated with intermittent nightly peritoneal dialysis: 10 hours on a cyclical, 5 exchanges, and a 3-L fill volume. The weight gain and scrotal edema disappeared. Measured ultrafiltration volumes were appropriate, and the weekly total Kt/V urea was 1.77 and 1.71 on two occasions. No recurrence of the edema or weight

gain was observed up to September 2008, when the patient received a successful renal graft.

Case report: patient 2

A 60-year-old man with ESRD secondary to diabetic nephropathy commenced chronic HD in July 2008. In August 2008, a CPD catheter was surgically inserted without difficulty. This patient had had no prior abdominal surgeries. He returned for CPD training in September 2008, at which time it was noted that fluid infusion was uneventful, but fluid return did not occur. Abdominal radiography verified the position of the tip of the CPD catheter in the right lower abdominal quadrant and indicated the presence of a large amount of stool. Use of laxatives cleared the bowel, but did not improve drainage of the CPD catheter. Repeated instillations of tissue plasminogen activator (TPA) and heparin into the CPD catheter also failed. In October 2008, the patient underwent laparotomy with lysis of adhesions and repositioning of the CPD catheter.

Two weeks later, he started CAPD with 4 daily exchanges and a 2.5-L fill volume alternating between 1.5% and 2.5% dextrose solution. Almost from the beginning, he noticed low drain volumes and weight gain, with formation of gross swelling of the scrotum and penis that was uncomfortable. On physical examination, blood pressure was elevated (160/90 mmHg), and pronounced edema of the scrotum and penis, as well as of both lower extremities, was present.

Because of the history of catheter malfunction and repeated laparotomy with lysis of adhesions, a dialysate leak was suspected. However, peritoneal scintigraphy with technetium sulfur colloid failed to show any fluid leaks. A PET revealed high-average transport with appropriate residual and ultrafiltration volumes (Table I). The patient was then treated with HD for 3 weeks. After disappearance of the scrotal and penile edema and substantial reduction of the lower-extremity edema, which had been a chronic problem from before the onset of dialysis, the patient returned to CPD. The CPD prescription was changed to nightly continuous cycling PD, with 4 exchanges of 2.5% dextrose using a 2.5-L fill volume, plus 1 exchange of icodextrin (2 L) in the daytime. The patient also was advised to reduce dietary salt intake. Although daytime drain volumes have at times been low, the scrotal edema has not returned; however, the lower-extremity edema is still present.

Discussion

The patients reported here illustrate two points:

- First, men on CPD whose main or sole complaint is development of scrotal edema should be investigated not only for leaks of dialysate in tissues adjacent to the peritoneal cavity, but also for mechanisms of imbalance of salt and fluid intake and output. Local causes were the first to be recognized and should be considered in any patient developing scrotal edema, especially if edema is an isolated finding (9–17). However, failing to also considering other, general causes of fluid retention in the differential diagnosis may lead to mismanagement of scrotal edema in some CPD patients.
- Second, available technology should be used to investigate the cause of the scrotal edema. The clinical history and physical examination should direct the choice of whether imaging or peritoneal transport studies are conducted first. In our patients, imaging of the peritoneal cavity was performed first because the clinical histories suggested local causes. The intraperitoneal distribution of the radioisotopic indicator was normal in both patients, without fluid leaks, suggesting another mechanism of scrotal edema. It should be noted, however, that imaging techniques may fail to detect small leaks in some instances (18).

Imbalance of fluid intake and output may result in scrotal edema in CPD patients. In our patients, this imbalance resulted from malposition of the peritoneal dialysis catheter in patient 1 and from unfavorable peritoneal transport characteristics in patient 2. It should be emphasized that scrotal edema as a result of fluid imbalance is rarely the only clinical sign of volume retention (patient 1). However, in patients with volume retention, scrotal edema is usually accompanied by multiple other clinical signs (8)—as in patient 2 in the present report. Also, many men on CPD with symptomatic volume retention do not develop scrotal edema (8).

Proper use of the information provided by a PET is of critical importance in detecting the causes of volume retention. In the case of abnormally high residual volume with ultrafiltration volumes in the expected range for the peritoneal transport category (third PET in patient 1), CPD catheter malfunction

should be suspected and investigated further. If residual and ultrafiltration volumes are in the expected ranges, but the peritoneal transport category is high or even high-average (patient 2), then the fluid imbalance can be corrected by changing the dialysis prescription to a combination of short-dwell automated CPD with long-dwell icodextrin exchanges. Reducing salt intake should also be advised to these patients. Reduction in salt intake is the main treatment for patients with generalized fluid gain, low or low-average peritoneal transport category, and residual and ultrafiltration PET volumes both in the expected range. Finally, patients with ultrafiltration volume below the expected range should be investigated for either catheter malfunction or one of the causes of ultrafiltration loss (6).

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