We present here the case of a continuous ambulatory peritoneal dialysis (CAPD) patient who developed sclerosing calcifying peritonitis with gross macroscopic calcification of the small bowel, a rare and life-threatening complication of sclerosing peritonitis.

A 40-year-old female had been on CAPD for 7 years. A peritoneal biopsy during an open cholecystectomy for cholelithiasis showed sclerosing peritonitis, but the patient refused to change dialysis modality. She remained free of symptoms for 3 years, but then was admitted with cloudy effluent, abdominal pain, and referred pain to the left shoulder. A white blood cell count showed 25,000 cells/µL, and a peritoneal cell count showed 1000 cells/µL. An abdominal computed tomography scan was nondiagnostic. The patient was started on intraperitoneal antibiotics, but 3 days later she was taken for surgery because of acute abdomen.

Laparotomy revealed a tanned and thickened peritoneum and a small bowel with significant fibrosis and foci of calcification on the antimesenteric surface. Enterectomy and primary anastomosis was performed. Pathology revealed extensive mural fibrosis, calcium deposition, and localized inflammatory infiltration of the small bowel. The patient developed an anastomotic leak and, despite a second operation, died in the intensive care unit from septic shock.

Although some authors report successful outcomes in similar cases by using surgery or other treatments (parenteral nutrition, immunosuppression), or both, we urgently recommend that, if sclerosing calcifying peritonitis is diagnosed, the patient be switched promptly to hemodialysis.

Key words
Sclerosing peritonitis, ectopic small-bowel calcification

Introduction
Sclerosing peritonitis is a rare but serious complication of continuous ambulatory peritoneal dialysis (CAPD). In all patients on long-term CAPD, a variable degree of diffuse peritoneal fibrosis (“simple sclerosis”) has been documented and is usually clinically silent. In simple sclerosis, there are no histologic changes involving inflammation or severe calcification (1).

If sclerosing peritonitis ensues, the histologic picture becomes more dramatic. The basic disorder of sclerosing peritonitis is an inflammatory process that affects the parietal and visceral peritoneum diffusely. Acute and chronic inflammatory changes are both observed, and vasculopathy—including vascular occlusion and potentially vascular ossification—is evident. These processes result in a spectrum of macroscopic changes ranging from simple parietal peritoneal opacification with or without tanned peritoneum to extensive mural fibrosis of the small bowel, adhesions, or encapsulating cocoon, constituting the separate entity “sclerosing encapsulating peritonitis” (1,2). Clinical presentation includes reduced ultrafiltration capacity, dysfunctional peristalsis of the intestine, and luminal obstruction. Although rare, small-bowel perforation has also been reported (3).

Another entity with extensive peritoneal calcification occurring alone or in combination with encapsulating peritonitis has been characterized as “calcifying peritonitis” (4). Parietal peritoneum calcification is usually a prerequisite.

Here, we report a rare case of sclerosing peritonitis and small-bowel macroscopic calcium deposition.
without obvious [either macroscopic or computed tomography (CT) finding] peritoneal calcification as would be expected.

Case report

A 40-year-old woman with end-stage renal disease was admitted with fever (38.8°C), generalized abdominal pain, and referred pain to the left shoulder. The patient had been on dialysis for 12 years: 5 years initially on hemodialysis, and the last 7 years on CAPD with lactate-buffered solutions. Her medical history included systemic lupus erythematosus diagnosed 18 years earlier, an appendectomy, 2 caesarion sections, and an open cholecystectomy performed 5 years earlier. A peritoneal biopsy at the time of the cholecystectomy showed changes of sclerosing peritonitis, but the patient was still asymptomatic and chose to remain on CAPD. During the 3 years preceding admission, she had been diagnosed with secondary hyperparathyroidism (intact parathyroid hormone level 500 pg/mL), but she sustained normal serum calcium levels (9.6 mg/dL). Her serum phosphorus was 4.3 mg/dL. By a standard peritoneal equilibration test, the patient was classified as a high-average transporter. She was taking sevelamer, vitamin D, and amlodipine as an antihypertensive.

On admission, laboratory studies revealed a white blood cell count of 25,000 cells/mL with 88% polymorphonuclear cells, a serum amylase level of 118 U/L (reference 0 – 90 U/L), and a peritoneal fluid amylase of 221 U/L, with normal liver function tests.

An abdominal CT scan was performed, but was nondiagnostic. At that point, the patient’s dialysate effluent became cloudy, and so the symptoms were attributed to CAPD-related peritonitis. A peritoneal cell count showed 1000 cells/µL. It was the patient’s third peritonitis episode; the first two had been culture-negative. Oral intake was stopped, and the patient was treated initially with intraperitoneal ceftazidime, tobramycin, and vancomycin, plus intravenous cefoxitin. Three days later, the patient was still febrile, and the peritoneal effluent became bloody. The white blood cell count remained elevated (37,000 cells/mL). Acute abdomen was diagnosed, and the patient was taken for surgery.

Laparotomy revealed a tanned and thickened parietal peritoneum with macroscopic changes of sclerosing peritonitis and a bloody fluid collection. Much of the small bowel—120 cm, starting 20 cm from the ligament of Treitz—was also tanned and thickened and showed no peristalsis. The sigmoid colon and rectum showed the same macroscopic changes. The antimesenteric surface of the small bowel showed obvious calcium deposition, with crystals forming at distant foci (Figure 1). The mesentery was thickened, but no adhesions or encapsulating sheath formations were seen. There were no signs of perforation.

The most affected part of the small bowel was resected, and primary anastomosis was performed. The peritoneal (Tenckhoff) catheter was removed, and the peritoneal cavity was washed out with large amounts of normal saline. A soft drain was inserted adjacent to the anastomosis.

The patient had a dramatic recovery during the first postoperative days. A central venous line was inserted for hemodialysis. Her white blood count dropped to normal (8000 cells/mL). Unfortunately, on the 8th postoperative day, she developed an anastomotic leak and fecal peritonitis. A second operation was performed, and both ends of the small bowel were brought out as a stoma. The patient died 5 days later in the intensive care unit from septic shock.

The pathology report revealed extensive mural fibrosis, calcium deposition with macroscopic granular appearance, and localized inflammatory infiltration of the small bowel. Severe vasculopathy, with basement membrane proliferation and extensive granular deposition of calcium in branches of the superior mesentery artery, was observed. The mesentery was thickened and showed changes of acute inflammation (Figures 2 and 3).

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**FIGURE 1** Resected bowel, surgical specimen. Arrows point to areas of calcification.
Calcium deposition as a possible complication of long-term CAPD was first described in 1987 by Marichal et al. (5), and the nosological entity was separately named “calcifying peritonitis” (6). In most cases only parietal peritoneum is involved. On visceral involvement, calcification is described as plaques of calcium or eggshell calcification (6,7).

The pathogenesis of calcifying peritonitis is still unclear. However, some important predisposing factors of this ectopic ossification have been recognized (8). Sclerosing peritonitis (but not simple sclerosis) is consistently present in all cases of reported calcifying peritonitis. In sclerosing peritonitis, the inflammatory process affects the peritoneum diffusely, resulting in substitution of the normal mesothelium by an acellular band of hyalinized collagen. There is also marked thickening of microvessel walls and narrowing of the vascular lumen (2,4,8,9). As the process evolves, fibrosis may involve the outer wall of the small bowel, with eventual obliteration of the longitudinal muscle layer and the myenteric plexus. As a result, the peritoneum and the small bowel both lose their normal texture and become tanned, thickened, and wrinkled. The small intestine may lose its peristalsis and become completely dysfunctional (2).

Normal mesothelium acts as a protective barrier against all offending agents. The hypothesis for calcifying peritonitis is that, when the protection of mesothelium is lost, inflammatory or other factors may stimulate stem cells (mesoblasts) to differentiate into osteoblasts that are responsible for ectopic calcification (8). Sclerosing peritonitis was present in our patient for the last 5 years.

Furthermore, one very important pathogenetic factor both for sclerosing peritonitis and the development of calcifying peritonitis is CAPD-related peritonitis (2,8). Most patients with reported calcifying peritonitis have a medical history of multiple episodes of CAPD peritonitis, although sclerosing encapsulating peritonitis may occasionally occur in the absence of such episodes (2,10). Cox et al. reported a case of gross peritoneal calcification with no history of frequent peritonitis episodes, but with extensive sclerosing peritonitis (11). Other trigger factors that have been incriminated include the use of acetate-containing dialysate, hypertonic glucose solutions, beta-blockers, and lately, chlorhexidine in alcohol sterilizing sprays (2,4). Our patient had no history of beta-blocker administration, and she used povidone iodine as an antiseptic.

It has been postulated that secondary hyperparathyroidism plays a major role in the pathogenesis of calcifying peritonitis, which could be considered a case of ectopic calcification. A systemic calciphylaxis model has been proposed, in which tissues respond to sensitizing agents with inappropriate calcium deposition—one of the main sensitizing factors being parathyroid hormone. In some reports, patients had severe secondary hyperparathyroidism (6,7), and in one, evidence of metastatic soft tissue calcification was also present (6). However, in other cases, peritoneal calcification was not accompanied by abnormalities of calcium and phosphate metabolism (11), or the
calcium and parathyroid hormone status was unknown (3,12). Our patient sustained normal Ca and Ca×P levels, and her parathyroid hormone level was not much elevated.

Management of sclerosing calcifying peritonitis is a difficult challenge. Some authors suggest performing abdominal radiography or a CT scan as a screening test on all patients who have been on CAPD for more than 5 years (13). Verbanck et al. (3) also report the use of ultrasound (3.5 MHz curved-array transducer) to detect gross calcifications and thickening of the bowel. If such signs are detected, they suggested that the patient should be switched promptly to hemodialysis, because if calcifying peritonitis develops, the outcome is extremely poor.

Total parenteral nutrition for a variable period of time is inevitably required to avoid malnutrition and sepsis and to rest the intestine (4,12). Surgery is a late option with high morbidity. The surgeon may be faced with a last-resort decision to perform extensive and inappropriate resections and anastomoses. Removing (peeling) the calcium plaques and the fibrous sheath or adhesions (enterolysis) to reveal a healthier bowel and peritoneum may not be feasible and may result in bowel perforation. However, some authors have reported about 8 patients treated successfully with surgical enterolysis (13). Lately, immunosuppressive therapy with corticosteroids or other immunosuppressive agents has been proposed before and after surgery to avoid recurrence and further deterioration. However, more research is needed in this field.

Conclusions
Sclerosing calcifying peritonitis, although rare as a complication of long-term CAPD, is detrimental. We therefore recommend that, if sclerosing peritonitis is diagnosed, the patient should be closely monitored and promptly switched to hemodialysis.

References

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