Sclerosis Encapsulating Peritonitis in continuous ambulatory peritoneal dialysis patients: what to look for

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Authors: J. Fernandez Jara\textsuperscript{1}, C. Cardenas Valencia\textsuperscript{2}, N. Alegre Bernal\textsuperscript{1}, M. Morales Garcia\textsuperscript{2}, J. Romero\textsuperscript{2}, P. Borrego Jimenez\textsuperscript{2}, A. Villalba Garcia\textsuperscript{2}, P. Perez Martin\textsuperscript{2}, J. Cubero Carralero\textsuperscript{2}; \textsuperscript{1}Leganes/ES, \textsuperscript{2}Leganes/Madrid/ES
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Learning objectives

To present the spectrum of radiologic findings of sclerosis encapsulating peritonitis in patients undergoing continuous ambulatory peritoneal dialysis (CAPD).

Background

Sclerosis encapsulating peritonitis is an uncommon serious complication of continuous ambulatory peritoneal dialysis (CAPD).

It was first reported as a complication of intermittent peritoneal dialysis in 1980. Since then most cases have been associated with CAPD.

It occurs with an incidence of 0.9 - 7.3 % in patients undergoing CAPD, and the frequency of occurrence is related to the duration of CAPD.

The exact cause of sclerosis encapsulating peritonitis is unknown, however, multiple risks factors have been described:

- Long - term duration of CAPD
- Recurrent episodes of bacterial peritonitis
- Irritant effect of the CAPD catheter
- Various dialysis solutions (acidic, hypertonic, glucose-based, lactate-buffered, those containing plasticizers)
- Clorhexidine and formaldehyde.
- Beta-blocker therapy

It can vary from a moderate detrimental effect on peritoneal transport kinetics, to a progressive sclerosis encapsulating peritonitis, which may lead to cessation of peritoneal dialysis and to death.

"Sclerosis" refers to the progressive formation of sheets of dense collagenous tissue.
"Encapsulating" describes the sheath of new fibrous tissue that covers and constricts the small bowel and restricts its mobility.

"Peritonitis" implies an ongoing inflammatory process and the presence of a mononuclear inflammatory infiltrate within the new fibrosing tissue.

Histologic peritoneal findings are fibroconnective tissue, inflammatory infiltrates, and dilated lymphatics.

Diagnosis is made radiologically or surgically; however, it is difficult because clinical features are insidious and nonspecific.

Clinical features of sclerosis encapsulating peritonitis include:

- Loss of ultrafiltration capacity, often requiring transfer to maintenance haemodialysis, which is the most frequent clinical presentation.
- Bloody dialysis effluent
- Abdominal pain
- Nausea
- Vomiting
- Abdominal mass
- Episodes of incomplete or complete bowel obstruction
- Malnutrition

It is associated with an important morbidity and mortality primarily because of acute or subacute small-bowel obstruction, with resultant gut failure and malnutrition, sepsis, and death.

Curative treatment of established encapsulating peritoneal sclerosis is surgical excision of the thickened peritoneum and adhesiolysis. However surgery is high risk for these patients.

Occasionally, resection of nonviable bowel is necessary.

Other less effective treatment include immunosuppression with prednisolone, sirolimus or tamoxifen; more conservative measures include cessation of peritoneal dialysis and bowel rest with total parenteral nutrition.
Imaging findings OR Procedure details

The radiological diagnosis of sclerosis encapsulating peritonitis may now be confidently made on CT by identification of following illustrated findings. The main CT features are summarized in Table 1.

In this poster we present the spectrum of radiologic findings in sclerosis encapsulating peritonitis in our hospital cases from 1999 to 2010.

TABLE 1

CT FEATURES OF SCLEROSIS ENCAPSULATING PERITONITIS

1. PERITONEAL ABNORMALITIES
   1. Peritoneal thickening
   2. Peritoneal calcification
   3. Peritoneal enhancement

2. SMALL-BOWEL ALTERATIONS
   1. Bowel tethering
   2. Bowel wall thickening and calcification

3. FLUID COLLECTIONS
   a. Loculated fluid collections

1. PERITONEAL ABNORMALITIES:

In sclerosis encapsulating peritonitis, an inflammatory process affects the peritoneum diffusely, resulting in widespread peritoneal fibrosis.

Typically, mild peritoneal thickening progresses to diffuse, severe peritoneal thickening and eventually to peritoneal calcification.

a. Peritoneal thickening:

It is usually diffuse and is identified because the normal peritoneum is a fine, thin structure that becomes better delineated when it is thickened.
It is better appreciated where the intra-peritoneal organs do not lie close to the peritoneal lining. (Fig. 1 and 2)

Peritoneal thickening and enhancement may be seen with other processes, such as:

- Tuberculosis
- Calcified peritoneal carcinomatosis
- Pseudomyxoma peritonei
- Peritoneal mesothelioma

I. *Tuberculosis peritonitis* demonstrates high-attenuation ascites reflecting its high protein content, thickening and nodularity of peritoneal surfaces and omentum, often with enlarged lymph nodes with central low attenuation

II. *Calcified peritoneal carcinomatosis* demonstrates tumor nodule implantation along the diaphragmatic, hepatic, and splenic peritoneal surfaces resulting in smooth, nodular, or plaque-like thickening with contrast enhancement.

III. *Pseudomyxoma peritonei* is suggested by the presence of masses of low attenuation accompanied by ascites, with septa representing the margins of mucinous nodules, typically scalloping the liver edge. There is soft-tissue thickening of the peritoneal surface, reflecting the more solid non-mucin-producing components of the disease.

b. Peritoneal calcification

It can vary from a small focal area of calcification (Fig. 2, 3 and 4) to a fine linear pattern (Fig. 4), or more extensive conglomerate calcification (Fig. 5 and 6).

It becomes more pronounced as the disease progresses.

Peritoneal calcification is also seen in tuberculosis peritonitis, Pseudomyxoma peritonei, certain peritoneal tumor deposits, and peritoneal mesothelioma.

c. Peritoneal enhancement

It is a very subtle finding and may be easily overlooked (Fig. 2 and 7)

It is most visible when it lies adjacent to the relatively low attenuating fluid or fat.
Patient on CAPD may occasionally present with acute bacterial peritonitis, which may also cause enhancement of the peritoneum.

2. SMALL-BOWEL ALTERATIONS:

Small-bowel dilatation occurs in sclerosis encapsulating peritonitis as the sclerosed, thickened peritoneum surrounds the small-bowel loops, leading to bowel obstruction.

Varying lengths of small bowel may tightly enclose within pockets of fibrotic peritoneum. This phenomenon has been described as a "cocoon" of thickened peritoneum that traps small-bowel loops within it.

a. Bowel tethering

The small-bowel loops are often collected centrally by the encapsulating fibrotic peritoneum (Fig. 7). The diffuser inflammatory fibrotic process may progress to involve the outer aspect of the wall of the small-bowel, leading to mural fibrosis, thickening of the small-bowel wall (Fig. 8), adherent bowel loops, narrowing of the bowel lumen, and proximal bowel obstruction.

The fibrotic process may manifest as a mass of small bowel loops tethered together. Ultimately, small-bowel necrosis with perforation may occur.

b. Bowel wall thickening and calcification

It is seen occasionally in patients with sclerosis encapsulating peritonitis.

This can affect both small bowel (Fig. 8) and large bowel and tends to be a feature of more advanced cases.

Serosal or mural calcification is also seen (Fig. 1, 5 and 9).

3. FLUID COLLECTIONS:

Patient on CAPD inevitably have dialysate fluid within the abdomen and pelvis. Hence, the presence of free fluid during radiologic investigations in these patients is nonspecific.

In sclerosis encapsulating peritonitis, the fibrotic, thickened peritoneal membranes can result in loculated ascites.
In addition, the large fluid collections may contribute to the central location of the tethered small-bowel loops by way of mass effect.

a. **Loculated fluid collections**

They can be small or large and single or multiple. (Fig. 10)

There are seen in up to 90% cases.

As the small-bowel becomes involved, tethered and masslike, the tethered small-bowel may produce loculated fluid collections too.

These CT features are diagnostic of sclerosis encapsulating peritonitis in the appropriate clinical setting.

**Images for this section:**
Fig. 1: Abdominal CT shows irregular, nodular peritoneal thickening (white arrows). There is diffuse vascular calcification (black arrows). There are also peritoneal calcification and calcification of the small bowel wall (arrowhead)
Fig. 2: Peritoneal thickening and enhancement (arrow) and a focal deposit of parietal peritoneal calcification (arrowhead)
Fig. 3: Small areas of peritoneal calcification (arrows)
**Fig. 4:** Linear (black arrow) and focal areas (white arrow) of peritoneal calcification.
Fig. 5: Coronal reconstruction abdominal CT scan shows extensive and pronounced peritoneal calcification (black arrows). Note also the serosal calcification of the small bowel.
Fig. 6: Same patient as in Fig. 5. Abdominal radiograph shows multiple curvilinear calcifications (arrows) that represent peritoneal calcifications. Serpiginous calcification consistent with vascular calcification (arrowhead).
Fig. 7: Enhancing peritoneum is well demonstrated in addition to the tethered bowel posteriorly.
Fig. 8: Thickening of the small bowel wall. Note also peritoneal calcification (arrowheads) and thickening (arrow).
Fig. 9: Serosal calcification (arrowheads) of the small bowel
**Fig. 10:** Loculated fluid collection in the pelvis (asterisk).
Conclusion

- Sclerosis encapsulating peritonitis is a rare but important complication of continuous ambulatory peritoneal dialysis patients.

- It has a high morbidity and mortality due to acute or subacute small-bowel obstruction.

- Diagnosis is often late because of the nonspecific clinic. And it should always be considered whenever a patient on CAPD reports episodes of abdominal pain, nausea and vomiting

- Radiologic imaging, essentially CT, facilitate the early diagnosis and, hence, early management with withdrawal of peritoneal dialysis and peritectomy.

Personal Information

Javier Fernández Jara

Hospital Universitario Severo Ochoa

Leganés (Madrid), Spain

email: javierfernandez_jara@hotmail.com

References

