Clinical Radiology (2007) **62**, 732–737

PICTORIAL REVIEW

Computed tomography appearances of sclerosing encapsulating peritonitis

C. George*, **K. Al-Zwae**, **S. Nair**, **J.E.I. Cast**

Department of Radiology, Hull Royal Infirmary, Hull, UK

Received 17 October 2006; received in revised form 26 December 2006; accepted 10 January 2007

Sclerosing encapsulating peritonitis (SEP) is a serious complication of peritoneal dialysis (PD) characterized by thickened peritoneal membranes, which lead to decreased ultra-filtration and intestinal obstruction. Its early clinical features are nonspecific, and it is often diagnosed late following laparotomy and peritoneal biopsy, when the patient develops small bowel obstruction, which can be a life-threatening complication. However, this is changing with increasing awareness of computed tomography (CT) findings in SEP. CT can yield an early, non-invasive diagnosis that may improve patient outcome. We present a review of the CT appearances of SEP.

Introduction

Sclerosing encapsulating peritonitis (SEP) is a serious complication of peritoneal dialysis (PD) characterized by thickening of the peritoneal membranes, which leads to decreased ultra-filtration and ultimately intestinal obstruction. Previous studies have reported a prevalence of 0.54–7.3% for SEP.[1]

The early clinical features of SEP are nonspecific and are often not recognized. The diagnosis is often established at a late stage of the disease at laparotomy when the patient develops partial or complete small bowel obstruction, which is a grave complication of SEP.[2] However, this is changing with increasing awareness of computed tomography (CT) findings in SEP. CT appearances of SEP described in the literature include peritoneal thickening, peritoneal calcification, loculated fluid collections, and adherent small bowel loops.[2,3] Its presence should be suspected in patients treated by PD who develop small bowel dysfunction with associated abdominal pain and progressive loss of ultra-filtration. We present a review of the CT appearances in SEP with a brief description of the clinical behaviour and outcome of SEP.

What is SEP?

Sclerosing peritonitis as a complication of PD was first reported in 1980.[4] PD-induced diffuse peritoneal fibrosis varies from opacification and ''tanning'' of the peritoneum, which may have only a moderate detrimental effect on peritoneal transport kinetics, to a progressive SEP, which may lead to cessation of peritoneal dialysis and to death.[5] ''Sclerosing'' 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 motility; and ''peritonitis'' implies an ongoing inflammatory process and the presence of a mononuclear inflammatory infiltrate within the new fibrosing tissue.[5]

Less than 1% of PD patients develop overt SEP as manifested by combinations of intestinal obstruction, weight loss, and ultra-filtration failure.[5] The cause of chronic injury to the peritoneum that leads to peritoneal fibrosis in all PD patients is

* Guarantor: J.E.I. Cast and Correspondent: C. George, Department of Radiology, Hull Royal Infirmary, Anlaby Road, Hull, North Humberside HU3 2JZ, UK. Tel.: +44 1482 675162; fax: +44 1482 674614.

E-mail address: cheriangeorge@hotmail.com (C. George).

0009-9260/$ - see front matter © 2007 The Royal College of Radiologists. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.crad.2007.01.022

multi-factorial. Patients with recurrent or severe episodes of peritonitis over a long duration (mean duration 4.7—9.7 years[2]) of PD are particularly at risk. Other factors implicated in its cause are exposure to peritoneal catheter, various dialysis solutions (acidic, hypertonic, glucose-based, lactate-buffered, those containing plasticizers), chlorhexidine and formaldehyde, beta-blocker therapy, and sustained interleukin-1 production.[5] SEP has also been documented in the absence of the above risk factors.[5]

Diagnosis of SEP

Affected patients almost always develop a progressive loss of ultra-filtration capacity, often requiring transfer to maintenance haemodialysis. They may have bloody dialysis effluent. Clinical features of SEP include recurrent abdominal pain, nausea, vomiting, abdominal mass, episodes of incomplete or complete bowel obstruction, and malnutrition.

Ultrasound findings described in SEP include a tri-laminar appearance of the bowel wall, tethering of the bowel to the posterior abdominal wall, dilatation and fixation of small bowel loops, ascites, and membrane formation.[6] Barium studies in SEP show varying lengths of small bowel tightly enclosed in a ''cocoon'' of thickened peritoneum, proximal small bowel dilatation, and increased transit time.[6]

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

Peritoneal thickening

Peritoneal thickening is usually diffuse and is identified by the fact that normal peritoneum is a fine, thin structure, which becomes better delineated when it is thickened. It is likely to be appreciated where the intra-peritoneal organs do not lie close to, or merge with, the peritoneal lining (Figs. 1 and 2). This is seen in all cases of SEP. Peritoneal thickening and enhancement may be seen with other processes that seed the peritoneum, including tuberculosis, peritoneal carcinomatosis and pseudomyxoma peritonei. Tuberculous peritonitis demonstrates high-attenuation ascites (20—40 HU) reflecting its high protein content, thickening and nodularity of peritoneal surfaces and omentum, often with enlarged lymph nodes with central low attenuation.[7] Peritoneal carcinomatosis demonstrates tumour nodule implantation along the diaphragmatic, hepatic, and splenic peritoneal surfaces resulting in smooth, nodular, or plaque-like thickening with contrast enhancement.[8] Pseudomyxoma peritonei is suggested by the presence of masses of low attenuation accompanied by ascites, with septa representing

Table 1 Computed tomography features of SEP

Peritoneal thickening
Loculated fluid collections
Peritoneal calcification
Tethering or matting of the small bowel
Marked enhancement of the peritoneum
Calcification over liver capsule, spleen, posterior peritoneal wall and bowel
Thickening of the bowel wall

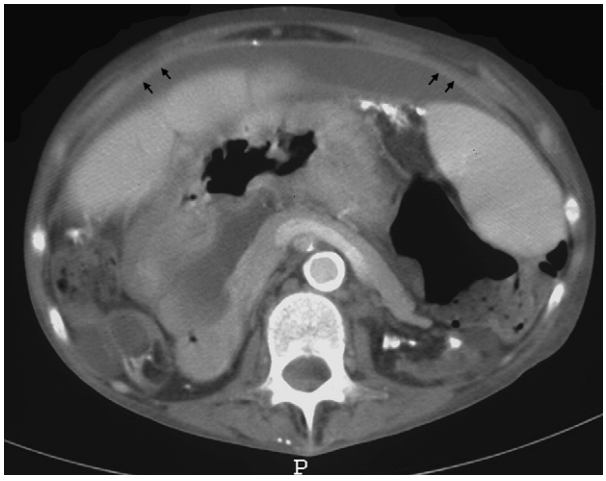

Figure 1 Peritoneal thickening (arrows) demonstrated in a 58-year-old woman on PD for 10 years with a history of multiple episodes of peritonitis who presented with ascites and abdominal pain.

Figure 2 Peritoneal thickening (arrows) in another patient on long-term PD who presented with clinical signs of peritonitis for which her dialysis catheter was removed.