

## Research Article

# Computed Tomography Findings of Peritoneal Dialysis Related Complications

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### Abstract

**Objectives:** The aim of our study is to demonstrate the computed tomography (CT) findings of peritoneal dialysis (PD)-related complications.

**Methods:** CT findings of PD-related complications of 28 patients (14 female, 14 male, mean 52.3±2.5 years, (range 34-73)) were evaluated retrospectively. Patients were examined in terms of PD catheter complications, dialysis liquid leakage, hernia, intra-abdominal collection, sclerosing encapsulated peritonitis, and perforation.

**Results:** The mean duration of PD treatment was 39,4 months (range 4-180). The ratio of complications detected in CT is 93% (n=26). Four findings were detected in 1 patient (3.5%), three findings in 10 patients (39%), two findings in 7 patients (25%), and a finding in 8 patients (28.5%). The most common finding was PD catheter malposition (n=21, 75%). Others were hernia (n=18, 64%), dialysis liquid leakage (n=14, 50%), sclerosing encapsulated peritonitis (n=2, 7%), and subcutaneous emphysema (n=1, 3.5%).

**Conclusion:** Abdominal CT is an effective imaging method to demonstrate PD-related complications. PD catheter malposition, hernia, and dialysis liquid leakage were the most common complications.

**Keywords:** Complication, imaging, peritoneal dialysis

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Peritoneal dialysis (PD) is a treatment modality in end-stage renal disease that has advantages like free mobility in daily activities, in patients with vascular access problems, diabetes and cardiovascular pathologies when compared to hemodialysis.<sup>[1-3]</sup> In PD, dialysis fluid is delivered via the catheter placed in the pelvis and the peritoneal membrane works as a dialyser.<sup>[1]</sup> PD is generally cheaper than hemodialysis, can be performed at home and short-term surveillance is equal, even higher, than hemodialysis.<sup>[4]</sup> However, in the long term, the efficacy decreases due to infectious and non-infectious complications.<sup>[2]</sup> Peritonitis, PD catheter exit site infection, tunnel infection, other complications related to PD catheter, peritoneal adhesion, hernia and dialysis fluid leakage are the most common complications.<sup>[5, 6]</sup>

Clinical findings of PD-related complications are not reliable in many patients. Because of that reason, imaging methods are frequently used for diagnosis.<sup>[7]</sup> The aim of this study is to demonstrate the imaging findings of PD-related complications with computed tomography (CT).

### Methods

Our study has been approved from the ethics committee of our hospital (TUTF-BAEK 2018/384). CT examinations of PD patients were evaluated between January 2012 and June 2018. Age and sex of the patients, and complications of PD were analyzed. PD catheter complications, dialysis liquid leakage, umbilical, ventral, inguinal, and hiatal hernias, in-

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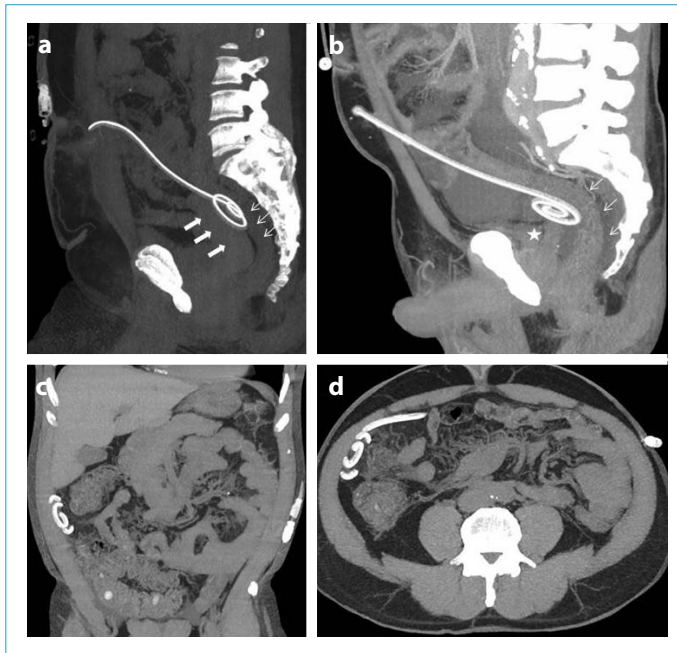
traabdominal collections, abscess, sclerosing encapsulated peritonitis, bowel and bladder perforation were investigated. CT examinations were performed with 64-slice CT scanner (Aquillon, 64-detector, Toshiba Medical Systems, Tokyo, Japan). The CT parameters were as follows: gantry rotation time, 0.5 s; section collimation, 0.5 mm; helical pitch 53; 125 mAs; and 120 kVp. CT examinations were performed in supine position without intravenous contrast material except searching for abscess. CT examinations were evaluated by a radiologist with 13 years abdominal imaging experience (EY). Images were evaluated at the PACS workstation (Picture archiving and communication system workstations, Sectra PACS IDS7 17.3, Linköping, Sweden). SPSS 16.0 for Windows program was used. Analysis of categorical data was expressed by frequency and percentage.

## Results

Twenty-eight PD patients (14 female, 14 male, mean age  $52.3 \pm 2.5$  years (range 34-73)) were evaluated. Mean duration of PD was 39.4 months (range 4-180). The ratio of complications in CT was 93% (n=26). Four findings were detected in 1 patient (3.5%), three findings in 10 patients (39%), two findings in 7 patients (25%), and a finding in

8 patients (28.5%). The most common finding in CT was catheter malposition (n=21, 75%) (Fig. 1 a-d).

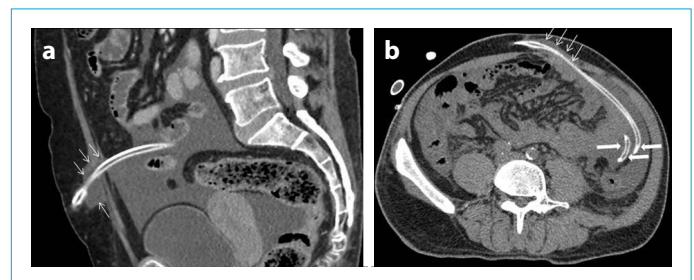
Hernia was found in 18 patients (64%). The most common type of hernia was umbilical (n=14, 50%). Others were inguinal (n=1, 3.5%), umbilical and ventral (n=1, 3.5%), ventral (n=1, 3.5%), and hiatal hernia (n=1, 3.5%) (Fig. 2). Dialysis liquid leakage was found in 14 patients (50%). Location of dialysis fluid leakage were PD catheter access site (n=7, 25%) and the previous abdominal incision area (n=7, 25%) (Fig. 3 a, b). Sclerosing encapsulated peritonitis was found in 2 patients (7%). Duration of PD of sclerosing encapsulated peritonitis patients were 9 and 15 years (Fig. 4 a-d). Subcutaneous emphysema was found in 1 patient (3.5%) (Table 1).



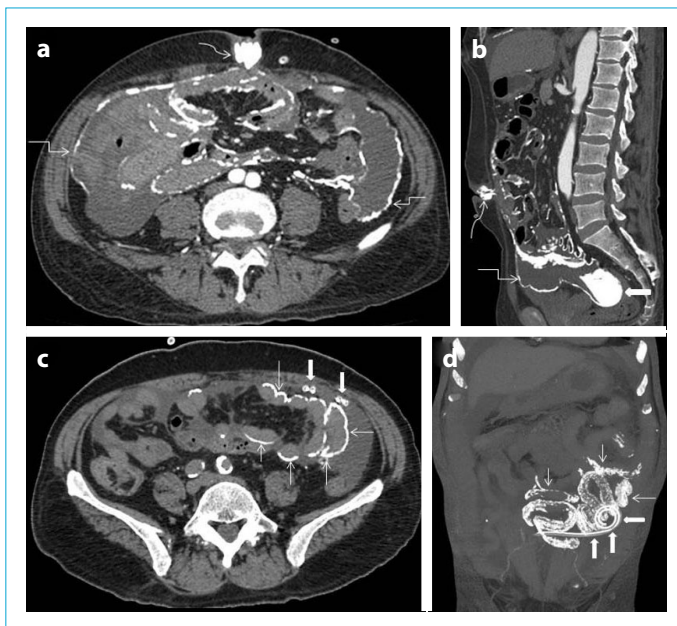
**Figure 1 (a, b).** Normal position of PD catheter. **(a)** 57 year-old female patient. The PD catheter is located between the rectum (thin arrows) and the uterus (thick arrows). **(b)** 52 year-old male patient. The PD catheter is seen between the rectum (thin arrows) and the collapsed bladder (asterisk). **(c, d)** PD catheter malposition. 52 year-old male patient. The PD catheter is seen in the subhepatic area on coronal (c) and axial (d) planes.



**Figure 2.** 66 year-old male patient. Umbilical hernia (curved arrow), ventral hernia (angled arrow) and accompanying dialysis fluid leakage (thin arrows) at the peritoneal access site of the PD catheter are easily detected in sagittal view.



**Figure 3 (a, b).** **(a)** 55 year-old female patient. Dialysis fluid leakage (thin arrows) is followed through the PD catheter. **(b)** 49 year-old male patient. Dialysis fluid leakage (thin arrows) and catheter malposition (thick arrow) are seen.



**Figure 4 (a-d).** (a, b) 60 year-old female patient with PD for 9 years. Linear calcifications surrounding the peritoneum (angled arrows), and small bowels are seen. Course calcification in umbilical area (curved arrow) and mass like calcification in rectouterine pouch (thick arrow) are detected. (c, d) 65 year-old male patient with PD for 15 years. Linear calcifications (thin arrows) surrounding the small intestine which indicate sclerosing encapsulated peritonitis and PD catheter malposition (thick arrow) are observed.

**Table 1.** CT findings of PD related complications

	Total (n=28)	Female (n=14)	Male (n=14)
Age, mean±SD	52.3±2.5	51.5±3.2	54.2±2.7
CT Findings, n (%)	26 (93)	13 (93)	13 (93)
Catheter malposition	21 (75)	10 (71)	11 (78)
Hernia	18 (64)	11 (78)	7 (50)
umbilical	14 (50)	5 (36)	9 (64)
inguinal	1 (3.5)	-	1 (7)
umbilical and ventral	1 (3.5)	1 (7)	-
ventral	1 (3.5)	1 (7)	-
hiatal	1 (3.5)	-	1 (7)
Dialysis liquid leakage	14 (50)	7 (50)	7 (50)
catheter access cite	7 (25)	5 (36)	2 (14)
abdominal incision area	7 (25)	2 (14)	5 (36)
SEP	2 (7)	1 (7)	1 (7)
Subcutaneous emphysema	1 (4)	-	1 (7)

CT: Computed tomography, PD: Peritoneal dialysis, SEP: Sclerosing encapsulated peritonitis.

## Discussion

PD-related complications are not rare.<sup>[8]</sup> Infectious and noninfectious complications may occur.<sup>[1]</sup> In a study involving 33 patients, the ratio of PD-related complications was

82%.<sup>[3]</sup> In our study, CT detected PD-related complication ratio was 93%.

Catheter malposition is migration of the tip of PD catheter to a different site than rectovesical or rectouterine pouch. This may cause inadequate dialysis, pain, fluid overload and increased risk of peritonitis.<sup>[1]</sup> PD catheter malposition can be detected with CT and the relationship with the adjacent organs can be demonstrated clearly. In our study, catheter malposition was the most common complication (n=21, 75%).

Abdominal wall hernias were detected more than 25% of patients with PD.<sup>[9,10]</sup> PD catheter access site, umbilicus, previous surgical incision area and inguinal canal are common areas of hernia.<sup>[2, 3]</sup> Although the ratio of umbilical hernia was reported as 27%, clinical findings were not found in 78% of these cases.<sup>[3]</sup> In our study, hernia ratio was found 64%. Clinical symptoms related to hernia were not detected in these patients' clinical data.

Infusion of dialysis fluid increases the pressure in the intra-abdominal cavity, and may cause dialysis solution leakage and hernias.<sup>[9]</sup> Dialysis fluid leakage is seen when the integrity of the peritoneal membrane is impaired. The most common leakage areas are anterior wall of the abdomen, access site of the catheter to peritoneum, previous incision site, and inguinal canal.<sup>[2, 3, 11]</sup> It is clinically important because it may reduce the withdrawal of the dialysis fluid, and may cause fluid overload. Clinical features and the localisation of the dialysis leakage will determine the treatment method. Leaks that develop immediately after catheter placement and small leaks are usually treated conservatively. Surgery is performed in patients who are not conservatively treated.<sup>[2]</sup> In our study, dialysis fluid leakage were seen in 14 patients (50%).

Sclerosing encapsulated peritonitis is a potentially lethal complication that requires early diagnosis and termination of peritoneal dialysis.<sup>[12]</sup> The frequency was reported between 0.9-7.3% with varying duration of peritoneal dialysis.<sup>[12,13]</sup> The development of fibrosis worsens the dialysis.<sup>[14]</sup> CT findings are contrast-enhanced thickening in peritoneum and intestinal wall, linear calcifications, thick fibrous bands, loculated fluid collections, and partial or complete bowel obstruction.<sup>[15]</sup> In the literature, it is stated that the frequency increases especially after 8 years of PD.<sup>[16]</sup> In our study, the duration of PD of 2 sclerosing encapsulated peritonitis patients were 9 and 15 years.

The main limitation of our study was retrospective design. The number of patients was somewhat small as our study was a single center experience. Another limitation is most of our patients did not have clinical correlation.

CT is a highly effective method that is often used to detect

PD-related complications. Ultrasound is especially useful in demonstrating PD catheter-related complications and hernias.<sup>[1, 17]</sup> Magnetic resonance imaging can be used in dialysis liquid leakage and hernias.<sup>[1]</sup> In our study, PD catheter malposition, hernia, and dialysis liquid leakage were the most common complications. Future prospective studies involving more patients will be helpful for rare complications.

## Disclosures

**Ethics Committee Approval:** The study was approved by the Local Ethics Committee.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – E.Y.; Design – E.Y., I.K.; Supervision – S.U., N.T.; Materials – E.Y.; Data collection &/or processing – E.Y., I.K.; Analysis and/or interpretation – E.Y., I.K., S.U., N.T.; Literature search – E.Y., I.K.; Writing – E.Y.; Critical review – E.Y., I.K., S.U., N.T.

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