# Peritoneal Dialysis and Malignancy: An Experience With a Patient Complicated by Gastric Carcinoma

Clinical Medicine Insights: Case Reports
Volume 12: 1–4

DOI: 10.1177/1179547619835176



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**ABSTRACT:** An 86-year-old man who had been treated with peritoneal dialysis for 14°months due to end-stage kidney disease secondary to hypertensive nephrosclerosis presented with a recent history of malaise, abdominal discomfort, and anorexia. An endoscopic evaluation revealed an elevated, ulcerated, and friable lesion around the lesser curvature of the stomach. The concurrent gastric biopsy specimens revealed moderately differentiated adenocarcinoma, while a cytological examination of the dialysis fluid revealed clusters of malignant cells. This is the first report illustrating a case of a Borrmann type 3 gastric cancer with synchronous peritoneal involvement in which the assessment of the disease state was aided by the cytological analysis of peritoneal effluent. Several concerns relating to this pathology are also discussed.

**KEYWORDS:** Peritoneal dialysis, neoplasms, stomach neoplasms, cytology, adenocarcinoma

**RECEIVED:** January 27, 2019. **ACCEPTED:** January 31, 2019.

**TYPE:** Case Report

**FUNDING:** The author(s) disclosed receipt of the following financial support for the research, authorship, and/ or publication of this article: This study was supported in part by a Grant-in-Aid for Research on Advanced Chronic Kidney Disease, Practical Research Project for Renal Diseases from the Japan Agency for Medical Research and Development (AMED), and by a grant for Private University Research Branding Project from the Ministry of Education, Science and Culture, Japan.

**DECLARATION OF CONFLICTING INTERESTS:** The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: TA is affiliated with an endowed department supported by Terumo Co., Chugai Pharmaceutical Co., Ltd., and Kyowa Hakko Kirin Co., Ltd. The authors report no other conflicts of interest in this work.

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## Introduction

Patients receiving chronic dialysis as a therapeutic management for end-stage kidney disease (ESKD) are potentially at an increased risk of malignancy, which often follows a locoregional pattern, with the kidney and bladder being the most common sites.[1-3] Cases of gastric cancer complicated by ESKD have been reported anecdotally.[4-6] However, whether there is any relationship between ESKD and gastric cancer remains unclear,[1-3] and there is a lack of information regarding the disease as a comorbid neoplasm, especially in patients on peritoneal dialysis (PD). In this report, we describe our experience with a male chronic PD patient whose condition was complicated by advanced gastric cancer. Several concerns relating to this pathology are also discussed.

## Case Report

An 86-year-old man who had been treated with daytime PD using single daily exchange (1 L of 1.35% glucose dialysate) with a total dwell time of 4 h for 14 months due to ESKD secondary to hypertensive nephrosclerosis was admitted to our hospital with a recent history of malaise, abdominal discomfort, and anorexia. He reported several episodes of hematochezia or tarry stool during the last 2 weeks. After the implantation of a Tenckhoff PD catheter at 85 years of age through a classic transverse surgical incision, he was exclusively treated with the procedure. As a result, his serum creatinine levels ranged from 5.04 to 5.48 mg/dL. Four months before this admission, cloudy dialysate was noted with an elevated number of leukocytes in the peritoneal fluid (1710/μL) with 80% neutrophils, 17.5% monocytes, 1% eosinophils, and 0.5% lymphocytes. At the time, cytological tests of the effluent showed no malignant cells. The patient did not manifest fever or abdominal pain, and peritoneal fluid cultures were negative for bacteria and fungi, whereas the effluent turbidity subsided and the dialysate cell count eventually dropped to <100/μL after initiating an empirical treatment with intraperitoneal meropenem. Although the leukocyte differential as well as the cell count in peritoneal effluent were not monitored on a regular basis during the observation period, we confirmed that the leukocyte counts were 28 and 46/μL at 5 and 2 weeks prior to this admission, respectively. His other medical history included asymptomatic hyperuricemia, and he had undergone conventional open cholecystectomy because of acute cholecystitis 37 years before.

At the time of admission, he was alert and oriented. His blood pressure and temperature were 164/77 mm Hg and 35.5°C, respectively. An abdominal examination disclosed mild discomfort upon deep palpation, but neither rebound tenderness nor organomegaly was noted. A laboratory evaluation revealed the following results: white blood cell count, 8800/ $mm^3$; hemoglobin, 9.7 g/dL; hematocrit, 29.3%; platelet count, $26.6 \times 10^4$/ $mm^3$; blood urea nitrogen, 117 mg/dL; serum creatinine, 6.1 mg/dL; sodium, 131 mmol/L; potassium, 5.7 mmol/L; chloride, 95 mmol/L; and a C-reactive protein level, 4.17 mg/dL. Upper gastrointestinal endoscopy performed on hospital day 3 showed an elevated, ulcerated, and friable lesion around the lesser curvature of the stomach, extending from 1 cm below the gastroesophageal junction to near the pylorus with invasion to the anterior and posterior wall of the

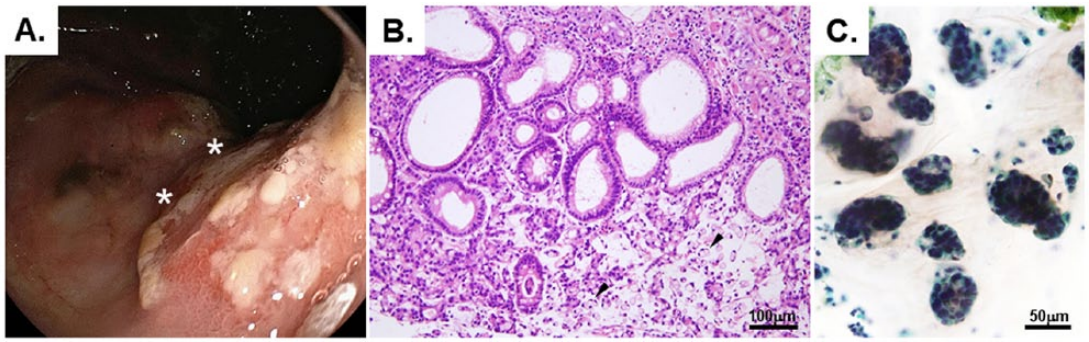


**Figure 1.** The endoscopic and pathologic findings. On the upper gastrointestinal endoscopy (A), a Borrmann type 3 lesion partially covered by whitish exudate was found in the lesser curvature of the stomach. The biopsy sites in this view are indicated with asterisks. The examination of the biopsy specimen (B) revealed moderately differentiated adenocarcinoma admixed with neoplastic cells, the cytoplasm of which was filled with clear vacuoles of mucin (arrowheads), displacing the cell nucleus to the periphery (hematoxylin and eosin staining). The cytological examination of the peritoneal dialysis effluent (C) revealed clusters of malignant cells (Papanicolaou staining). The scale bar is indicated in each panel.

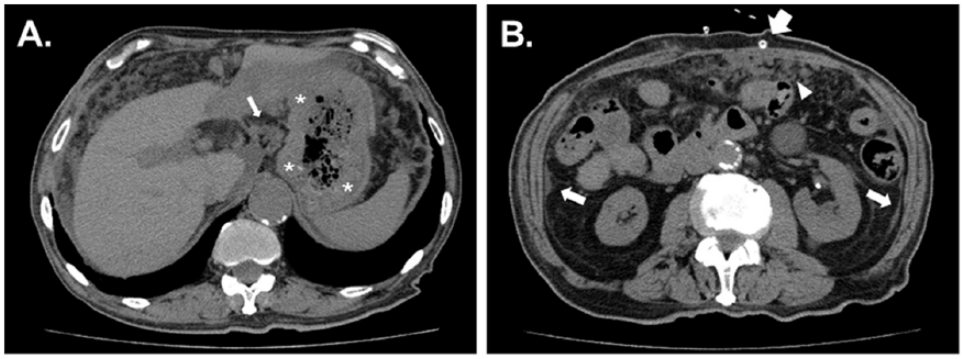


**Figure 2.** The results of the abdominal CT examination. Select images of the CT scan (A, B) revealed the thickened gastric wall (asterisks) and enlarged lymph nodes (narrow arrow) along the lesser curvature to the antrum of the stomach. A nodular soft tissue lesion in the omentum (arrowhead) and enhanced peritoneal thickening (middle arrows) were also confirmed. The PD catheter within the wall of the abdomen is indicated (wide arrow). CT indicates computed tomography; PD, peritoneal dialysis.

body, whereas concurrent gastric biopsy specimens revealed moderately differentiated adenocarcinoma (Figure 1A and B). A subsequent computed tomography (CT) examination showed the thickening of the gastric wall corresponding to the neoplastic lesion, with multiple enlarged regional lymph nodes. Small nodular lesions in the omentum and enhanced parietal peritoneum were also demonstrated (Figure 2). At this point, no cloudy effluent was observed, while a cytological examination of the clear drained dialysate revealed clusters of malignant cells consistent with adenocarcinoma (Figure 1C). Based on these findings, the patient was diagnosed with advanced-stage Borrmann type 3 gastric cancer with peritoneal dissemination. In view of this diagnosis, the patient chose to receive palliative support from a primary care professional and was discharged on hospital day 15. He died at his home 5 days later. The same PD regimen had been continued, on a family-assisted basis, until the patient's death. The post-mortem examination was not performed.

## Discussion

Peritoneal carcinomatosis of stomach origin is not an uncommon condition. Although it has been demonstrated that 14% to 43% of patients presenting with gastric cancer may have this pathology,[7,8] the present case is the first report of a chronic PD patient whose condition was complicated by gastric cancer with synchronous peritoneal involvement. The gastroscopic evaluation allowed us to diagnose the disease in a straightforward manner, while it is interesting that the assessment of the disease state was aided by the cytologic analysis of the PD effluent. Obviously, systemic studies on this topic are lacking; thus, we strongly recommend the accumulation of cases similar to our own. We believe that the evaluation of similar cases will help to not only clarify the nature of the disease but also identify patients who can benefit the most from peritoneal dialysate cytology, thereby leading to the development of optimum diagnostic strategies, including the indication of the procedure for the overall PD patient population.

Our experience with the present patient is substantially different from previously reported empirical examples, wherein culture-negative turbid dialysate with or without the elevated cell numbers provided a diagnostic clue in relation to the concurrent peritoneal neoplastic involvement,[9–12] implying that the presence of malignancy in the peritoneum may not necessarily be associated with cloudy dialysate. Alternatively, or in addition, the current case indicates that malignant cells can be

detected by peritoneal effluent cytology, even in patients with clear dialysate. However, it has been shown that the aseptic turbidity of peritoneal fluid can be ascribed to abnormal increases of either cellular or non-cellular constituents of the effluent.[13] Not surprisingly, the presence of atypical malignant cells may also play a pathogenic role in this disease state.[13] In our patient, it remains unclear whether or not the culture-negative turbid peritoneal effluent with increased polymorphonuclear leukocytes that manifested 4 months before the patient's admission was related to the stomach adenocarcinoma. Given the prompt disappearance of the cloudy dialysate after the commencement of the antibiotic treatment, we have considered the possibility of infectious peritonitis with an organism that was difficult to detect by the standard culture technique using blood culture bottles. The negative results in the present patient may be attributable, at least in part, to our failure to perform the procedure using centrifuged specimens, which has been shown to facilitate correct and prompt microbial identification.[14]

Despite a steady decline in the incidence of gastric cancer in the last few decades, it remains one of the most common malignancies and is the second leading cause of cancer mortality worldwide.[15–17] The poor prognosis of this neoplasm has been—at least in part—ascribed to the high prevalence of an advanced disease state at presentation, with up to 39% of patients harboring disseminated disease at the time of the diagnosis.[8,18,19] As a matter of fact, abdominal surgery, which was not applicable in the current case, is a reliable therapeutic option for some subsets of patients with earlier-stage disease.[16,17,19] However, this may otherwise be a matter of concern, especially in patients on PD, as an intervention that disturbs the integrity of the abdominal cavity boundaries would disrupt the regular PD schedule.[20,21] Nevertheless, we should bear in mind that the procedure can be successfully reinstituted, even after gastric resection.[22]

In the ordinary clinical setting, terminal-stage PD patients with lethal comorbidities who have a reduced functional capacity and serious difficulties in performing peritoneal exchange or frequent hospital visits are often transferred to hemodialysis, while some patients who opt for PD to maintain their personal independence may express their desire to die at home and remain on PD until the end,[23] as was seen in the present patient. Currently, there is little evidence as to feasibility and safety of continuing PD in patients with malignancies who have metastatic peritoneal involvement,[12,24] while disclosing whether there are distinct changes in the peritoneal functions during progression of the peritoneal carcinomatosis may be another prerequisite. Finally, we believe that thoroughly weighing all options and disease severity as well as the risks of complication on a case-by-case basis should still be mandatory. The accumulation of further findings will help in establishing the optimum renal replacement strategies in this population and resolving how to deal with PD patients whose pathology is life threatening in the short term, although it represents a formidable challenge in the field of nephrology.

## Author Contributions

TA drafted the manuscript. TK, KK, and SM made contributions to the acquisition of the clinical data. SM and DN provided a detailed review of the contents and structure of the manuscript, resulting in significant changes to the original document. All authors have read and approved the final manuscript.

## Informed Consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

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