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Peritoneal Dialysis-associated Peritonitis Complicated with Intestinal Obstruction

Yapu Zhang, Li Guo*

Affiliated Hospital of Hebei University, Hebei Baoding 071000

Abstract: Objective: To investigate the clinical features of peritoneal dialysis-associated peritonitis complicated with intestinal obstruction, and provide evidence for the prevention and treatment of peritonitis with intestinal obstruction. **Methods:** 11 patients with peritoneal dialysis-associated peritonitis complicated with intestinal obstruction were recruited from January 2017 to December 2022. Their clinical manifestations, laboratory tests, imaging manifestations, treatment plans and prognosis were analyzed. **Results:** Of the 11 patients, 5 were male and 6 were female; 8 had chronic glomerulonephritis (CGN) and 3 had diabetic nephropathy (DN) as the primary disease. All patients had anemia (8 cases<100g/L), elevated C-reactive protein, procalcitonin, and erythrocyte sedimentation rate, plasma albumin less than 35g/L, and potassium (9 cases hypokalemia, 2 cases hyperkalemia). The peritoneal dialysis fluid routine total leukocyte count was significantly elevated (367±157.00)×10^6 /L and the neutrophil percentage was (85.73±4.60)%; Positive cell culture of peritoneal permeate is 100%, with 4 cases of Escherichia coli, 1 case of Enterococcus faecalis, 1 case of Staphylococcus aureus, 1 case of Staphylococcus capitis, 1 case of Klebsiella pneumoniae, 1 case of Pseudomonas aeruginosa, and 2 cases of 2 were fungi. All patients were treated with abdominal plain film or abdominal CT examination, which indicated extensive pneumoperitoneum and fluid accumulation in the intestinal canal of the abdominal cavity. 4 patients had their symptoms relieved after treatment and continued maintenance peritoneal dialysis, with an improvement rate of 36.37%. 5 patients had their symptoms of peritonitis or intestinal obstruction persistently unrelieved despite active treatment, and the peritoneal dialysis catheter was removed and replaced with hemodialysis treatment, with an extraction rate of 45.46%. Two patients died, with a mortality rate of 18.18% and a total treatment failure rate of 63.64%. **Conclusion:** Enteric-derived bacteria are common causative agents of peritoneal dialysis-associated peritonitis, and patients need to be alert to the occurrence of intestinal obstruction once and in combination with hyperinflammatory state, anemia, hypoproteinemia and hypokalemia, which should be detected early and treated promptly.

Keywords: peritoneal dialysis, peritonitis, intestinal obstruction

Introduction

Peritoneal dialysis (PD)-associated peritonitis is the most common clinical complication of continuous ambulatory peritoneal dialysis (CAPD) treatment in patients.[1] In recent years, the number of cases of peritoneal dialysis peritonitis complicated by intestinal obstruction has gradually increased, We summarize the clinical data of 11 patients.

1. Data and methods

1.1 Study population

11 patients with continuous ambulatory peritoneal dialysis (CAPD)-associated peritonitis complicated by intestinal obstruction were admitted to the Department of Nephrology of the Affiliated Hospital of Hebei University from January 2017, to December , 2022.

1.2 Diagnostic criteria

Diagnosis of peritoneal dialysis-associated peritonitis According to the 2016 International Society for Peritoneal Dialysis (ISPD) guideline recommendations[2].

1.3 Clinical observation indexes

Age, gender, age of abdominal dialysis, primary disease, blood routine, blood lipids, liver function, renal function, electrolytes, C-reactive protein, calcitonin, erythrocyte sedimentation rate, parathyroid hormone, serum ferritin, routine abdominal dialysis fluid and bacterial culture and drug sensitivity test results, efficacy and regression were collected from 11 patients.

1.4 Retrieval and culture of peritoneal dialysis peritoneal fluid

When peritonitis is suspected, the peritoneal fluid is immediately retrieved (abdominal time >2h) and sent for routine and culture of peritoneal dialysis fluid respectively.

1.5 Treatment for peritonitis

Once peritonitis is diagnosed, empirical anti-infective treatment with 1st generation cephalosporins combined with 3rd generation cephalosporins is given, and those with positive culture of peritoneal dialysis effluent will be adjusted according to the drug sensitivity results, If the symptoms continue to worsen, fasting, gastrointestinal decompression and intravenous nutritional support should be given.

2. Results

2.1 General data

Among the 11 patients in the group with peritonitis complicated by intestinal obstruction, 5 were male and 6 were female; age ranged from 30 to 68 years, with an average of (58.82±10.68) years; age of peritoneal dialysis ranged from 12 to 115 months, with an average of (42.27±33.67) months; 8 cases had chronic glomerulonephritis (CGN) and 3 cases had diabetic nephropathy (DN) as the primary disease.

Table 1 Clinical data of patients

Case	Gender	Age	Primary disease	PD-Age (month)	coinfection site	Number of peritonitis	Vest	length /Days	cost /RMB
1	Male	58	CGN,	43	Lung	2	extraction, change of HD	24	56747.61
2	Male	64	CGN	26	Lung	0	good turnaround	14	22745.41
3	Female	62	DN	34	Intestinal tract	2	Good turnaround	20	35368.24
4	Female	30	CGN	42	Lung	3	Extraction, change of HD	6	25437.98

5	Female	58	DN	21	Intestinal tract	1	Death	27	21450 4.5
6	Female	47	CGN	106	Lung	1	Extraction, change of HD	20	26573. 57
7	Female	68	CGN	33	Intestinal tract	0	Good turnaround	17	27554. 67
8	Male	65	CGN	15	None	3	Good turnaround	18	26605. 89
9	Female	67	CGN	12	Intestinal tract	0	Getting better.	10	16827. 94
10	Male	63	DN	18	Intestinal tract	1	Extraction, change of HD	15	60209. 79
11	Male	65	CGN	115	Lung	2	Extraction, change of HD	23	48170. 41

2.2 Blood tests related to laboratory indicators

The patients all had anemia, elevated C-reactive protein, calcitonin, and erythrocyte sedimentation rate, plasma albumin all below 35 g/L, and blood potassium (hypokalemia in 9 cases and hyperkalemia in 2 cases).

Table 2 Patients' blood test related laboratory indexes

Cases	CRP (mg/L)	PCT (ng/ml)	Blood sedimentation (mm/h)	Blood potassium (mmol/L)	Hemoglobin (g/L)	Albumin (g/L)	Blood creatinine (μmol/L)
1	98.5	27.93	78	3.1	98	32	876
2	141	37.93	152	6.3	86	33	1712
3	106.18	12.34	67	4	92	34	967
4	98.01	8.93	89	2.5	79	23	657
5	109	10.45	121	2.9	114	34	794
6	67.9	0.87	93	2.6	80	28	813
7	57.8	0.61	69	6.7	112	34	896
8	110.2	21.99	107	2.8	111	29	819
9	130.4	27.84	75	2.7	68	16	750
10	85.9	2.17	94	3.1	78	18	769
11	79.5	0.49	149	3.1	69	23	810

2.3 Laboratory indicators related to peritonitis on peritoneal dialysis

The total number of conventional leukocytes on peritoneal dialysis fluid was significantly elevated (367±157.00) × 106 /L and the percentage of neutrophils (85.73±4.60)%; the positive rate of cell culture on peritoneal dialysis fluid was 100%, with 4 cases of Escherichia coli, 1 case of Enterococcus faecalis, 1 case of Staphylococcus aureus, 1 case of Staphylococcus capitis, 1 case of Klebsiella pneumoniae and 2 cases of fungi. 1 case, Pseudomonas aeruginosa 1 case, and 2 cases were fungi.

Table 3 Laboratory indicators related to peritonitis in patients

Cases	Abdominal dialysis fluid routine ($\times 10^6$ /L)	Percentage of neutrophils (%)	Peritoneal dialysis fluid culture
1	234	89.2	Pseudomonas aeruginosa
2	334	84.9	Klebsiella pneumoniae
3	278	83.1	Escherichia coli
4	261	80.9	Staphylococcus capitis
5	458	93.2	Escherichia coli
6	185	78.7	Candida albicans
7	497	87.4	Escherichia coli
8	678	91.1	Staphylococcus aureus
9	573	89.1	Escherichia coli
10	178	79.3	Enterococcus faecalis
11	362	86.1	Aspergillus niger

2.4 Imaging findings

All patients perfected abdominal plain film or abdominal CT examination suggested extensive pneumatization and fluid accumulation in the intestinal canal in the abdominal cavity, and gas-fluid flat was seen.

2.5 Treatment and regression

4 patients continued maintenance peritoneal dialysis with an improvement rate of 36.37%. 5 patients with peritoneal dialysis catheters were removed and replaced by hemodialysis treatment despite active treatment, with a withdrawal rate of 45.46%. 2 patients died, and mortality rate of 18.18% and a total treatment failure rate of 63.64%; The median length of stay for patients with peritonitis combined with intestinal obstruction was 17.64 d (6 to 27 d), and the median hospitalization cost was RMB 50,976.91 (RMB 16827.94 - 214504.47).

3. Discussion

In recent years, the problems encountered in the process of peritoneal dialysis have become more and more, among which complicated intestinal obstruction is a more common complication in patients with CAPD. Adequate understanding of this complication is beneficial to reduce missed diagnosis..

The causative organisms of the patients in this study: enteric-derived bacteria in 5 cases: Escherichia coli in 4 cases and Enterococcus faecalis in 1 case; enteric-derived bacterial infection can lead to intestinal barrier dysfunction, increased permeability of the intestinal mucosa, causing edema and exudation of the intestinal wall, resulting in decreased intestinal peristalsis and passage function and causing intestinal obstruction, so we should be alert to the occurrence of intestinal obstruction in peritoneal dialysis-associated peritonitis caused by enteric-derived bacteria. The remaining 1 case of Staphylococcus aureus, 1 case of Staphylococcus capitis, 1 case of Klebsiella pneumoniae, 1 case of Pseudomonas aeruginosa, and 2 cases of fungi, of which 5 patients were combined with pulmonary infection. Once CAPD patients are combined with pulmonary infection, they need to actively control the infection to avoid peritonitis, and if there are symptoms of peritonitis they should be alert to CAPD complicated by intestinal obstruction, regardless of whether there is defecation and exhaustion, they need to be promptly Improve the abdominal plain film.

All patients in this study had anemia (8 cases<100 g/L), elevated C-reactive protein, calcitonin, and erythrocyte sedimentation rate, plasma albumin below 35 g/L, and potassium (9 cases hypokalemia and 2 cases hyperkalemia), indicating that anemia, hypoalbuminemia, and hypokalemia are risk factors for peritoneal dialysis-associated peritonitis combined with intestinal obstruction[3].

Intestinal obstruction is a common clinical emergency abdominal disease. In this study, the death rate of 11 patients with peritonitis complicated by intestinal obstruction was 18.18%, and the total failure rate of treatment was 63.64%. Encapsulated peritoneal sclerosis (EPS) is a rare and serious complication in patients on long-term peritoneal dialysis, with a duration of peritoneal dialysis mostly >8 years, and early recurrent intestinal obstruction[4]. We need to focus on patients with long peritoneal dialysis age and repeated intestinal obstruction, thus improving the survival rate of patients with peritonitis.

The retrospective analysis study of this study has many shortcomings. Firstly, there may be clinical underdiagnosis; secondly, it is difficult to accurately collect the time of intestinal obstruction in all enrolled patients and cannot better analyze and summarize the factors related to the rate of disease progression; in addition, the relatively small number of patient cases and the lack of post-discharge follow-up data cannot well guide the judgment of prognosis.

In summary, enteric-derived bacteria are common causative agents of peritoneal dialysis-associated peritonitis. Once patients with peritoneal dialysis peritonitis develop nausea, vomiting, abdominal pain, abdominal distension, and combined with hyperinflammatory state, anemia, hypoproteinemia and hypokalemia, they need to be alerted to the occurrence of intestinal obstruction, and abdominal plain film or abdominal CT examination should be performed as early as possible for early detection and timely treatment.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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