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CASE REPORT

Peritonitis with *Listeria monocytogenes* in a patient on automated peritoneal dialysis

Hanna Bjarkhamar Poulsen,¹ Torkil á Steig,¹ Jonas T. Björkman,² Shahin Gaini^{1,3}

¹Medical Department, National Hospital in the Faroe Islands, Tórshavn, Faroe Islands

²Statens Serum Institut Mikrobiologisk Diagnostik og Virologi, København, Hovedstaden, Denmark

³Department of Infectious Diseases, Odense Universitetshospital, Odense, Denmark

Correspondence to

Ms Hanna Bjarkhamar Poulsen, Hanna.poulsen@rn.dk

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SUMMARY

We present a case where *Listeria monocytogenes* serotype 1/2a was determined to be the causative agent of peritonitis in a patient on automated peritoneal dialysis. The patient, a 53-year-old Caucasian woman from the Faroe Islands was admitted to the National Hospital reporting of constant abdominal pain and a fever. Peritoneal cultures were positive for growth of *L. monocytogenes*. The patient was successfully treated with oral amoxicillin for 2 weeks and intraperitoneal vancomycin for 3 weeks. To date, the patient has not been readmitted due to peritonitis. The Faroese salmon was the suspected source of infection with *L. monocytogenes*.

BACKGROUND

Peritonitis is a common complication associated with peritoneal dialysis. Though a rare occurrence, there are 11 documented cases of *Listeria monocytogenes* peritonitis in patients on peritoneal dialysis in the literature (table 1).^{1–11} This case report presents a sporadic case of *L. monocytogenes* peritonitis in a peritoneal dialysis patient from the Faroe Islands. We present this case to share useful clinical information pertaining to treatment and possible sources of infection and to highlight this rare but serious aetiology of peritonitis in patients on APD. In this case report, we use the term ‘peritoneal dialysis’ (PD) to refer to patients who have received automated PD (APD), intermittent PD or continuous ambulatory PD (CAPD).

CASE PRESENTATION

A 53-year-old Caucasian woman was hospitalised on the 10 October 2016, reporting abdominal pain that had been constant for 4 days prior to hospitalisation and exacerbated by physical activity. The patient had been on APD since 2014 due to end-stage renal disease and autosomal dominant polycystic kidney disease and was on a waiting list for kidney transplantation. The patient had never experienced dialysis-related infections or other complications before the hospitalisation described in this report.

The patient had a prior history of hypertension and psoriasis, but no history of liver cirrhosis.

In April 2016, the patient was hospitalised with pyelonephritis and was treated with intravenous cefuroxime. She was also treated empirically with intraperitoneal gentamicin (80 mg) and vancomycin (2 g), because peritonitis could not be excluded at

the time of admission. Peritoneal fluid was collected and did not show any growth, therefore the intra-peritoneal antibiotics were discontinued. The cause of the infection was not determined, but it was likely related to an infected cyst in her kidney. On the 12 April, the patient was discharged with oral ciprofloxacin.

Five months later, on the 10 October 2016, the patient was hospitalised reporting of constant abdominal pain for 4 days prior to hospitalisation. She had a 39.4°C fever, nausea and had vomited once. Her vital signs were blood pressure of 152/87 mm Hg, heart rate of 78 beats per minute and 96% oxygen saturation without supplementation.

The peritoneal fluid was cloudy and turbid and a urine test strip was positive for leucocytes. These findings raised the suspicion of peritonitis and prompted the clinician to send the peritoneal fluid for microbiological examinations. The patient’s dry body weight was 87.5 kg. At admission, the weight was 89.2 kg. The patient was treated empirically with vancomycin (2 g) and gentamicin (80 mg) intraperitoneally as in the previous hospitalisation. The patient was also treated empirically with intravenous cefuroxime 1.5 g daily and metronidazole 500 mg three times a day.

The blood cultures were negative. On 11th of October, the culturing results from the peritoneal fluid showed growth of *L. monocytogenes*. The patient previously had a reported assumed allergic reaction to penicillin from back in her childhood; the correct treatment was not started right away on the day of the positive cultures with *L. monocytogenes*. On 12 October, the patient was successfully started without any allergic reaction on an oral amoxicillin course of 1 g three times a day for 14 days. The reason for not starting the right treatment right away was that the hospital staff wanted to be prepared with anaphylaxis treatment, if the patient was to react to the amoxicillin treatment. Intraperitoneal gentamicin and vancomycin and intravenous cefuroxime and metronidazole were discontinued. The dialysis catheter was not displaced and was determined to still be functional.

Four days later, on 14 October, the patient was discharged with no abdominal pain and her peritoneal fluid was transparent without any sign of infection. The peritoneal fluid was cultured and was found without any growth. The urine test strip was negative for leucocytes and nitrites. She was seen again in the outpatient clinic where she was



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Table 1 *Listeria monocytogenes* peritonitis in patients on PD

No	Age	Sex (F/M)	Year	Clinical presentation	Dialysis	Dialysate appearance	Serotype	Comorbidity	Immune status	Antibiotic therapy	Duration of treatment	Relapse	References
1	71	F	1983	Abdominal pain	CAPD	Cloudy dialysate	Not known	ITP, ESRD	Immunosuppressed	Intravenous and intraperitoneal erythromycin and intravenous TMP/SFX (patient allergic to penicillin)	Not known	No	6
2	50	F	1989	Abdominal pain	CAPD	Cloudy dialysate	Not known	SLE	Prednisolone and azathioprine	Ampicillin and gentamicin	4 weeks	<i>Staphylococcus aureus</i> 11 months after	8
3	31	F	1989	Abdominal Pain	CAPD	Cloudy dialysate	Not known	ESRD due to SLE	Immunosuppressed	First vancomycin then ampicillin	Not known	Not known	3
4	53	M	1990	Abdominal pain	CAPD	Cloudy dialysate	Not known	Wegeners granulomatosis	Cyclophosphamide, 25 mg	Intraperitoneal ampicillin and oral pivampicillin	3 weeks	No	7
5	60	M	1991	Abdominal pain, fever	CAPD	Cloudy dialysate	Not known	CLL	Prednisolone	Oral amoxicillin and intravenous gentamicin	10 days+4 weeks	Not known	9
6	67	M	1991	Abdominal pain	CAPD	Cloudy dialysate	Not known	Cirrhosis	Immunosuppressed	Ampicillin (failure of vancomycin and gentamicin)	Not known	No	11
7	38	F	1992	Abdominal pain, nausea, diarrhoea	CAPD	Cloudy dialysate	Not known	Failed kidney transplantation	Immunosuppressed	Tobramycin and ampicillin	2 weeks	No	10
8	64	M	1994	Abdominal pain	CAPD	Cloudy dialysate	Not known	Polymyositis	Immunosuppressed	Intraperitoneal vancomycin+gentamicin failed, then intraperitoneal ampicillin and gentamicin	Not known	No	4
9	28	F	2002	Abdominal pain, nausea, conjunctivitis	CAPD	Cloudy dialysate	Not known	SLE	Immunosuppressed	Intraperitoneal cephalosporins and ampicillin	3 weeks	No	1
10	38	F	2003	Fever, septic shock	CAPD	Cloudy dialysate	Not known	SLE	Prednisolone 5 mg and azathioprine 50 mg	Intravenous ampicillin and amikacin	4 weeks	No	5
11	Not known	Not known	2012	Not known	Not known	Not known	Not known	Not known	Not known	Ampicillin, amoxi-clavulanic acid and vancomycin	Not known	Not known	2
12	53	F	2016	Abdominal pain, fever, nausea and vomit	APD	Cloudy dialysate	1/2a	ADPKD	Prednisolone 7.5 mg	Oral ampicillin and intraperitoneal vancomycin	2 weeks+ intraperitoneal 3 weeks	No	Present case

APD, ambulatory peritoneal dialysis; ADPKD, autosomal dominant polycystic kidney disease; CAPD, continuous ambulatory peritoneal dialysis; CLL, chronic lymphocytic leukaemia; ESRD, end-stage renal disease; F, female; ITP, idiopathic thrombocytopenic purpura; M, male; PD, peritoneal dialysis; SFX, sulfamethoxazole; SLE, systemic lupus erythematosus; TMP, trimethoprim.

treated with intraperitoneal vancomycin (2g) once a week for 3 weeks.

The National Danish Reference Laboratory for Clinical Microbiology (Statens Serum Institute in Copenhagen, Denmark) reported the isolate to be an *L. monocytogenes* serotype 1/2a and Multilocus Sequence typing (MLST) type ST91.

OUTCOME AND FOLLOW-UP

To date, the patient has not been readmitted due to peritonitis. The patient was controlled regularly by taking blood samples every fourth week for the next few months in the outpatient clinic.

DISCUSSION

This report highlights that *L. monocytogenes* is one of the rare micro-organisms that can cause peritonitis in patients on PD and represents the first known case of *L. monocytogenes* in a peritonitis case at the National Hospital in the Faroe Islands. While the route of infection in this patient was not established, the patient admitted lack of proper hand washing hygiene after eating or preparing food. Six days prior to the hospital admission, the patient ate Salmon but did not practice proper hand washing. Following the meal, she experienced abdominal pain while another family member who shared the salmon experienced diarrhoea and vomiting.

The patient had a history of psoriasis and presented with an itchy rash around the dialysis catheter. Psoriasis is an inflammatory skin disease and is characterised by the compromised epidermal barrier function, similar to atopic dermatitis.¹² Thus, a compromised skin barrier combined with poor hygiene could be a possible route of infection in our patient. The patient was in treatment with 7.5 mg of oral prednisolone daily to treat her psoriasis.

Table 1 summarises 12 cases of *Listeria* peritonitis in patient on PD, 11 reported in the literature and the case we discuss in this report. Ten out of the 12 cases experienced abdominal pain and 11 out of the 12 cases reported cloudy dialysate. None of the cases experienced relapse. Our case report is the only one on APD. Serotypes from these cases are not known. The average patient age was 50.3 with a range from 28 to 71 years. Seven patients were females (63.6%) and four were males (36.4%). All patients had at least one underlying illness.

L. monocytogenes is a non-sporulating, motile Gram-positive rod. It is one of the micro-organisms routinely considered when diagnosing a foodborne disease. It is known for its ability to thrive and grow over a wide temperature range and is capable of surviving food-processing technologies that rely on salty conditions.¹³ In addition, *L. monocytogenes* has the capability to form biofilm.¹⁴ Unlike other pathogens, *L. monocytogenes* can continue to multiply at low temperatures, allowing for the growth of *L. monocytogenes* even in refrigerated foods.¹³

Sporadic cases of listeriosis can often be associated with consumption of contaminated food such as uncooked or non-reheated hotdogs (frankfurters), undercooked chicken, soft cheese or delicatessen foods. Drinking unpasteurised milk and eating pate are also a potential food source of *L. monocytogenes*.¹³ Non-food related exposures associated with an increased risk of sporadic listeriosis included recent use of antacids, laxatives or H₂-receptor antagonists.¹⁵

Clinical manifestations can vary from gastroenteritis to sepsis, meningitis, rhombencephalitis, perinatal infections and abortions. In recent years, an increasing rate of listeriosis has been reported in several European countries.¹³

Table 2 The antimicrobial susceptibility results from the peritoneal fluid

Antibiotics	Results
Meropenem	S
Penicillin	S
Sulfamethoxazole/trimethoprim	S
Erythromycin	S
Ampicillin	S
Cefotaxime	R
Gentamicin	S

In our case report, the patient's fluid culture was serotyped 1/2a, which is usually suggestive of a good prognosis. On a global scale, serotype 1/2a, 1/2b, 1/2c and 4b are the most common serotypes, of which 1/2a, 1/2b and 4b cause 95% of human cases of listeriosis worldwide.¹⁴ However, in many countries, there has been a shift from serotype 4b to 1/2a and 1/2b (Bjorkman JT, unpublished data, 2016), while in the Scandinavian countries, the 1/2a and 1/2b serotypes have been the major serotypes for many years.¹⁶ Of note, the 1/2a is still the most common *L. monocytogenes* serotype associated with genetic clusters in Denmark, though this is not necessarily found as the most common serotype associate with confirmed outbreaks.

The drug of choice for *L. monocytogenes* infection is considered to be penicillin/ampicillin with or without aminoglycoside.¹ Aminoglycosides may cause renal failure in up to 30% of patients with cirrhosis. Cephalosporins are not recommended for *L. monocytogenes*.¹⁷ However, the duration of therapy has yet to be established. In our case report, the duration of treatment ranged from 10 days to 4 weeks without any known relapse of *L. monocytogenes* -related infection (table 1). The antimicrobial susceptibility results from our case are shown in table 2.

The most frequent agents causing peritonitis in patients on peritoneal dialysis worldwide are Gram-positive cocci such as *Staphylococcus epidermidis* and *Staphylococcus aureus*.² The risk of infection depends on several factors including age, sex (female), diabetes, heart failure, pulmonary disease, anaemia and low-serum albumin level.² In addition, risk factors for bacteraemia and neuroinfection with listeriosis have also been reported to include old age, immune defects, cancer, HIV, cirrhosis, diabetes mellitus, alcoholism and immunosuppressive therapies.¹⁷ A retrospective analysis of 330 patients over a 5-year period showed that hypoalbuminaemia, inadequate education and exit site infection are significant risk factors for PD-associated peritonitis.¹⁸ Of importance to the case we present here, our patient was anaemic (6.9 mmol/L, reference range 7–9.5 mmol/L) at the time of hospital admission, had hypoalbuminaemia (33 g/L, reference range 35–52 g/L) during the hospitalisation. Therefore, our patient had four risk factors (hypoalbuminaemia, anaemia, female sex and age), which indicated that our patient was at a higher risk for developing PD-associated peritonitis.

The Food and Veterinary Agency in the Faroe Islands did not identify any specific food source, which could have caused the patients symptoms. They reported previously having found two *L. monocytogenes* serotypes 1/2a and 4b at a Faroese Salmon Processing Factory, which could implicate the salmon as a potential causative agent of the *L. monocytogenes* peritonitis.

Statens Serum Institute (SSI) in Denmark reported 39 other cases of infection with *L. monocytogenes* in 2016 in Denmark (an incidence 0.68/100,000). Two of these cases also had the same ST91,¹⁹ but detailed typing from SSI showed that the

isolate from this patient was not similar to any other isolated in the period. In general, ST91 is a rare type in Denmark with 1.6% of all human cases in the period 2013–2016. Furthermore, this ST has not been found in any food isolates in Denmark. For this reason, there was no indication for any cohesion between the three ST91 cases. Thus, they did not investigate the case further.

The manufacturer Fresenius Medical Care, which manufactured the solutions APD Balance 1.5%, APD Balance 2.3% used in this case, Baxter which manufactured the Extraneal APD were contacted and did not report any other cases with listeriosis using their products.

In summary, *L. monocytogenes* is a rare aetiological cause of PD-associated peritonitis seen in patients on PD. It usually occurs in patients who are immunosuppressed, which is exemplified by our case report of a woman awaiting kidney transplant with in treatment for comorbid autoimmune disease. Peritonitis must be suspected in all patients with abdominal pain and cloudy dialysate. Less than 4% of patients with PD-associated peritonitis have a fatal outcome in each episode of PD-associated peritonitis.² If treated early and adequately, the prognosis is usually good. As discussed in Charlier *et al*, ongoing cancer, multiorgan failure, decompensated comorbidity, monocytopenia or concomitant bacteraemia for neurolisteriosis are strong risk factors for mortality.¹⁷

For this patient, a foodborne contamination by Faroese salmon was suspected but not verified epidemiologically or microbiologically.

Learning points

- ▶ *Listeria monocytogenes* is usually known as a pathogen-causing sepsis and/or meningitis.
- ▶ This report reminds clinicians about *L. monocytogenes* has a rare aetiological cause of peritoneal dialysis (PD)-associated peritonitis seen in patients on PD who report abdominal pain, present with a fever and have turbid dialysate on inspection.
- ▶ Proper hygiene is crucial when changing the dialysis catheter. The patient should be properly educated in maintaining an acceptable level of hygiene during routine use.
- ▶ The drug of choice for *L. monocytogenes* infection is considered to be penicillin/ampicillin with or without aminoglycoside. However, there is no general antibiotic duration for *L. monocytogenes* peritonitis, and choice of treatment protocol should depend on clinical picture and regression of the infection.

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