



Case report

Paracoccus yeei as a cause of peritoneal dialysis peritonitis in the United Kingdom

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ABSTRACT

Introduction: *Paracoccus yeei* is a Gram-negative coccobacilli which is often an environmental organism. However, infection of patients usually with underlying immunosuppression has been described in the last decades, mainly due to the emergence of diagnostic molecular methods.

Case presentation: We describe here a case of *P. yeei* peritonitis in a patient undergoing peritoneal dialysis. Turbidity of the peritoneal dialysate was the sole clinical manifestation. Inflammatory markers were not raised. A peritoneal fluid specimen showed increased white-cell count, but no organisms were seen on Gram stain. MALDI-TOF mass spectrometry identified *P. yeei* as the infectious agent. Patient was successfully treated with gentamicin. Minimum inhibitory concentration analysis suggested *P. yeei* to be sensitive to aminoglycosides and specific betalactams but not to ciprofloxacin and ceftazidime, in line with previous literature.

Discussion: This case of *P. yeei* peritoneal-dialysis peritonitis contributes to accumulating evidence on the emergent role of this organism as a relevant human pathogen. It also provides information about antibiotic resistance patterns that helps to guide therapy more specifically and effectively.

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Introduction

Peritoneal dialysis (PD)-related infection is a common complication, which includes catheter exit-site infections, catheter-tunnel infections, and peritonitis, although it carries a low mortality of <5% [1]. Unfortunately, these infections have high morbidity and occur with the frequency of 0.24–1.66 episodes per patient-years [2]. This may lead to patient transfer to haemodialysis, with possible reduced quality of life and increased costs to health systems to follow [3,4]. Both Gram-negative (mostly *Pseudomonas aeruginosa*) and Gram-positive (staphylococcal and enterococcal) organisms are recognised PD-peritonitis aetiologies [3,5]. However, unusual aetiologies are described in the literature as case reports due to their rarity of presentation. We describe a case of PD-peritonitis caused by *Paracoccus yeei*, a Gram-negative coccobacillus, which has been described previously only four times as a causative agent of PD-peritonitis [6–9], and review the current available literature.

Case description

An 81-year-old female with end-stage renal failure secondary to type-2 diabetes mellitus had been on continuous ambulatory peritoneal dialysis (CAPD) since 2007. She was seen at the PD unit on 13th November 2017 reporting cloudy peritoneal fluid. She had one-day history of turbid PD fluid in absence of fever or abdominal pain. On examination, she looked systemically well, was afebrile and the abdomen was soft and non-tender. The peritoneal catheter exit site was clean and dry with no clinical signs of infection. Microscopic examination of the peritoneal fluid showed $105 \times 10^6/\text{L}$ white cells with $15 \times 10^6/\text{L}$ red blood cells. Eosinophil count was $<1 \times 10^6/\text{L}$. Gram stain showed no organisms. Peripheral white-blood cell count was $8.9 \times 10^9/\text{L}$, neutrophil count $7.2 \times 10^9/\text{L}$, CRP 10.9 mg/L. She was treated on clinical grounds as PD peritonitis with empirical intraperitoneal antibiotics (gentamicin 80 mg and vancomycin 1 g) to cover for Gram-negative and Gram-positive organisms. The patient was managed as an outpatient. She received the standard two weeks' therapy for an uncomplicated PD peritonitis and made a full recovery with no further related infective episodes.

Peritoneal fluid was cultured on Columbia blood agar (CBA) and chocolate agar under aerobic (room-air and 5% CO₂ at 37 °C) and anaerobic conditions. After 48 h, aerobic growth was noted on CBA of round –raised colonies of mucoid, shiny brownish appearance

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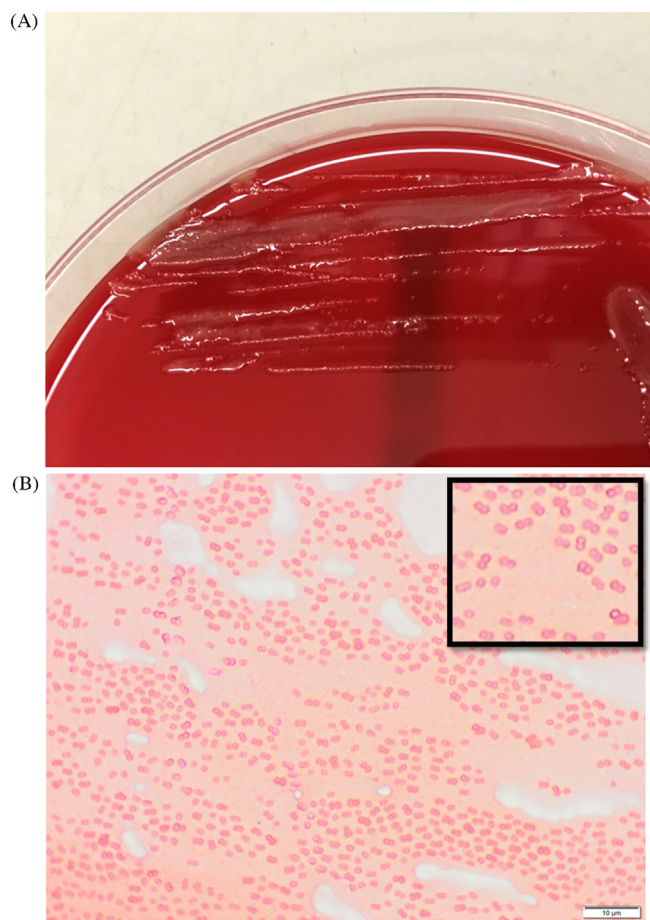


Fig. 1. (A) Growth of *Paracoccus yeei* colonies on Columbia blood agar. Note the presence of raised colonies of mucoid, shiny brownish appearance. (B) Gram stain of *Paracoccus yeei*. Note the presence of coccobacilli arranged in pairs and with peripheral Gram negative staining ("O" appearance). Inset shows a magnified image of the Gram stain to illustrate the "O" staining appearance.

that were oxidase and catalase positive (Fig. 1A). No anaerobic growth was seen. Gram stain showed Gram-negative coccobacilli arranged in pairs, with peripheral staining ("O" appearance), as described previously [6] (Fig. 1B). Identification was performed using MALDI-TOF mass spectrometry (BioMerieux, UK Ltd), with 99.9% accuracy. Confirmation was done by Public Health England, Colindale, London, UK using 16S rRNA sequencing with sequence data provided by the Bacterial Identification Service (BIDS) at the Antimicrobial Resistance and Healthcare Associated Infections reference unit (AMRHAI), Colindale.

Minimum inhibitory concentrations (MIC) using broth microdilution were performed at the AMRHAI (Table 1). Because no *P. yeei* interpretative criteria for sensitivity testing have yet been published, amikacin, gentamicin and tobramycin clinical breakpoints used for *Pseudomonas* and *Acinetobacter* spp were applied as per European Committee on Antimicrobial Susceptibility Testing (EUCAST) [10]. PK-PD (Non-species related) breakpoints suggested by EUCAST Clinical Breakpoint Table v.8.1(15/05/2018) were used for the remaining antibiotics [10]. These breakpoints are used only when there are no species-specific breakpoints or other recommendations in the species-specific EUCAST tables. Based on the above and on the *P. yeei* MICs obtained, sensitivity may be inferred for amikacin, gentamicin, tobramycin, piperacillin/tazobactam, imipenem and meropenem. Aztreonam, ceftazidime and ciprofloxacin fell in an intermediate categorisation (Table 1).

Table 1

Paracoccus yeei antibiotic minimal inhibitory concentrations (MIC) and sensitivities based on breakpoint.

Antibiotic	MIC (mg/L)	Breakpoint (mg/L)		S/R/I
		S≤	R>	
Amikacin ^a	0.25	8	16	S
Gentamicin ^a	2	2	4	S
Tobramycin ^a	0.25	2	4	S
Aztreonam ^b	8	4	8	I
Ceftazidime ^b	8	4	8	I
Imipenem ^b	0.016	2	8	S
Meropenem ^b	0.008	2	8	S
Piperacillin/tazobactam ^b	2	4	16	S
Ciprofloxacin ^b	0.5	0.25	0.5	I

^a as per *Pseudomonas* and *Acinetobacter* spp breakpoints [10].

^b PK-PD (Non-species related) breakpoints [10].

Discussion

We present a case of PD peritonitis caused by *P. yeei*. This is a non-motile, -oxidase and -catalase positive Gram-negative aerobic coccobacilli, which occur in soil, and natural and artificial brines [6]. Detection and identification of microorganisms from tissue samples using molecular technology have increased the number of rare and unusual bacteria that cause clinically important human infections. The first PD peritonitis case attributed to *P. yeei* was isolated from a peritoneal dialysate sample dating back to 1988, which was initially identified as EO-2 (eugenic oxidiser-2) [6]. Daneshvar et al characterised this EO-2 organism in 2003, which they renamed as *P. yeei* [6]. There have since been sporadic cases of *P. yeei* infection involving different body systems such as three cases of PD peritonitis (France [9], Australia [7], and Spain [8]), and cases with cornea [11] and myocardium [12] involvement, as well as cases of cirrhosis-associated bacteraemia [13], and skin bullous lesions-associated bacteraemia [14]. The latter, published by Funke et al in 2004, isolated the *P. yeei* from skin bullous lesions and peripheral blood. Here, it was molecular tests rather than routine biochemical laboratory tests, which identified *P. yeei* as the causative agent, the same as that characterised from EO-2 isolates by Daneshvar et al.

A constant finding in the scarce literature about this organism as a clinical infectious agent is its low pathogenicity; patients had indeed signs of infection, but they were not overtly septic, and responded promptly to antibiotic therapy. Of note, patients in all the cases published so far had some degree of immunosuppression [6–9,11–14], suggesting that combination of low bacterial pathogenicity with host immunosuppression, in association with environmental factors might be necessary for infection to succeed. Our patient had end-stage renal failure, which in itself, dampens immune responses, and had an indwelling PD catheter. She did not need hospitalisation and responded swiftly to intraperitoneal gentamicin. Our data show low MICs for aminoglycosides, although also suggest that treatment with piperacillin/tazobactam or meropenem would also have been acceptable. Aztreonam, ceftazidime and ciprofloxacin would not have been antibiotics of choice. Wallet et al, published similar MICs for aminoglycosides and imipenem but higher MIC values for piperacillin/tazobactam and ciprofloxacin [9]. This is important, because Wallet et al's findings and ours suggest that selection of antibiotic therapy to treat infection by *P. yeei* is not a straightforward exercise, although aminoglycosides seem to be a good empirical choice to start with. Of note, some empirical protocols use ciprofloxacin to treat PD peritonitis, to which our isolate was resistant. This emphasises the importance of determining the precise aetiology of infection together with its sensitivity profile, so a targeted and more effective therapy, as well as better antibiotic stewardship, are used.

Publishing this case is important because it increases our knowledge of this rare bacterium as a new pathogenic agent. It is

likely that *P. yeei* has been related to unidentified infection in the past, but it is only recently with the help of new diagnostic techniques, i.e MALDI-TOF mass spectrometry, and PCR and DNA sequencing, that we are now able to fully identify and characterise this organism. *Increasing the number of publications on P. yeei, contributes to a better understanding of disease processes in different clinical scenarios, in particular when the literature about this pathogen is, on its own, scarce. This pathogen mainly affects immune suppressed patients and its detection and identification is important for an effective and targeted treatment, and swift recovery.*

Conclusion

P. yeei is an environmental opportunistic Gram-negative organism which, although not highly pathogenic, is capable of producing significant morbidity. Antibiotic susceptibility is wide but resistance to specific antibiotics is observed, therefore timely recognition of this resistance is important for decreased morbidity and better outcomes.

Author statement

We, the authors of the present manuscript entitled “*Paracoccus yeei* as a cause of peritoneal dialysis peritonitis in the United Kingdom”, which has been submitted for publication to the journal ID Cases, confirm that both contributed equally to the conception and design, data acquisition, and analysis and interpretation of the data. We both contributed equally to the drafting and revision of the article and agreed to the final version of the submitted manuscript.

We both agree to be accountable for all aspects of the work related to the accuracy or integrity of any part of the work.

Authors contribution

Both authors contributed equally to the conception of the study, data acquisition and interpretation, as well as writing and editing of the manuscript.

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Ethical approval

This work did not need ethical approval since information used about the patient's case was completely anonymised.

Declarations of interest

None.

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