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CASE REPORT

Septic Shock, Renal Abscess, and Bacteremia Due to *Peptoniphilus asaccharolyticus* in a Woman with Nephrosis and Diabetes Mellitus: Case Report and Literature Review

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Abstract: *Peptoniphilus asaccharolyticus* is a Gram-positive anaerobic coccus, which forms part of the normal flora and the human commensals of the skin, genitourinary system, and gut. It can cause opportunistic infections in immunocompromised patients and is frequently isolated as part of polymicrobial spectra. Severe monomicrobial infections caused by the genus rarely occur. In this study, we report on septic shock, renal abscess, and bacteremia due to *P. asaccharolyticus* in a woman with nephrosis and diabetes mellitus. To the best of our knowledge, this report is the first to describe *P. asaccharolyticus* isolated from both renal abscess and blood cultures purely. The underlying diseases of the host and the removal of the double J tube were significant predisposing factors in this infection.

Keywords: *Peptoniphilus asaccharolyticus*, septic shock, renal abscess, bacteremia, immunocompromised

Introduction

Peptoniphilus spp., which are among the most important Gram-positive anaerobic coccus (GPAC) genera, are normal microbiota of the human body.[1] They can cause opportunistic infections and have been commonly associated with diabetic ulcers, chronic wounds, and bone and joint infections.[2] *Peptoniphilus* spp. have often been overlooked since the genus is mostly isolated from polymicrobial infections.[3] Severe mono-infections caused by the genus rarely occur. In this report, we describe a case of septic shock, renal abscess, and bacteremia due to *P. asaccharolyticus* in a middle-aged woman. The patient had a history of nephropathy, diabetes mellitus, and hypertension. A double J tube had been removed shortly before infection. To the best of our knowledge, this study is the first to describe *P. asaccharolyticus* isolated from both renal abscess and blood cultures purely. We need to be alert to the fact that this opportunistic GPAC can cause severe monomicrobial infections when induced by host factors, and the importance of anaerobic culture should be appreciated. Written informed consent was provided by the patient to allow the publication of the case details. This study was approved by the Ethics Committee, Jiangsu Province Hospital.

Case Report

A 49-year-old woman presented with low back pain, fever, and spiritlessness to the emergency department of Jiangsu Province Hospital on May 20, 2021. She had controlled diabetes mellitus and hypertension, in addition to a history of cholecystectomy and allergy to cephalosporin. In 2018, she received a partial nephrectomy of the right kidney under laparoscopy due to right renal space occupation and was diagnosed with renal clear cell carcinoma (grade II–III). Subsequently, she underwent percutaneous nephroscope ultrasonic lithotripsy (PCUL) of the left kidney because of the

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left renal stone in 2019. On March 8, 2021, she again underwent PCUL of the right kidney due to slight hydronephrosis and multiple renal calculi bilaterally with a double J tube placed after the surgery. The patient was then discharged. The double J tube was removed on May 11. Two days after removal, she experienced lower right back pain and fever; however, no chills, gross hematuria, dysuria, urgency, and frequency were reported. Drotaverine and indomethacin were administered for symptomatic treatment in other hospitals. However, the patient still had intermittent fever, experienced hypourocrinia, and showed spiritlessness.

Upon clinical examination, the patient was found to have the following vital signs: temperature, 38.4 °C; blood pressure, 77/41 mmHg; heart rate, 104 beats/min; and respiratory rate, 20 breaths/min. A CT scan showed calculi about 7 mm in diameter in the right kidney, near the entrance of the bladder, with obvious hydronephrosis of the upper ureter and renal pelvis, thickening of the right anterior renal fascia, and multiple right perirenal exudations. Slightly larger lymph nodes were also observed, with the larger one measuring about 13 mm in diameter. Changes after partial resection of the right kidney, mild dilatation of the left renal pelvis and upper ureter, multiple left renal calculi, and bilateral suprarenal gland thickening were reported. Among the laboratory values were the following: white blood count, 9220/μL (normal, 3500–9500) with 96.0% neutrophils; C-reactive protein >90 mg/L (normal, <10.0), procalcitonin, 34.24 ng/mL (normal, 0–0.05); and pro-B type natriuretic peptide 4642.3 pg/mL (normal, 0–300). The coagulation, liver, and kidney function indexes were abnormal, indicating multiple organ dysfunction. Septic shock was considered after her vital signs and medical history were assessed. Symptomatic treatment, including raising the blood pressure and replenishing the fluid of the patient, was immediately administered. The patient also received drainage of perinephric abscess and initial empiric antimicrobial therapy with imipenem.

The perirenal abscess and blood cultures collected before the usage of antibiotics were sent for microbiological examination. Blood cultures were routinely collected in two sets, with each set consisting of an aerobic bottle and an anaerobic bottle. The abscess was also collected in an aerobic bottle and an anaerobic bottle to increase the positive rate. The alarm time of the positive blood culture was 1 d and 21 h, and the positive abscess culture continued for 4 d and 2 h. Gram-positive cocci were detected in both specimens from anaerobic bottles (Figure 1A). On blood agar incubated anaerobically, white small compact colonies surrounded by a zone of β-hemolysis developed after incubation for 48 h (Figure 1B), whereas on blood agar incubated aerobically, no such growth was observed. Gram staining of the colonies showed Gram-positive cocci in pairs, short chains, tetrads, or small clusters (Figure 1C). Initial identification of *P. asaccharolyticus* for both specimens was performed using matrix-assisted laser desorption ionization-time-of-flight mass spectrometry (MALDI-TOF-MS) (BioMerieux) with a 99% confidence. Meanwhile, 16S rRNA gene sequencing revealed the highest homology (99.72%) with the *Peptoniphilus asaccharolyticus* strain W16018C2. We then performed phylogenetic analyses of partial 16S rDNA sequences by using the Neighbor-Joining method with the software MEGA 11 (bootstrap:1400). The closest relative was still the *P. asaccharolyticus* strain W16018C2 (GenBank KP944181).

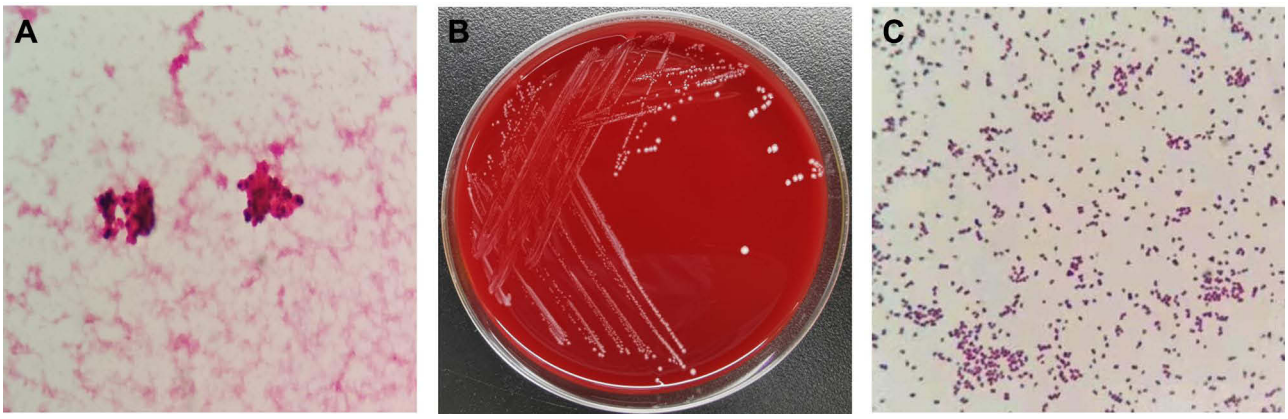

Figure 1 Colonies and microscopic morphology of *Peptoniphilus asaccharolyticus*. (**A**) Direct gram stain of the positive anaerobic bottles, 1000×. (**B**) Colonies on blood agar from anaerobic cultivation for 48 h. (**C**) Gram stain of the colonies on blood agar, 1000×.

In vitro anaerobic antibiotic susceptibility tests (ASTs) were conducted using E-Test Strips (BioMerieux) and interpreted in accordance with CLSI M100 S30 guidelines. The minimal inhibitory concentration (MIC) values for individual antibiotics were as follows: imipenem, 0.008 μg/mL; penicillin, 0.003 μg/mL; ampicillin<0.016 μg/mL; clindamycin, 0.25 μg/mL; tetracycline, 16 μg/mL; and metronidazole, 0.38 μg/mL. These values indicated that the isolate was sensitive to all agents tested, except for tetracycline.

On the basis of the aforementioned AST results, the patient continued receiving imipenem 2 g q8h intravenously for 6 d. The patient then became afebrile, the fluid from the renal pelvis drainage tube was clear, and markers of inflammation decreased. Linezolid 0.6 g q12h was used in combination with imipenem for another period of 7 d to isolate *Staphylococcus aureus* from sputum. The patient eventually recovered and was discharged, with a right renal drainage tube placed after hospitalization for 13 d.

Discussion

The genus *Peptoniphilus* comprises GPACs that are non-saccharolytic, apart from using peptone and amino acids as the main source of energy and butyric acid as the major metabolic end product.[4] In biological taxonomy, *Peptoniphilus spp*. belongs to the phylum Firmicutes, class Tissierellia, order Tissierellales, and family Peptoniphilaceae.[4] Historically, the taxonomy of *P. asaccharolyticus* had undergone several controversial revisions. Initially, the species was classified under the genus *Peptococcus. Peptococcus asaccharolyticus* was then transferred to the genus *Peptostreptococcus* in 1983, *Peptostreptococcus asaccharolyticus* was reclassified to a novel genus *Peptoniphilus* on the basis of 16S rRNA gene sequence analysis in 2001.[5] Currently, there are 20 species in the genus *Peptoniphilus* validly published and 10 species not validly published under the ICNP (Genus: Peptoniphilus (dsmz.de)), of which *P. asaccharolyticus* is the type species.[1]

Peptoniphilus spp. usually colonize the human skin, mouth, upper respiratory tract, gut, and genitourinary tract as commensals, constituting part of the human normal microbiota.[6] They can cause opportunistic infections and have been isolated from kinds of clinical specimens, with *P. asaccharolyticus* being most prevalent in chronic wounds and diabetic ulcers.[3] Although rarely reported, *Peptoniphilus* species have been cultured from other clinical specimens, such as bone and joint specimens, pressure ulcer samples, vaginal discharges, blood, urine, spinal fluid, amniotic fluid, eye discharge, pericardial fluid, and various specimens of abscesses.[1–3,6–9] Currently, diseases associated with this group of reported infections include skin and soft tissue infections,[2] bone and joint infections (including prosthetic joint infections),[7] arthritis and osteomyelitis,[6] bloodstream infections,[2] urinary tract infections,[8] pulmonary pneumatoceles,[10] peritonsillar abscess,[11] renal abscess,[12] bacterial vaginosis,[13] meningitis,[14] pericarditis,[9] scrotal abscess,[3] and spinal abscess.[3] Patients infected with the organisms are often elderly, immunocompromised, and post-surgical (particularly orthopedic surgery).[2,7] Underlying diseases include diabetes mellitus, pneumonia, acute exacerbation of chronic obstructive pulmonary disease, bowel or bladder disease, and gynecological diseases.[2,15]

P. asaccharolyticus isolated from clinical specimens usually act as part of polymicrobial infections, and the type of infection is generally noninvasive. The potential virulence of the bacterium has often been overlooked and underestimated.[3,14] Thus, we reviewed *P. asaccharolyticus*-associated invasive monoinfections on PubMed to analyze *P. asaccharolyticus* more purely and visually. Seven cases of invasive monoinfection were reported in a retrospective analysis, including 3 cases of bloodstream infection, 2 cases of tubo-ovarian abscess, and 1 case each of thoracic abscess and prosthetic joint infection.[3] Topiel and Simon reported 3 cases of monomicrobial bloodstream infections with *P. asaccharolyticus*.[15] However, no details of these cases were mentioned. Only 6 cases (including our case) of monoinfection due to *P. asaccharolyticus* were described in detail, as summarized in Table 1;[3,6,12,16,17] 3 cases associated with joints, 2 cases related to renal abscess, and 1 case of urinary tract infection. Our case is unique in that the patient was in such a severe condition that septic shock developed. Badri et al reported only 1 case of septic shock due to bacteremia with *Peptoniphilus* spp. infection, and no specific species of the genus responsible was mentioned.[18] Our case is the first report on septic shock, renal abscess, and bacteremia due to *P. asaccharolyticus*. Host factors might have played an important role in this type of infection, considering that all patients had underlying diseases or risk factors.

Our patient was infected after the removal of the double J tube, a stent tube commonly used to prevent ureteral stricture and adhesion blockage during laparoscopic upper urinary tract surgical procedures.[19] Urinary tract infections are

Table 1 Reports with Detailed Descriptions of Monomicrobial Infections Due to *Peptoniphilus asaccharolyticus* (as of December 2021)

Reference	Age	Sex	Diagnosis	Risk Factors	History Disease	Culture Positive	Treatment	Outcome	Year	Country
1[6]	55	F	Septic arthritis and osteomyelitis	Pyelonephritis in the preceding month	Diabetes, hypertension, hypothyroidism, asthma, dyslipidemia, depression, obesity, degenerative joint disease of the hip, cholecystectomy, and bilateral shoulder arthroplasties	Hip joint aspirate and tissue	Ceftriaxone and total hip arthroplasty, incision and drainage of the joint, and debridement.	Improved	2017	United States
2[3]	62	F	Early prosthetic joint infection	An uncomplicated total hip replacement 2 weeks earlier	None	Intraoperative deep-tissue samples	Cefuroxime, revision surgery, inlay and femoral head replacement.	Not mentioned	2019	Germany
3[12]	11	M	Renal abscess		Coarctation of the aorta repaired at age 11 months of a11 and a bicuspid aortic valve	Aspiration of renal abscess	Clindamycin, gentamicin, and percutaneous drainage of abscess	Improved	2001	United States
4[17]	82	M	Urinary tract infection with associated bacteremia	None	Former alcoholic with benign prostatic hypertrophy	Blood	Oxacillin, gentamicin, trimethoprim–sulfamethoxazole	Improved	1980	United States
5[16]	57	F	Septic arthritis	A dental procedure (tartar removal) two months ago	Peripheral spondyloarthritis	Synovial fluid of right knee	Amoxicillin, clavulanic acid and Right knee arthrocentesis	Improved	2016	Portugal
This report	49	F	Septic shock, renal abscess, and bacteremia	Double J tube removal	Diabetes mellitus, hypertension, cholecystectomy, renal clear cell carcinoma (grade II–III), and bilateral renal stone	Abscess, blood	Imipenem and drainage of perinephric abscess	Improved	2020	China

the major complications of these indwelling devices. Bacteria can colonize these devices and enhance their pathogenic potential by forming biofilms, with *E. coli* as the most frequent isolate.[20] Renal abscess associated with a double-J tube rarely occurs, particularly when the pathogen is *P. asaccharolyticus*. We inferred that the patient was immunocompromised because of several underlying diseases. The bacterial colony migrated with the line to the perirenal area during the removal of the double J tube, leading to infection. Bacteremia and septic shock subsequently developed, owing to a delay in treatment when performing invasive operations in individuals with such underlying diseases, clinicians should take care to prevent serious infections caused by this GPAC.

Factors that contribute to the low clinical isolation rate of *Peptostreptophilus* spp. are prolonged cultivation times and the requirement of special culture environments, in addition to the aforementioned species being overlooked as part of a polymicrobial infection.[6] The case presented in the current study once again emphasizes the importance of anaerobic culture in improving the detection of this anaerobic pathogenic microorganism. Currently, among the techniques used to identify the genus *Peptostreptophilus* are biochemical identification, MALDI-TOF-MS identification, and 16S-rRNA sequencing. However, some species, such as *P. asaccharolyticus* and *P. harei*, share similar biochemical features that cannot be accurately differentiated using biochemical methods.[21] Although MALDI-TOF-MS is a rapid identification technique, it may lead to the isolates being misidentified because of database limitations, particularly with the emergence of novel species. Sequencing of the 16S rDNA gene allows accurate identification of the genus at the molecular level. Several new species of *Peptoniphilus* have been identified by gene sequencing.[1,4] Phylogenetic analyses support the further determination of species.

The isolate in this study was sensitive to imipenem, penicillin, ampicillin, clindamycin, and metronidazole but not tetracycline. The drug sensitivity of 52 strains of *Peptostreptophilus* indicated that all isolates were sensitive to imipenem and piperacillin–tazobactam. Certain strains were resistant to penicillin, clindamycin, and metronidazole, although the majority were sensitive to these antibiotics.[18] Two other studies reported on the drug sensitivity results for 20 strains of *P. asaccharolyticus* isolated from diabetic foot infections; all isolates were sensitive to imipenem, meropenem, amoxicillin–clavulanate, penicillin, piperacillin–tazobactam, cefotetan, cefoxitin, and metronidazole. They also showed lower MIC ranges for dalbavancin, ceftobiprole, linezolid, daptomycin, and vancomycin; however, some strains were resistant to clindamycin and had high MIC values for levofloxacin and ceftazidime.[22,23] Antimicrobial choices should be based on drug sensitivity results. Surgical operations such as surgical excision, revision, and drainage, in addition antibiotic treatment, are also significant, particularly in the presence of local infections (eg, bone and joint infections, abscesses).

Conclusion

In conclusion, the rare case presented in this study demonstrates that *P. asaccharolyticus* induced by host factors can cause severe monomicrobial infections. Clinicians should be alerted to infections caused by *Peptostreptophilus* spp. and pay attention to the importance of anaerobic culture. Prompt antibiotic therapy combined with surgical treatment can effectively treat infections caused by the genus.

Disclosure

The authors report no conflicts of interest in this work.

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