Aerococcus urinae (A. urinae) is an unusual urinary tract pathogen [1–3], which is also reported in case of endocarditis [1, 3–5], septicemia [6–9], balanitis and phlegmon [1], lymphadenitis [10], and spondylodiscitis [11] in elderly patients with local or systemic predisposing conditions such as neutropenia and prostatic diseases. A. urinae is a gram-positive, catalase-negative, microaerophilic, alpha-hemolytic coccus, growing predominantly in tetrads and clusters. A. urinae is usually susceptible to β-lactam antibiotics and resistant to sulfonamides and aminoglycosides. Susceptibility to trimethoprim and cotrimoxazole is variable [9].

This paper presents three case reports of the serious A. urinae infections, two associated with bacteremia and to our knowledge the first case recorded of spontaneous bacterial peritonitis (SBP).

Case 1
A 67-year-old male with preexisting chronic liver disease [due to hepatitis C virus (HCV) infection] was admitted to the hospital with a history of fever, abdominal pain, nausea, and vomiting. On admission, he had a temperature of 37.8 °C, diffuse ascites, abdominal distention and splenomegaly. The other physical examinations were normal. The laboratory results were as follows: peripheral white blood count 15,800 mm$^{-1}$, hemoglobin level 11.3 g/dl, hematocrit 33.5%, and C-reactive protein (CRP) 18 mg/l. Abnormal biochemical findings were as follows: alanine aminotransferase 52 IU/l, aspartate aminotransferase 121 IU/l, γ-glutamyl transpeptidase 78 IU/l, albumin 2.7 g/dl, and the protrombin time 14.6 s. Ascitic fluid findings were as follows; leukocyte count of 1,480 mm$^{-1}$ (with 78% neutrophils), total proteins 0.65 g/dl, albumin of 0.25 g/dl. Serum/ascites albumin gradient (SAG) was 2.45 g/dl. The finding of a low albumin and a moderately high leukocyte count in the ascitic fluid supported the diagnosis of spontaneous peritonitis. Antibodies for hepatitis B surface antigen (anti-HBs) and HCV (Anti-HCV) were all found to be positive. Abdominal ultrasonography (US) revealed chronic parenchymal liver diseases, splenomegaly, and ascites. After ascitic fluid and urine specimens were taken for the culture, the patient was treated empirically with cefepime 2·1 g iv. The urine culture was sterile and the ascitic fluid culture was positive, showing a pure culture of A. urinae. On the third day of the therapy, the control paracentesis was made and we observed that the leukocyte count had decreased to 130 mm$^{-1}$. The patient’s conditions had improved and the therapy was continued for 7 days.

Case 2
A 61-year-old female with stage IIIA multiple myeloma was admitted to our hospital with a 7-day history of high fever (39 °C). The physical examination was unremarkable except that hepatomegaly was observed. The laboratory results as follows: leukocyte count 4,660 mm$^{-1}$, hemoglobin level 7.8 g/dl, hematocrit 21%, and CRP 261 mg/l. Laboratory findings including electrolytes, glucose, liver, renal, and thyroid function tests were reported as normal. After blood and urine specimens were taken for culture, the patient was treated empirically with cefepime 2·2 g iv. The urine culture was sterile. After three days incubation, one blood culture was positive, showing a pure culture of A. urinae. On the third day of the therapy, the patient was afebrile. The therapy was continued for 10 days.
**Case 3**

A 14-year-old male was admitted to the hospital with preexisting acute myelogenous leukemia (AML). He was afebrile at the time and splenomegaly was observed on physical exam. The patient had a serum white cell count of 800 mm⁻¹, a hemoglobin of 9.52 g/dl, a hematocrit of 27.6%, platelets of 32.20 mm⁻¹, and CRP 96 mg/l. The other laboratory findings were reported as normal. He was febrile at 38.1 °C on hospital on day 25. After blood and urine specimens were taken for culture, the patient was treated empirically with ceftriaxone 2 × 1 g iv. The urine culture was sterile, but two blood cultures yielded growth of *A. urinae*, which was susceptible to ceftriaxone. On the third day of the therapy, the patient was afebrile.

The blood and paracentesis specimens were taken into the blood culture bottles (Bactec Plus/F; Becton Dickinson, USA [BD]). After 3–4 days of incubation, these positive blood culture bottles with a Gram stain positive for gram-positive cocci in clusters were subcultured on 5% sheep blood agar with incubation at 37 °C in 5–7% CO₂. One of these isolates grew only after 48 h of reincubation at 37 °C in anaerobic conditions. Preliminary identification of the alpha-hemolytic colonies grown on the sheep blood agar revealed a gram-positive, catalase-negative coccus, pyrrolidonyl-arylamidase (PYR) (Oxoid) negative, and positive for leucine aminopeptidase (LAP) (Oxoid). Biochemical identification was performed by the BBL Crystal Gram-positive identification Kit (BD) according to the manufacturers’ instructions. The urine cultures taken from all patients were incubated overnight at 37 °C in ambient air and they were sterile.

Antibiotic susceptibility was tested by the disk diffusion method using Mueller–Hinton blood agar. CLSI guidelines for *Streptococcus* species other than *Streptococcus pneumoniae* were used for susceptibility testing [12]. Our strains of *A. urinae* were all resistant to erythromycin, clindamycin, trimethoprim-sulfamethoxazole and gentamicin but susceptible to penicillin, levofloxacin, chloramphenicol, ampicillin, cefotaxime, ceftriaxone, cefepime, and vancomycin.

Although *A. urinae* has been associated with mild urinary tract infections, occasional reports have noted a clinically significant role for this organism in serious infections [1, 3, 8]. The cases presented here all had serious infections (two patients with bacteremia and the other patient with SBP) caused by *A. urinae* with systemic predisposing conditions, which were multiple myeloma, chronic liver disease, and AML, like previously reported [1]. In recent years, several cases of septicemia have already been reported [6–9]; however, SBP has not been previously described. The majority of the patients with *A. urinae* infection are elderly males with a median age of 73 [2]. Interestingly, one of three patients was a 14-year-old male and the other was a 61-year-old female.

It is known that the possible source of *A. urinae* systemic infections is the urinary tract and it is optimally isolated from urine best after prolonged incubation in 5% CO₂ and equally under anaerobic conditions [8, 13, 14]. However, routine urine cultures are incubated only overnight at 37 °C in ambient air in most laboratories. Thus, *A. urinae* would be missed without a Gram stain of urine, which may not be cost-effective, the urine cultures of these patient were sterile [7, 8]. This may explain the fact that the urine cultures of our patients were negative.

As, *A. urinae* has been frequently resistant to antibiotics commonly used to treat urinary tract infections, inadequate treatment of this infection has been linked to fatal outcomes or severe complications [1, 14]. Also, *A. urinae* resembles alpha-hemolytic streptococci or enterococci, which are most common urine isolates, and it could be misidentified or overlooked in clinical cultures. Therefore, the diagnosis of *A. urinae* infections by the clinician and microbiologist become problematic. The Gram stain could be distinctive, as *A. urinae* forms tetrads, and clusters. Rapid PYR testing is useful for differentiate *A. urinae* (PYR negative) from enterococci (PYR positive). *Pediococcus* spp. are PYR negative and have a Gram stain morphology similar that of *A. urinae*; however, they differ in their resistance to vancomycin and in their positive bile esculin test results. The important biochemical reactions for differentiating between *Aerococcus* species (*A. viridans, A. urinae, A. chrysenseni, A. urinaehominis*, and *A. sanguinicola*) are production of PYR, LAP, and acid production from carbohydrates [15]. We characterized our isolates by phenotypic tests (morphology, catalase, PYR, LAP), biochemical profiles, and antibiotic susceptibilities [2, 16]. As Grude et al. [13] showed the BBL-Crystal-GP identification kit correctly and specifically identified all *A. urinae* isolates compared to 16S rRNA sequence determination, we used this kit for identification of *A. urinae*.

In conclusion, although *A. urinae* is a rarely isolated urinary tract pathogen and causes mild infections, this organism can cause serious complications, especially in patients with predisposing factors, if untreated. Therefore, the routine diagnostic procedures should be able to identify this bacteria and clinicians should be aware of the pathogenic potential of this organism.

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**References**

