American Journal of Case Reports

e-ISSN 1941-5923
© Am J Case Rep, 2019; 20: 697-700
DOI: 10.12659/AJCR.914866

Received: 2018.12.29
Accepted: 2019.03.05
Published: 2019.05.15

Aerococcus Viridans: Case Report, Microbiology, and Literature Review

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
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Conflict of interest: None declared

Patient: Female, 85
Final Diagnosis: Bacteremic *Aerococcus viridans* urinary tract infection
Symptoms: Change in mental status • fever
Medication: —
Clinical Procedure: Blood culture • urinalysis and urine culture
Specialty: Infectious Diseases

Objective: Rare disease

Background: *Aerococcus viridans* are Gram-positive, catalase and oxidase-negative, microaerophilic, and non-motile bacteria species that are rarely associated with human infections such as arthritis, bacteremia, endocarditis, and meningitis. The bacteria are also fastidious (i.e., have complex nutritional requirements) and often confused with *Streptococci* species or treated as a contaminant.

Case Report: We report a case of *Aerococcus* septicemia in an 85-year-old female patient, who transferred from a nursing home to an acute care hospital in Washington DC, USA. She had a 2-day history of worsening mental status, fever of 38.9°C (102°F), and tachycardia. Urinalysis revealed numerous white blood cells and bacteria. Laboratory tests revealed a white blood cell count of 14 000 cells/mL (85% neutrophils, 8% lymphocytes, 5% bands, and 2% monocytes), hemoglobin of 12.6 g/dL, and serum creatinine of 0.8 mg/dL. Blood and urine cultures obtained during admission grew penicillin-resistant *A. viridans*, identified via matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF) on day 3 of admission. The patient received empiric vancomycin with piperacillin-tazobactam, and we deescalated to vancomycin monotherapy to complete a 14-day treatment course.

Conclusions: This case report highlights the role of MALDI-TOF for identifying fastidious organisms, and we were able to form a better clinical correlation between patient symptoms and causative organisms. We believe that antimicrobial therapy (in accordance with susceptibility results) should be initiated in symptomatic patients who have *A. viridans* isolated in significant amounts in urine or from a sterile site.

MeSH Keywords: *Aerococcus* • Bacteriuria • Spectrometry, Mass, Matrix-Assisted Laser Desorption-Ionization • Urinary Tract Infections

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/914866

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Background

Aerococcus is a genus of microaerophilic Gram-positive cocci that are α-hemolytic, catalase and oxidase negative, facultatively anaerobic, and leucine aminopeptidase positive. Unlike other bacteria, it divides on 2 planes at right angles, which results in tetrads and irregular clusters [1]. The colonies are morphologically similar to Viridans streptococci and enterococci. Biochemical characteristics are also similar, and many commercially available systems for species determination (based on biochemical reactions) have not been specific. There have been reports of *A. sanguinicola* incorrectly assigned as *A. viridans*, and some systems have poorly differentiated between *Granulicatella* and *A. urinae* [2–4]. Thus, species identification with biochemical reactions is inappropriate for *Aerococci*.

On the other hand, 16S rRNA gene sequencing clearly distinguishes most *Aerococci* [3]. Christensen and colleagues reported that 0.8% of all urine specimens (cultured during a 4-month period in a Denmark hospital) yielded growth of "*Aerococcus*-like" organisms [4]. These similarities may have led to a misidentification of *Aerococcus,* and subsequent misconception that the bacteria are a rare cause of human infections. Fortunately, with the introduction of matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF), *Aerococci* are more readily identified and acknowledged as human pathogens. Among the different species, *A. urinae* is the most common cause of a urinary traction infection, along with *A. sanguinocol* and *A. viridans* [3,4].

A. viridans was first described as a potential human pathogen in 1967 [1]. The bacteria have a fastidious growth, and they are often confused with other strains of *Streptococci* or *Staphylococci*. *A. viridans* strains are widely distributed in healthcare and marine environments (e.g., causing fatal infections in lobsters) [5]. Prior studies conducted on *Aerococci* as an etiologic agent of infection have been performed on isolates from urinary specimens. The infected patients are typically older than 65 years of age, predominantly female, with underlying risk factors for urinary tract infection.

Case Report

An 85-year-old female presented to the emergency department (ED) after 2 days of mental status changes (e.g., excessive sleepiness and generalized weakness) at her nursing home. She had a past medical history of Alzheimer's dementia, breast cancer (treated with right mastectomy, chemotherapy, and radiation more than 20 years ago), and right-sided upper extremity deep vein thrombosis (required amputation up to the right shoulder two years ago). In the ED, she had a temperature of 38.9°C (102°F), blood pressure of 140/73 mm Hg, heart rate of 101 beats per minute, and O_2 saturation of 100% on room air. Physical examination was unremarkable, yet the patient was not following instructions and there did not appear to be any focal neurological deficits. Laboratory results were notable for a white blood cell count of 14 000 cells/mL (85% neutrophils, 8% lymphocytes, 5% bands, and 2% monocytes), hemoglobin of 12.6 gm/dL, serum creatinine of 0.8 mg/dL, and serum sodium of 149 mEq/L. All other serum electrolytes were within normal limits. The patient's urine sample (collected via straight bladder catheterization) revealed numerous white blood cells and 3+ bacteriuria (using a high-power field on wet mount). The initial diagnosis was sepsis due to a translocated urinary traction infection. We obtained blood cultures, and started empiric piperacillin-tazobactam. On the first day of hospitalization, the patient remained febrile with a maximum body temperature of 38.6°C (101.5°F), and we added empiric vancomycin to the regimen. Later that day, urine cultures identified Gram-positive cocci in clusters.

Investigation

A set of 2 blood cultures was obtained prior to initiating antimicrobial therapy. Using a continuous monitoring automated blood culture system (BD BACTEC™), 10 mL of blood was inoculated into aerobic and anaerobic culture bottles. Upon receipt in the laboratory, the samples were incubated at 35°C until signal positive or until the end of day 5. In this patient's case, a positive signal was observed on day 2. The bottles were unloaded from instrument and Gram's staining and cultures were performed using standard microbiological protocol [6]. The blood samples were sub-cultured on 5% sheep blood agar, and this resulted in 1–2 mm, circular, α-hemolytic colonies. The Gram-positive cocci were arranged in clusters, and were catalase negative and bile esculin negative. The isolates were subjected to identification using MALDI-TOF MS instrument (Bruker Daltonics, Bremen, Germany). The isolates were confirmed to be *A. viridans* (identification score ≥2.2). Antibiotic susceptibility testing was performed with Etest®strips (bioMérieux) to generate a minimum inhibitory concentration (MIC). MIC interpretation was done using the Clinical Laboratory Standards Institute guidelines (CLSI) break point [7]. The isolate of *A. viridans* recovered from the blood specimen was susceptible to vancomycin and meropenem, but resistant to cefotaxime, ceftriaxone, levofloxacin, linezolid, penicillin, tetracycline, and sulfamethoxazole/trimethoprim.

The urine sample also underwent microbiological testing. On wet mount, microscopic examination revealed numerous white blood cells and bacteria (per high-power field). The semi-quantitative culture on a cysteine lysine electrolyte deficient (CLED) agar also demonstrated significant bacterial growth, with a colony count $>10^5$ CFU/mL. The colonies were small (2 mm) and yellowish in color. The isolate was sub-cultured on 5% sheep blood

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agar, revealing 2 mm, circular, α-hemolytic colonies. On Gram staining, these colonies were identified as Gram-positive cocci of approximately 1 µm in size, arranged in clusters, catalase-negative, and bile esculin-negative. MALDI-TOF MS instrument (Bruker Daltonics, Bremen, Germany) positively identified the isolate. Antibiotic susceptibilities were identified using test strips (bioMérieux) to generate a MIC and interpreted using the CLSI break point [7]. Antimicrobial susceptibility results of both urinary and blood isolates of *A. viridans* were identical.

Repeat blood cultures from the first 2 hospital days were negative. A transthoracic echocardiogram (TTE) did not find any valvular vegetation.

Treatment

On day 3 of hospitalization, piperacillin/tazobactam was discontinued. Two days later, the patient was discharged to a long-term acute care hospital, where she completed a 14-day course of vancomycin.

Outcome and follow-up

The patient had a resolution of her fever and other initial symptoms.

Discussion

Gram-positive cocci of *Aerococcus* are morphologically similar to *viridans Streptococci*. The clinical significance of *Aerococci* is often disregarded or underreported, due to their fastidious growth. Isolates can also be misidentified and considered as insignificant contaminants. *Aerococci* are widely distributed in hospital environments, and the bacteria can lead to serious infections (e.g., bacteremia, endocarditis, and urinary traction infection) [8]. In our case, we believe that the patient's nursing home residence was an environmental source of infection.

Urinary traction infections due to Gram-positive bacteria are easily overlooked due to the limited availability of urine culture-based assays in hospital microbiology laboratories. Notable Gram-positive uropathogens include *Staphylococcus saprophyticus, Enterococcus faecalis*, and *Streptococcus agalactiae*. Other previously underreported (but emerging) Gram-positive uropathogens include *Aerococcus, Actinobaculum, Corynebacterium,* and *Gardnerella* [9]. Based on current evidence, Gram-positive bacteria remain important uropathogens. Alas, molecular tools (e.g., amplification and sequencing of 16S rRNA) are not commonly found in clinical microbiology laboratories, but these are required for the accurate identification of *Aerococci*. In our case, the rapid clearance of bacteremia and a negative TTE decreased the likelihood for endocarditis diagnosis; therefore, a transesophageal echocardiogram was unnecessary. *Aerococci* typically exhibit high MICs or resistance to ciprofloxacin, clindamycin, gentamicin, sulfamethoxazole/trimethoprim, and tetracycline [10,11]. Although a few case reports have highlighted resistance to penicillin and vancomycin [12,13], empiric antibiotic recommendations are to utilize penicillin and sulfonamides. In our case report, the isolate was sensitive to vancomycin and meropenem, but it was resistant to all oral antibiotics and first-line drugs for urinary traction infections (with the exception of fosfomycin, which was untested). Prompt and accurate identification of *Aerococcus* is necessary to initiate appropriate antibiotics and avoid life-threatening systemic infection. If left untreated infections with *A. viridans* can lead to severe complications such as acute pyelonephritis, bacteremia, urosepsis, and death.

Conclusions

Our case report highlights the role of MALDI-TOF for identifying fastidious organisms. We now have a better clinical correlation linking a causative organism with triad of symptoms. Infections with *A. viridans* are still rare, but they are more common than previously thought. When significant colony forming units of *A. viridans* are isolated from symptomatic patient, antimicrobial therapy should be administered empirically, and eventually narrowed based on susceptibility results.

Future perspectives

The role of *Aerococci* in normal flora and the incidence of bacteriuria in asymptomatic patients need to be further delineated.

Conflicts of interest

None.

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