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Case Report

Serratia Marcescens, an Opportunistic Gram Negative Infection in Cardiac Valve Surgery

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ABSTRACT

***Serratia marcescens* (*S.M*) is a species of gram–negative bacteria in the family *enterobacteriaceae.* A human pathogen, *S. marcescens* is involved in nosocomial infections, particularly in urinary tract and wound infections.**

This report describes a 63 years-old man that referred to hospital with dyspnea FC IV and he underwent cardiac valves replacement surgery with a diagnosis of severe mitral stenosis (M.S), severe tricuspid regurgitation (T.R), and moderate aortic insufficiency (A.I). Five days after operation, he presented with 40 °C fever, respiratory distress, elevation of liver enzymes, and decreased consciousness. Sepsis work up showed positive blood culture for *Serratia marcescens*. Despite therapy, he died due to *Serratia marcescens* endocarditis and mediastinitis.

Positive blood culture for *Serratia marcescens* is very rare but it should be considered in post operation patients after cardiac valve replacement presenting with fever. Besides, prevention of endocarditis due to *Serratia marcescens* should be observed.

Key words: *Serratia marcescens*, Endocarditis, Mediastinitis

Introduction

Serratia marcescens is an opportunistic gram negative, bacillus shaped bacteria that belongs to the family enterobacteriaceae. In 1819, Bartolomeo Bizio, an Italian pharmacist discovered *S. marcescens*. Bizio identified the bacterium as the cause of the miraculous bloody discoloration of cornmeal mush or polenta. He named *Serratia* in honor of the Italian physicist *Serratia* who invented the steamboat, and named *marcescens* from the Latin word for decaying because the bloody coloration quickly disappeared. Key characteristics of *S. marcescens* include the production of DNAase, lipase, and gelatinase and it is oxidase negative. These bacteria grow well on standard media and produce a red to dark pink pigment that aids in identification (1). Some strains of *S. marcescens* are capable of producing a pigment called prodigiosin, which ranges in color from dark red to pale pink, depending on the age of the colonies (2). This pathogen tends to colonize the respiratory and urinary tracts of adults in hospitals. In adult patients, it is responsible

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for 2% of nosocomial infections of the blood stream, lower respiratory tract, urinary tract, surgical wounds, skin and soft tissues (2). In pediatric wards, there have been outbreaks of *S. marcescens* meningitis, wound infections, and arthritis. Moreover, in people addicted to heroin, *S. marcescens* cause endocarditis and osteomyelitis in patients. Mortality rate is very high. For those patients with nosocomial blood stream infections, crude mortality is 26%. In urinary tract infections, approximately 30-35% of the patients are asymptomatic. In 90% of urinary infection cases, the patients had a recent history or instrumentation of the urinary tract. Patients with respiratory tract infection are usually infected with *S. marcescens* following instrumentation such as ventilation or bronchoscopy. Meningitis or cerebral abscesses caused by *S. marcescens* can occur in premature children and neonates with prior sepsis or after a head surgery, neurosurgery, or lumbar puncture (3).

Case report

A 63-years old man presented with progressive dyspnea FC IV from three months ago. In his physical exam, there was a systolic murmur III/IV at mitral valve position, diffuse expiratory wheeze and rales at base of both lungs, hyperpigmentation, scaling and lower extremity edema 3+, and increased jugular vein pressure (JVP). In his electrocardiogram (ECG), RBBB and left ventricle hypertophy (LVH) and a Q wave (III, aVF, V1-V3) was observed. Echo was performed and there was severe MS, severe TR, moderate AI and he has mild LV dysfunction. Lab test data were as follows: WBC = $4.8\times10^3/\mu l$, Hb = 10.1 g/dl, PLT = $83\times10^3/\mu l$, PT = 15.2 Sec, PTT = 28 Sec, INR = 1.9, AST = 44 IU/l, ALT=22 IU/l, ALK-P=783 IU/l, T. BIL = 1.5 mg/dl, D. BIL = 0.8 mg/dl, CRP = 3+, ESR = 90 mm/h.

He underwent cardiac valve replacement surgery. Five days after operation, he presented with 39.5 °C fever, elevated liver enzymes up to 2-3 fold, dyspnea, GI bleeding and mild and decreased consciousness. Sepsis workup showed positive blood culture for *S.M* (Figure. 1). This bacterium produces late lactose fermenter colonies. *S.M* may be red pigmented, especially if plate is left at 25 °C on macConkey agar (Mac), colorless colonies on Hecton enteric agar (HR), yellow or colorless on xylose-lysine-deoxycholate agar (XLD) (4,5). IMVIC reaction for *S.M* consists of: indole = negative, methyl red = variable, voges-proskaver = positive, citrate (simmons) = positive. Triple sugar iron (TSI) agar profile for *S.M* showed the following: the entire medium becomes acidic (yellow) and on KIA, alkaline (red) slant/acid (yellow) both, and no gas. Routine tests for identification of *S.M* consist of DNAase and gelatinase, especially at 25 °C. Supplemental test for identification of *S.M* included as: lysine and ornithine decarboxylale = positive, and arginine didydrolans and lactose fermentation = negative. Differentiation between *S.M* and *Serratia* liquefaciens group is based on l-arabinose fermentation that *S.M* is negative and *Serratia* liquefaciens group is positive (5). Then, he was diagnosed with *S.M* endocarditis or mediastinitis according to antibiogram treated with imipenem and ceftriaxone, but after 3 days he died from septic shock due to spreading infection.

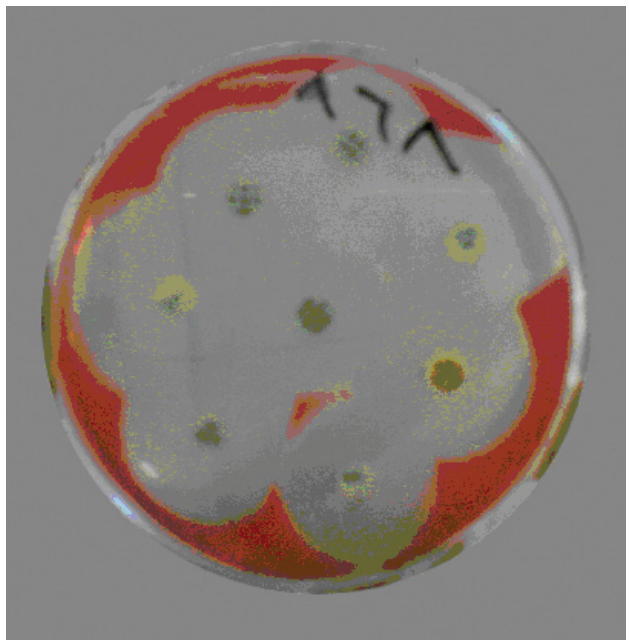

Figure 1. Red pigmented *Serratia marcesoens* on Mueller- Hinton agar

Discussion

Hospital-acquired infection (HAI) is an important cause of increased morbidity and mortality amongst hospital patients and represents a major health and economic burden worldwide. Contributory factors include inadequate infection control practices coupled with growing range of modern medical procedures. Increasing antimicrobial resistance complicates the situation further (1,6-8). In an investigation by Bai-

Horg, among 528 infants enrolled, 60 patients (11.4%) had 97 nosocomial infections. The prevalence of nosocomial infections was 17.5% (3). In another investigation by Hajdu, prevalence of HAI was 17%. Majority of patients had respiratory tract infection, mostly the upper respiratory tract (1). We do not have the exact prevalence rate of HAI in Iran but it expected to be more that 17%.

Serratia are opportunistic gram-negative bacteria classified in the tribe klebsielleae and the large family enterobacteriaceae. In the hospital, *Serratia* tends to colonize the respiratory and urinary tract of adults rather than the gastrointestinal tract. *Serratia* causes about 2% of nosocomial infections of the blood stream, lower respiratory tract, urinary tract, surgical wounds, and skin and soft tissues of adult patients. Outbreaks of *S.M* meningitis, wound infections, and arthritis have occurred in pediatric wards. *Serratia* has caused endocarditis and osteomyelitis in people addicted to heroin. Cases of arthritis resulting from *Serratia* infection are reported in out-patients who have received intraarticular injections. In the USA, *Serratia* species cause 7.4% of nosocomial blood stream infections. The prevalence of *Serratia* in nosocomial infections is diminishing, but these bacteria are still able to cause hospital outbreaks, especially in intensive care units. Crude mortality for nosocomial blood stream infection with *Serratia* is 26%. Mortality is high in patients with meningitis and endocarditis caused by *Serratia* infection. The main risk factor for sepsis or bacteremia is hospitalization. Placement of intravenous, intraperitoneal, or urinary catheters and prior instrumentation of the respiratory tract, and cardiac valve replacement have been identified as risk factors for in-patients (9-11). In an investigation by Samir et al, post-operative blood stream infections occurred in 6.3% of children undergoing median sternotomy(7,12), and in other investigation by Teszner et al, mediastinitis due to *Serratia* infection was seen following surgical intervention for severe congenital heart anomalies (8).

As mentioned earlier, *S.M* blood culture is very rare but cardiac valve replacement is a risk factor for *S.M* septic shock as was the situation in this case report. Thus, prevention of *S.M* infection and its complications should be observed in cardiac valve replacement operations.

References

1.Hajdu A, Samodova OV, Carlsson TR, Voinova LV, Nazarenko SJ, Tjurikov AV, et al. A point prevalence survey of hospital-acquired infections and antimicrobial use in a paediatric hospital in north-western Russia. J Hosp Infect 2007 Aug;66(4):378-84.

2.Metintas S, Akgun Y, Durmaz G, Kalyoncu C. Prevalence and characteristics of nosocomial infections in a Turkish university hospital. Am J Infect Control 2004 Nov;32(7):409-13.

3.Su BH, Hsieh HY, Chiu HY, Lin HC, Lin HC. Nosocomial infection in a neonatal intensive care unit: a prospective study in Taiwan. Am J Infect Control 2007 Apr;35(3):190-5.

4.Eriksen HM, Iversen BG, Aavitsland P. Prevalence of nosocomial infections in hospitals in Norway, 2002 and 2003. J Hosp Infect 2005 May;60(1):40-5.

5.Forbes BA, Sahm DR, Weissfeld AS. Diagnostic Microbiology. 12 ed. Missouri: Mosby; 2006.

5.Kurz CL, Chauvet S, Andres E, Aurouze M, Vallet I, Michel GP, et al. Virulence factors of the human opportunistic pathogen Serratia *marcescens* identified by in vivo screening. EMBO J 2003 Apr 1;22(7):1451-60.

6.Shah SS, Kagen J, Lautenbach E, Bilker WB, Matro J, Dominguez TE, et al. Bloodstream infections after median sternotomy at a children's hospital. J Thorac Cardiovasc Surg 2007 Feb;133(2):435-4·.

7.Teszner E, Tabbutt S, Shah S, Zaoutis T, St. John K, Bell L, et al. Risk Factors for Pediatric Mediastinitis after Cardiac Surgery: Investigation of a Case Cluster. Am J Infect Control. 2004 32(3): E84-E85.

8.Friedman ND, Kotsanas D, Brett J, Billah B, Korman TM. Investigation of an outbreak of *Serratia marcescens* in a neonatal unit via a case-control study and molecular typing. AJIC 2008;36(1):22-8.

9.Mlynarczyk A, Mlynarczyk G, Pupek J, Bilewska A, Kawecki D, Luczak M, et al. *Serratia marcescens* isolated in 2005 from clinical specimens from patients with diminished immunity. Transplant Proc 2007 Nov;39(9):2879-82.

10.Crivaro V, Bagattini M, Salza MF, Raimondi F, Rossano F, Triassi M, et al. Risk factors for extended-spectrum beta-lactamase-producing *Serratia marcescens* and *Klebsiella pneumoniae* acquisition in a neonatal intensive care unit. J Hosp Infect 2007 Oct;67(2):135-41.

11.David MD, Weller TMA, Lambert P, Fraise AP. An outbreak of *Serratia marcescens* on the neonatal unit: a tale of two clones. Journal of Hospital Infection 2006 May;63(1):27-33.