**Serratia Marcescens**

**Introduction:**

*Serratia* species are opportunistic gram-negative bacteria classified in the tribe Klebsielleae and the large family Enterobacteriaceae.

*Serratia marcescens* is the primary pathogenic species of *Serratia*. Rare reports have described disease resulting from infection with *Serratia plymuthica*, *Serratia liquefaciens*, *Serratia rubidaea*, and *Serratia odorifera*.

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. *S. marcescens* has a predilection for growth on starchy foodstuffs, where the pigmented colonies are easily mistaken for drops of blood.

In 1819, Bartolomeo Bizio, a pharmacist from Padua, Italy, discovered and named *S. marcescens* when he identified the bacterium as the cause of a miraculous bloody discoloration in a cornmeal mush called polenta. Bizio named *Serratia* in honor of an Italian physicist named Serrati, who invented the steamboat, and Bizio chose *marcescens* (from the Latin word for decaying) because the bloody pigment was found to deteriorate quickly.

Since 1906, physicians have used *S. marcescens* as a biological marker for studying the transmission of microorganisms because, until the 1950s, this bacterium was generally considered a harmless saprophyte. Only since the 1960s has *S. marcescens* been recognized as an opportunistic pathogen in humans.

**Pathophysiology**

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**Scientific classification**

- **Kingdom:** Bacteria
- **Phylum:** Proteobacteria
- **Class:** Gamma Proteobacteria
- **Order:** Enterobacteriales
- **Family:** Enterobacteriaceae
- **Genus:** Serratia
- **Species:** *S. marcescens*
In the hospital, *Serratia* species tend to colonize the respiratory and urinary tracts, rather than the gastrointestinal tract, in adults.

*Serratia* infection is responsible for about 2% of nosocomial infections of the bloodstream, lower respiratory tract, urinary tract, surgical wounds, and skin and soft tissues in adult patients. Outbreaks of *S marcescens meningitis*, wound infections, and *arthritis* have occurred in pediatric wards.

*Serratia* infection has caused *endocarditis* and *osteomyelitis* in people addicted to heroin.

Cases of *Serratia* arthritis have been reported in outpatients receiving intra-articular injections.

**Frequency**

**United States**

*Serratia* species are responsible for 1.4% of nosocomial bloodstream infections.

**International**

The prevalence of *Serratia* species as a cause of nosocomial infections is diminishing, but these bacteria are still able to cause hospital outbreaks, especially in intensive care units.

**Mortality/Morbidity**

- The crude mortality rate associated with *Serratia* nosocomial bloodstream infection is 26%.
- *Serratia* meningitis and *Serratia* endocarditis carry a high mortality rate.

**Age**

Outbreaks of *Serratia* infection occur in neonates and infants. In adults, most *Serratia* infections are isolated, but occasional nosocomial outbreaks occur.

**Clinical**
**History**

- **Sepsis**: Patients with *Serratia* sepsis may present with fever, chills, shock, and respiratory distress.

- **Urinary tract infection**
  - Approximately 30-50% of patients with *Serratia* urinary tract infections are asymptomatic. Symptoms may include fever, frequent urination, dysuria, pyuria, or pain upon urination.
  - In 90% of cases, patients have a history of recent surgery or instrumentation of the urinary tract.
  - Important risk factors for with *Serratia* urinary tract infections include diabetes mellitus, urinary tract obstruction, and renal failure.

- **Respiratory tract infection**
  - Patients with *Serratia* respiratory tract infection are usually colonized with *Serratia* species after instrumentation (eg, ventilation, bronchoscopy), especially those with chronic obstructive pulmonary disease.
  - *Serratia pneumonia* may develop, but this is rare. Patients with pneumonia may have fever, chills, productive cough (sometimes with pseudohemoptysis), hypotension, dyspnea, and/or chest pain.

- **Meningitis or cerebral abscess**
  - *Serratia* meningitis or cerebral abscesses may develop in premature children and neonates with prior sepsis. Patients who have experienced head trauma or have undergone neurosurgery, lumbar puncture, or even epidural injections are at risk of developing meningitis or cerebral abscess.
  - The symptoms are those of gram-negative meningitis (eg, headache, fever, vomiting, stupor, coma).

- **Intra-abdominal infections**: Patients with *Serratia* intra-abdominal infections may present with biliary drainage, hepatic abscess, pancreatic abscess, and peritoneal exudate. *Serratia* peritonitis can complicate peritoneal dialysis.

- **Osteomyelitis and arthritis**: *Serratia* osteomyelitis and arthritis may develop following hematogenous spread in persons who are addicted to intravenous drugs or may be caused exogenously by surgery, open trauma, or intra-articular injection.
Endocarditis: Patients with *Serratia* endocarditis may present with fever, petechiae, and, occasionally, embolic complications (eg, stroke, arterial emboli).

Ocular infections: Patients with *Serratia* ocular infections present with keratitis or endophthalmitis.

Soft-tissue infections: Patients with *Serratia* soft-tissue infections may have surgical scars, cellulitis, phlebitis, or skin infections.

Otitis media: Patients with *Serratia* otitis media present with earaches, hearing loss, and ear discharge.

Parotitis: *Serratia* parotitis is rare.

**Physical**

- Pink hypopyon in the absence of hyphema may suggest *S. marcescens* endophthalmitis.  

**Causes**

- Sepsis or bacteremia
  - The main risk factor for *Serratia* sepsis/bacteremia is hospitalization. Placement of intravenous, intraperitoneal, or urinary catheters and prior instrumentation of the respiratory tract have been identified as risk factors among inpatients.
  - Other risk factors include cardiac valve replacement, transfusions, and the use of contaminated intravenous infusions. An outbreak of bacteremia was caused by pooling the residual contents of preservative-free epoetin vials for later use. Another outbreak was traced to tampering with an infused narcotic by a hospital employee. A multistate outbreak of *S. marcescens* bloodstream infection was linked to contaminated intravenous magnesium sulfate distributed in the United States by a compounding pharmacy. A contamination of a faucet resulted in 2 cases of bacteremia during an outbreak of 10 *S. marcescens* infections in an intensive care unit.
- Urinary tract infection
  - Ninety percent of patients with *Serratia* urinary tract infection have a history of recent surgery or instrumentation of the urinary tract.
Important risk factors include diabetes mellitus, urinary tract obstruction, and renal failure.

- Respiratory tract infection: *Serratia* respiratory tract infection may develop after instrumentation (eg, ventilation, bronchoscopy), especially in patients with chronic obstructive pulmonary disease. During an outbreak of *S marcescens* infections traced to a contaminated faucet (including consumption of tap water from the faucet) in an intensive care unit, 9 patients developed respiratory tract infection (8 developed septic bronchitis; 1 developed empyema), while another 9 patients developed only *S marcescens* colonization of the respiratory tract.11

- Meningitis and cerebral abscess: *Serratia* meningitis or cerebral abscess may develop in premature children and neonates with prior sepsis. *Serratia* meningitis may also develop in adults who have experienced head trauma or have undergone neurosurgery, epidural injection, or lumbar puncture.

- Osteomyelitis and arthritis: Osteomyelitis or arthritis can be hematogenous in people addicted to intravenous drugs, or can be caused exogenously by surgery, open trauma, or intraarticular injection.

- Ocular infections
  - *Serratia* infection frequently causes nonulcerating bacterial keratitis, which is associated with wearing soft and rigid contact lenses.
  - *Serratia* endophthalmitis usually occurs after eye surgery.

- Parotitis: Bacterial parotitis may develop in individuals with prior sialectasia.

- Cutaneous infections: Dermal abscesses and skin ulcers in the legs have appeared after a toe-web infection.12

References:


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