Toxic Shock Syndrome

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Disease/Etiological Agents

Toxic Shock Syndrome (TSS) – *Staphylococcus aureus*, *Streptococcus pyogenes*

**Transmission**

*Staphylococcus aureus*

Women who use super-absorbent tampons, use diaphragms or contraceptive sponges, may have recently given birth, had a miscarriage or an abortion (1). Other individual at risk include those who have undergone surgery, or may have a local infection in the skin or deep tissue (1).

*Streptococcus pyogenes*

Transmitted via respiratory droplets from an infected individual to a new host. Can also be transmitted through direct contact with infected nasal discharge. Can be transferred via contaminated food, such as unpasteurized milk from cows that contain the bacterium (4).

**Reservoirs**

*Staphylococcus aureus*

Normal flora in children and adults. Specifically found in the nasal cavity, oral cavity and gastrointestinal tract.

*Streptococcus pyogenes*

Humans are the primary reservoir, although cattle can also act as a reservoir (4).

**General Characteristics of MO**

*Staphylococcus aureus*

Gram-positive staphylococci. Differentiated from *Staphylococcus epidermidis* by being yellow in colour. *S. aureus* is a facultative anaerobe, producing lactic acid when cultured in anaerobic conditions. It is oxidase-negative, catalase-positive and a halophile, able to grow in environments with a salt concentration as high as 15% (2)

*Streptococcus pyogenes*

Gram-positive, Group A streptococci. It is a catalase-negative, facultative anaerobe. It is classified as a Group A streptococcus because it has a hyaluronic capsule and exhibits beta hemolysis on a blood agar (3).

**Key tests used in identification**

In determining if TSS is caused by *Staphylococcus aureus* or *Streptococcus pyogenes* an important test is a catalase test. *S. aureus* is catalase-positive and will thus immediately produce bubbles (oxygen) when subjected to 3% hydrogen peroxide. *S. pyogenes* is catalase-negative,
and will not produce any bubbles (2). A Gram stain can also be performed and the morphology of the microorganisms can be used to differentiate between *S. aureus*, which will appear in clusters, and *S. pyogenes*, which will appear in long chains (2)(3).

**Virulence Factors**

*Staphylococcus aureus*

*S. aureus* promotes colonization of host tissue via surface proteins and evades phagocytosis with the presence of capsules. They produce membrane-damaging toxins such as leukotoxins and hemolysins that aid in the lysis of eukaryotic cells. They also produce exotoxins, specifically toxic shock syndrome 1 (TSST-1) (8), which displays the characteristic symptoms of the disease in the host (2).

*Streptococcus pyogenes*

*S. pyogenes* display M proteins which aid in adherence. These M proteins along with a hyaluronic capsule prevent phagocytosis by the host’s defenses. Like *S. aureus*, *S. pyogenes* also produces exotoxins that result in the symptoms typical of TSS (3).

**Signs and Symptoms of disease**

Signs and Symptoms of TSS by *S. aureus* include (1):

- Fever higher than 38.9°C
- Flat, red, rash that covers most of body
- Shedding of skin in large sheets – specifically on palms and soles
  - Seen two weeks after onset of symptoms
- Low blood pressure, vomiting, diarrhea
- Chills, headaches, fatigues
- Decreased urine output and sediment in urine
- Decreased liver function
- Low blood platelet count indicated by bruising
- Disorientation and confusion
- Difficulty breathing
- Increased bloodflow to eyes mouth and vagina causing them to appear red

Signs and symptoms of TSS by *S. pyogenes* include (1):

- Dangerously low blood pressure
- Decreased kidney and liver function
- Low blood platelet count indicated by bruising
- Red, flat, rash covering most of body
- Difficulty breathing

**History**

*Staphylococcus aureus*
TSS due to *S. aureus* was an epidemic in the 1980s with an incidence of 10 cases/100 000 women (9). Over the following 6 years, that incidence decreased by 90% to 1 case for every 100 000 women (8).

*Streptococcus pyogenes*

Epidemics of Group A *Streptococcus pyogenes* were seen in Italy and Spain the 1600s with the outbreak of scarlet fever. The infection surged again during World War II as rheumatic fever (5).

**Control, Treatment and Prevention**

*Staphylococcus aureus*

*S. aureus* may or may not be methicillin-resistant. For strains showing susceptibility to methicillin, a combination of the antibiotic clindamycin with oxacillin is an effective treatment against infection. For methicillin-resistant strains of *S. aureus* a combination of a glycopeptide and antibiotic such as vancomycin and clindamycin may be effective (6).

TSS can be prevented through hygienic feminine care. It is important for women to use low-absorbency tampons, changing them often. When using contraceptives it is important to follow the instructions provided by the manufacturer and never leave them in longer than recommended (7).

*Streptococcus pyogenes*

*S. pyogenes* shows susceptibility to antibiotics. It can be treated with penicillin and clindamycin. Penicillin proves to be effective when given soon after infection is acquired, but less so when organism is given time to grow to large numbers within the host. Clindamycin demonstrates high efficacy even when treatment is delayed (5).

Group A *Streptococcus pyogenes* infection can be prevented by proper wound care after surgery (1).

**Local and Global Cases**

Prevalence in the United States has been on a steady decline since the 1980s with a cumulative incidence of no more than 0.5 cases /100 000 persons (9). Globally, TSS has a prevalence of 3/100 000 persons (10).

**References**


