**Staphylococcus aureus:** Toxic Shock Syndrome

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Toxic Shock Syndrome (TSS) is a bacterial infection most commonly caused by the toxins released by *Staphylococcus aureus*. *S. aureus* is a normal bacteria present on human bodies and can be found mainly in moist areas, especially the nose and vagina. Research shows that the syndrome can also be caused by another group of bacteria called *Streptococcus pyogenes*, however this is more rare. TSS is a sudden and dangerous disease if left untreated. The syndrome has long been associated with women and their use of tampons, especially if they are left in for too long. Hyper-absorbant tampons and douching can result in TSS because their prolonged use can enhance the growth of *S. aureus* and cause the bacteria to release exotoxins into the bloodstream. However, the syndrome can also affect men, women, and children.

*S. aureus* produces "superantigenic exotoxins, including TSS toxin-1, which activates a vast number of T-cells..." Cytokines that are produced by the T-cell and activated by the TSS toxin-1 cause the symptoms of TSS.

The symptoms of TSS include:

- High fever
- Hypotension (low blood pressure)
- Vomiting and/or diarrhea
- A rash (looks like a sunburn), especially on palms and soles
- Confusion
- Muscle aches
- Eyes, mouth, and throat are red
- Seizures
- Headaches

TSS cannot be transmitted from an infected person to an uninfected person. However, the bacteria *S. aureus* can be transmitted between persons. It is the toxins that *S. aureus* releases that cause symptoms of TSS and not the actual bacteria. *S. aureus* is a gram positive bacteria normally seen as clusters; they live on the skin and mucosal sites. They are non-motile and do not form spores; they are also a facultative anaerobe. *S. aureus* ferments mannitol and produces lactic acid.

There is no specific test that can diagnose TSS, however a doctor can do a physical and pelvic exam. In addition, a blood and urine test might be done, and in some cases a biopsy. The doctor will check the "blood count, electrolytes, and liver kidney functions". If the patient has an elevated white blood cell count or abnormal kidney and liver functions, this could indicate TSS. A chest exam may be done to check for fluid in the lungs.

Basically, since there is no specific test for TSS, doctors often run tests to rule out other disease possibilities.

TSS was first discovered to affect children in 1978, however it was not recognized as a serious disease until after the epidemic in 1981. It was found that women using super absorbency tampons were having symptoms of TSS. TSS was the cause of death of several
young women in the early 1980s who were using a super absorbent brand name tampon, which was taken off the market after the deaths\textsuperscript{5}.

\textit{S. aureus} has many virulence factors. The capsule and Fibronectin-binding proteins are the cell surface factors; however, the exoproteins, such as cytolysins and superantigens help in the progression of the infection by damaging the tissues to the mucous membranes and skin\textsuperscript{9}. \textit{S. aureus} disrupts host cell through secretions such as “superantigens, pore-forming toxins, exoenzymes, and miscellaneous proteins”\textsuperscript{9}. According to the textbook of bacteriology, \textit{S. aureus} also have invasins that help spread the toxin to other areas of the body; “biochemical properties” that allow the bacteria to resist phagocytosis; and resistance to “antimicrobial agents”\textsuperscript{9}.

If diagnosed with TSS, the patient must immediately seek medical attention\textsuperscript{5}. The goal of the treatment is to prevent organ failure and stop the poison from spreading to other areas of the body. If the symptoms are caused due to tampon use, the vaginal cavity will be flushed out with saline. In most cases, IV fluids will be given to the patient because they have lost so much fluid. The patient may also need a ventilator to help with breathing. If kidneys have been affected, then the patient might need dialysis to help the toxins exit the blood. Finally, medications for blood pressure or fever may be given\textsuperscript{7}.

Best way to avoid TSS is prevention. Do not use superabsorbent tampons, as they can be left in the vaginal cavity for too long and also can cause microscopic rips in the cavity when pulled out. Another important way to prevent TSS is to wear sanitary napkins instead of tampons at night. Using the least absorbent tampon for the menstrual flow is important so the tampon can be changed more regularly; do not leave tampons in for more than 8 hours. And lastly, remove any cervical caps, menstrual sponge, or diaphragm when it is not being used. None of these contraceptives should be left in for longer than 24 hours\textsuperscript{5}.

TSS was recognized as a serious disease in 1980 after the epidemic between 1979-1980. After the epidemic, number of cases decreased from 6 to 12 per 100,000 to 1 per 100,000 women between the ages of 15 and 44 in 1986\textsuperscript{10}. No known outbreaks have been recorded in Texas.


