

Staphylococcus aureus

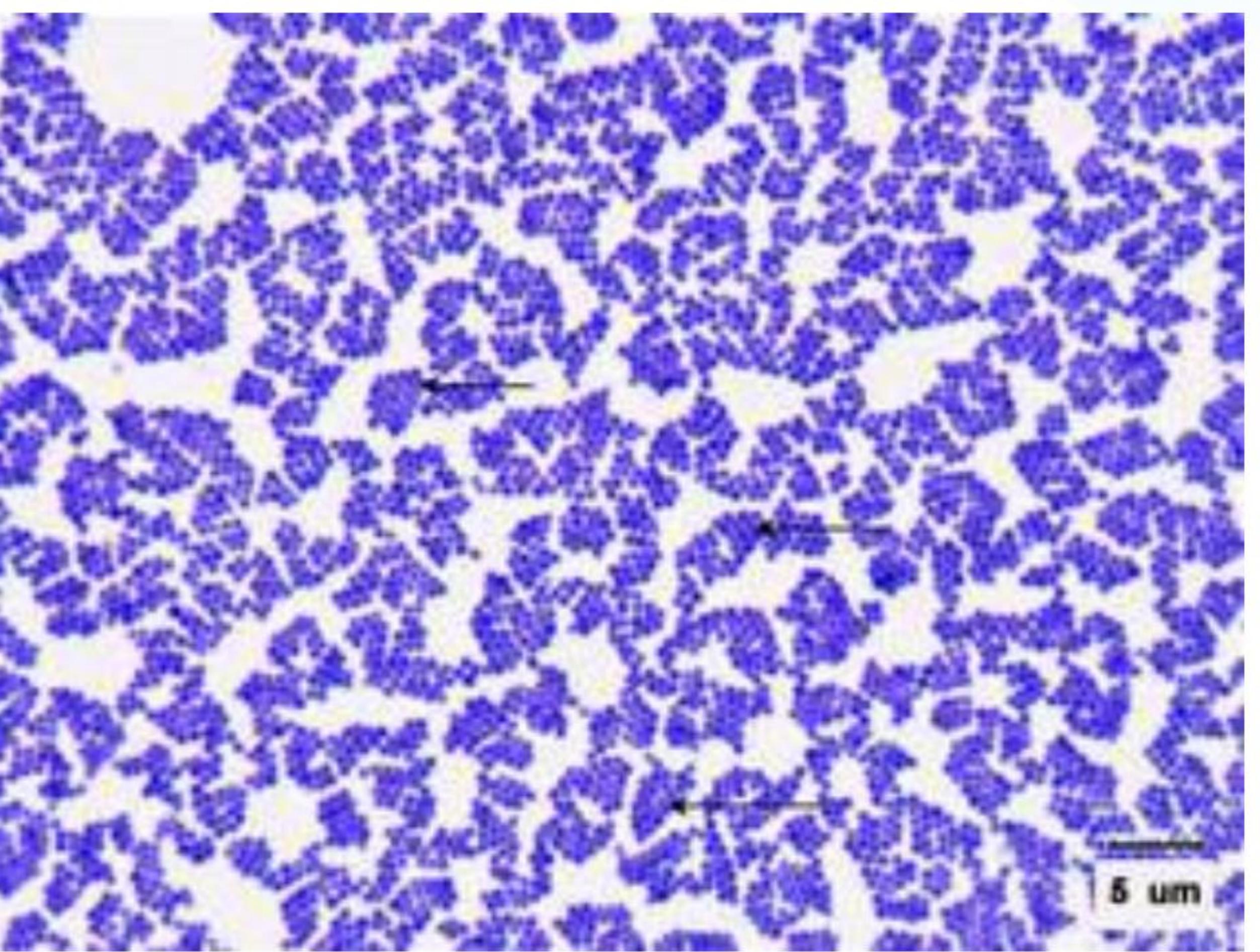
Introduction

Staphylococcus aureus is gram positive cocci that resides on the skin and mucus membrane but can cause a wide range of infections to severe systematic disease. It produces various toxins, including those responsible for staphylococcal scalded skin syndrome (SSSS), which may appear in both menstrual & non-menstrual cases. Due to its high resistance ability (eg - MRSA), correct diagnosis and timely treatment are very important.



| Definition

It is a bacterial infection caused by *staphylococcus aureus* , a gram positive cocci that appears in clusters.



Clinical Symptoms of S. aureus Infection:

1. Staphylococcal toxic shock syndrome (STSS): It can occur in the following cases.

Menstrual Cases

It mainly causes toxic shock syndrome (TSS), usually associated with tampon during periods. Symptoms include - Sudden high fever , Low BP , Red Rashes (like sun burn) Vomiting , Diarahea.

Non-menstrual Cases

S. aureus cause a variety of Infections such as soft tissue & Skin Infections, bone and Joint Injections (osteomyelitis, Septic arthritis), respiratory Infection (Pneumonia) & Cardiac infection (endocarditis).

2. Staphylococcal scalded skin Syndrome (ssss)/4S-

It is dermatological disease caused by the exotoxin of the toxigenic strain of *S. aureus*. It is mostly seen in infected non-breastfed children who lack the maternal immunoglobulins (majority less than 2 years of age), people with renal dysfunction + immunocompromised Individuals.

Clinical Features:

- ✓ Very tender, flaccid blisters
- ✓ skin peeling (exfoliation)
- ✓ Nikolsky's Sign positive (skinpeels off on gentle rubbing)
- ✓ No mucus membrane involvement



| Complications :

- ✓ Extensive skin loss → body fluid loss.
- ✓ Hemodynamic Instability (shock)
- ✓ hypothermia.

Lab Diagnosis:

Specimen Collection:

Pus on any specific discharge swabs, urine, sputum, feces or blood samples depending upon the clinical condition.

Specimen Analysis:

The specimen analysis is done as follows:

Direct Microscopy - The specimen is gram stained as per the gram staining process and the microscopic observations recorded. The presence of *S. aureus* infection in the patient shows the presence of small cocci arranged in grape like clusters importantly.

Culture:

For further confirmation, the collected patient sample is then inoculated on specific culture media as follows:

Nutrient rich Agar :

After the sample inoculation into a nutrient rich Agar medium, the inoculated medium is incubated at around 37°C overnight. The Colonies formed are large, Yellow coloured due to the formation of carotenoids by the bacteria importing a golden color.

(b) Nutrient broth:

The Growth in a Nutrient both after overnight incubation at 37°C shows colorless, uniformly turbid growth with rarely stringly but amorphous sediment formation.

agar (MSA) for the isolation of *Staphylococcus aureus*

Culture (Continued)

(c) Blood Agar:

On the blood Agar after Overnight incubation atmosphere 30% CO₂ at 37°C , hemolytic colorless zones are formed due to the formation of Beta - hemolysin specifically by the bacteria.

(d) Mannitol Salt Agar Medium (with 75% NaCl) :

The *S. aureus* is salt- tolerant & ferments mannitol after an Overnight incubation turning the Pink coloured Selective medium into Yellow colour. The other contaminant bacteria are usually not salt tolerant & are Killed during Incubation. Meat - infusion Agar with 7.5% NaCl can also be used as a Selective medium for epidemiological Investigations with incubation for 48



Staphylococcus aureus



Staphylococcus aureus and *Staphylococcus* spp.

Biochemical test

The *S. aureus* bacteria are catalase positive while the pathogenic streptococci species are *S. aureus* are oxidase negative & Coagulate positive while *S. epidermidis* and *S. Saprophyticus* coagulase negative.

Coagulase test:

The Coagulase test is widely used for confirming the presence of the *S. aureus* pathogen in the patient's sample. The Coagulase enzyme produced by this bacterium clots the blood plasma.

The other staphylococcal species usually do not clot the blood plasma as they do not form the Coagulase enzyme.



Indications:

- ✓ To identify staphylococcus aureus.
- ✓ To separate harmful staphylococci from less harmful ones.
- ✓ To check if a bacteria from Pus, Wound, blood, urine or Sputum is S.aureus.
- ✓ To help doctors to choose the right antibiotic.

Antibiotic Sensitivity test:

The sensitivity to antibiotics can be assessed for deciding upon the patient's antibiotic therapy in the following ways.

Serial dilution method:

It is a time consuming quantitative Procedure for determining the precise bacterial Sensitivity towards the antibiotics.

Dise method:

It is a qualitative, less time Consuming but less precise method as compared to the serial dilution method.



agar media, spread
Petri dish

Growth Time
→
~24 hours



**No bacterial growth
(Zone of inhibition)**

Indication:

- ✓ Severe or life-threatening Infections (eg-sepsis)
- ✓ Failure of Initial antibiotic therapy.
- ✓ Recurrent or chronic Infection e.g-recurrent UTI, chronic Wounds
- ✓ Hospital - acquired infections or infections in immunocompromised patients.

Interpretation of Antibiotic Sensitivity Test

1. Sensitive (S)

- ✓ The bacteria can be killed or stopped by the antibiotic.
- ✓ The antibiotic will work well for treatment.

2. Intermediate (I)

- ✓ The antibiotic might work, but not very Strongly.
- ✓ It may require a higher dose or it may work only in Certain body areas.

Antibiotic & Serological Tests

Resistant (R):

- ✓ The bacteria cannot be killed by antibiotic.
- ✓ The antibiotic will not work.

Serological test:

Serological tests are not considered very significant in the diagnosis of the disease, but they are found to be more useful in certain research procedure.

However, Molecular diagnostic methods such as Polymerase Chain reaction (PCR) can be effectively used for diagnostic purpose.

Indications:

- ✓ To detect antibodies or antigens in infection.
- ✓ For diagnose chronic infection (eg-hepatitis, HIV).
- ✓ To detect recent or past infection (IgM vs IgG).
- ✓ To confirm autoimmune disease (eg-ANA).
- ✓ To monitor disease progression or immunity after Vaccination.

Result Interpretation

1. Presence of IgM antibodies:

Indicates recent or current Infection.

IgM - first antibody to appear.

3. Positive antigen detection:

It means the pathogens antigen present, indicating Current infection.

2. Presence of IgG antibodies:

Indicates past infection

IgG-long-term antibody.

4. Negative Result:

It means no antibodies / antigens detected.

Conclusions

S. aureus is an germ that can cause many types of infections, including skin problem & Serious Condition like ssss during menstrual & Non-menstrual times. To confirm the infection, biochemical & antibiotic sensitivity tests are perform to choose the right medicine. Serological tests are not very helpful for diagnosis but PCR is a modern test that quickly & accurately detects the bacteria . Early and correct diagnosis helps in giving proper treatment and preventing Complications.

Quiz

1.Which medium turns yellow due to mannitol fermentation by *Staphylococcus aureus*?

- Blood agar
- Nutrient agar
- Mannitol salt agar
- Chocolate agar

2.Which antibiotic sensitivity test is described as quantitative and time-consuming?

- Disc
- B. Serial
- C. Kirby
- D. Rapid

Quiz

3. why are serological tests considered less significant for routine diagnosis?

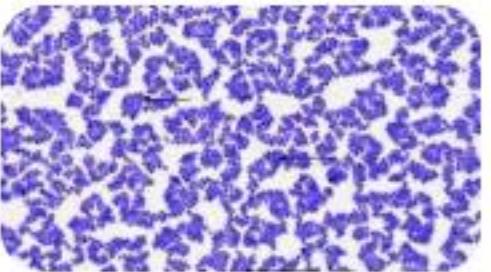
- A. Because they require highly expensive equipment.
- B. Because molecular methods like PCR are more effective for diagnostic purposes.
- C. Because they cannot detect antibodies or antigens.
- D. Because they are only useful for diagnosing acute infections.

Image Sources



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Source: depositphotos.com



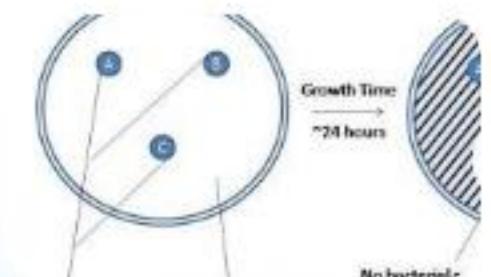
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