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Staphylococcal Food Poisoning: Emerging Bacterial Zoonoses

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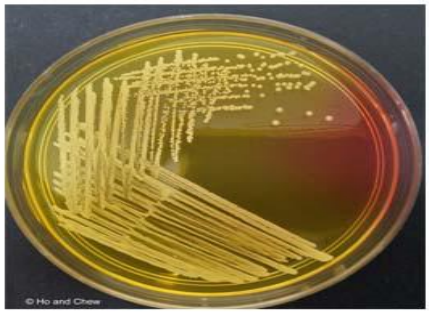
Introduction

Staphylococcus aureus is a vital bacterial human pathogen that causes a large array of clinical manifestations. (Lowy FD,1998). Infections are common both in community-acquired as well as hospital-acquired settings and treatment remains difficult to manage because of the emergence of multi-drug resistant strains such as MRSA (Methicillin-Resistant *Staphylococcus aureus*).(CDC, 2003). *S. aureus* is found in the environment and is also found in normal human flora, located on the skin and mucous membranes (most often the nasal area) of most healthy individuals. *S. aureus* normally doesn't cause healthy skin infection; however, if it's allowed to enter the bloodstream or internal tissues, these bacteria may cause a spread of probably serious infections. Transmission is typically from direct contact. However, some infections involve other transmission methods.(Rasigade JP, 2014)

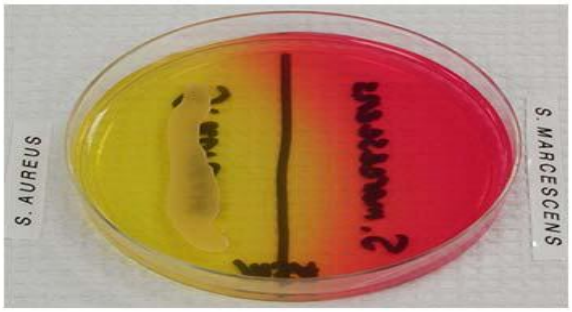
Etiology

Staphylococcus aureus are cocci-shaped Gram-positive bacteria (stain purple by Gram stain) and tend to be arranged in "grape-like." Clusters. These organisms can grow in various media, up to 10% salt, and colonies are often golden or yellow (aureus means golden or yellow).

Mannitol Salt Agar (MSA) for the isolation of *Staphylococcus aureus*



Yellow colonies of *Staphylococcus aureus*



Staphylococcus aureus and *Serratia marcescens* on MSA

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These organisms can grow aerobically or anaerobically (facultative) and at temperature ranges between 18 C and 40 C. For biochemical identification typical tests includes: catalase positive (all pathogenic *Staphylococcus* species),coagulase positive (distinguish *Staphylococcus aureus* from other *Staphylococcus* species).

Epidemiology:

Disease is distributed worldwide. Humans are the natural reservoir for staphylococci. Coagulates negative staphylococci are a neighbourhood of the traditional skin flora and also are found within the anterior nares. The anterior nares are colonized by S. aureus in 20-40% of the normal population. Staphylococci cause infection either as a result of autoinoculation or by transmission from a carrier to a patient. Most often this is often the results of transient carriage although occasionally a carrier could also be liable for an epidemic of staphylococcal disease. In some countries, the disease is primarily a cause of food poisoning. Most sporadic cases are not recorded. Outbreaks affecting several or many of us are people who are primarily known and recorded. Most outbreaks are caused by human strains and, to a lesser degree, by strains from cattle or other animals. Animal products like meat, milk, cheese, cream etc usually constitute as substrate for staphylococcal multiplication. Pasteurization of milk doesn't guarantee safety if toxins were produced before heat treatment, because the toxins are heat-resistant. Outbreaks have also been caused by reconstituted powdered milk, even when the dried powder contained few or no staphylococci. It has been suggested that a proportion of the intestinal disorders frequently observed in developing countries are caused by staphylococcal gastroenteritis disorder.

Source of Infection and Mode of Transmission:

The principal reservoir of *S. aureus* is the human carrier. A high proportion of healthy people (30% to 35%) have staphylococci in the nasopharynx and on the skin. A carrier with a respiratory disease can contaminate foods by sneezing, coughing etc. Similarly, he may contaminate food he handles if he features a staphylococcal skin lesion. Strains of human origin predominate in epidemics, but animals also are reservoirs of the infection. Milk from cow udders infected with staphylococci can contaminate various milk products. Many outbreaks of staphylococcal poisoning are caused by the consumption of inadequately refrigerated raw milk or cheeses from cows whose udders harboured staphylococci. A variety of foods and dishes could also be vehicles of the toxin. If environmental conditions are

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favourable, *S. aureus* multiplies within the food and produces enterotoxins. Once made, the toxin is not destroyed even if the food is subjected to boiling for the usual cooking time.

Clinical manifestation:

In Humans:

Staphylococcus aureus causes a variety of diseases. These consist of local skin and soft tissue infections, invasive systemic infections like infective endocarditis, sepsis or metastatic infections and tract infections like pneumonia. Additionally there are toxin–related illnesses that include gastrointestinal disorder or toxic shock syndrome. The incubation period is short, generally three hours after ingestion of the food involved. The interval between ingestion and the first symptoms may vary from 30 minutes to 8 hours depending on the amount of toxin ingested and the susceptibility of the individual. The major symptoms are nausea, vomiting, abdominal pain, and diarrhea. Some patients may show low fever (up to 38°C). More serious cases may also show prostration, cephalalgia, abnormal temperature, and lowered blood pressure as well as blood and mucus in the stool and vomit. The course of the disease is typically benign and thereforethe patient recovers without medication in 24 to 72 hours.

In Animals:

Staphylococcus mainly causes Mastitis in cattle. In modern milking systems, *S. aureus* may be considered as a common pathogen in cows. Udders. The agent is transmitted by means of milking machines or the milker.s hands, and enters through the milk duct or superficial lesions on the teat. Mastitis caused by *S. aureus* in cattle may vary from the prevalent subclinical form of infection to a severe gangrenous form. Both forms are economically important because of the losses they cause in milk production.*S. intermedius* and *S. aureus* are the most common agents in canine skin infections and cause pyoderma, impetigo, folliculitis, and furunculosis. *S. aureus* is frequently a complicating agent of demodectic mange, producing cellulitis in the deep layers of the skin.

Diagnosis:

The short incubation period between ingestion of the food involved and the appearance of symptoms is the most important clinical criteria.

Laboratory Identification:

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Staphylococci are identified in clinical samples using Gram's stain and their morphological characteristic – Gram positive cocci in grape-like clusters. They form round often beta-hemolytic colonies on agar. The aureus means gold color of the colonies. All staphylococci are catalase positive. There are some tests that are used to distinguish S. aureus from other staphylococcal species such as coagulase and manifold fermentation tests. As substitutes, serological methods, such as immune diffusion, immune fluorescence, hem agglutination inhibition**,** enzyme-linked immune sorbent assay (ELISA)**,** and reverse passive latex agglutination are used . The isolation of entero toxigenic staphylococcal strains from foods and typing by phage or immune fluorescence have epidemiological value. Examination of staphylococci quantitatively in processed or cooked foods serves as an indicator of hygiene conditions in the processing plant and of personnel supervision. (Benenson *et al*., 1990)

Treatment:

Most staphylococcal infections require antibiotic therapy. Choice of an suitable antibiotic is based on antibiotic susceptibility testing. Recently number of staphylococci that become resistant to the beta-lactam antibiotics is increasing rapidly. They have also subsided vulnerable to the second line agents like vancomycin. In addition, localized collections like staphylococcal abscesses requires surgical drainage.

Prevention & Control:

To prevent staphylococcal infections many approaches have been used. These consist of topical application of antibiotics to the nares to eliminate nasal carriage of staphylococci in high-risk groups such as hemodialysis patients. Another approach has been the recent development of potential staphylococcal vaccines. These candidate vaccines comprises of polysaccharide-protein conjugate products as well as surface ligand domain peptide vaccines. Both have manifested effective in animal models of infection but in humans their efficacy is still under investigation.

Control measures include the following:

a. To bring awareness among those who prepare food at home and other food handlers, so that they will take proper personal hygiene measures;
b. Restricting individuals with abscesses or other skin lesions from handling food;
c. Refrigeration at 4°C or less of all foods in order to prevent bacterial multiplication and the formation of toxins. Foods must not be kept at room temperature for so long.

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Supervision by veterinary milk inspector of dairy installations, the correct operation of refrigeration units and their use immediately after milking, and refrigerated transport of the milk to pasteurization plants. Supervision by veterinary meat inspector should be held responsible for enforcing hygiene regulations before and after slaughter as well as during handling and processing of meat products. Adapting hygienic conditions in meat retail establishments is also important.

Conclusion:

S.aureus infections are encountered by the nurse practitioner, primary care provider, internist and the infectious disease expert on a regular basis. The key feature of treatment is to ascertain the presence/absence of drug-resistant strains. When prescribing antibiotics, one should limit the duration to no more than 7 to 10 days for most infections. The reason is that the empirical prescription of antibiotics has led to the event of resistant strains. Pharmacists should coordinate with the clinician to focus on antimicrobial therapy, and nursing can chart the progress so modification to the regimen are often made if treatment is ineffective. This kind of inter professional coordination is necessary to treat such infections with precision. In addition, the patient should be educated by an inter professional team of nurses and physicians about hand hygiene to help prevent transmission of infection to others.