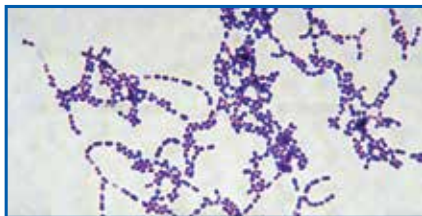


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SYNERGISING MEDICAL MICROBIOLOGY, PATIENT SAFETY AND CLINICAL PRACTICE

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Streptococcus pyogenes is responsible for a wide spectrum of infections which include pharyngitis ('strep throat'), otitis media, sinusitis, meningitis (including secondary brain abscess), impetigo, scarlet and rheumatic fever, pneumonia, cellulitis, osteomyelitis, necrotising fasciitis and septicaemia.



Typical chain-like appearance of *S. pyogenes*



Colonies of *S. pyogenes* and haemolysis of blood agar



Acute streptococcal tonsillitis

PATHOPHYSIOLOGY OF INFECTION

Streptococcus pyogenes is a Gram-positive coccus which grows in chains. Microbiologically, it belongs to group A in the Lancefield classification system for β -haemolytic *Streptococcus*, and therefore is also referred to as 'group A streptococcus' or 'GAS'.

S. pyogenes may be a normal resident (commensal) of the upper respiratory tract but can become highly virulent if it overcomes the host's defence system. The bacterium's cell wall is very complex, with a chemical structure which closely resembles human connective tissue, which allows it to escape recognition by the immune system. Therefore, neutrophils and macrophages may fail to phagocytose the bacterium, allowing it to cause invasive disease.

**DEFINITIONS**

Reservoir – a place where pathogens can survive outside the body and from which they could be transferred (directly or indirectly) to patients.

Rheumatic heart disease - active or inactive disease of the heart from rheumatic fever. It is characterised by reduced heart function caused by inflammatory changes in the myocardium or scarring of the valves.

Necrotising fasciitis ('neck-ro-tie-zing fas-e-i-tis') is a rapidly progressive bacterial infection of the fascia, with secondary necrosis of the subcutaneous tissues. *Streptococcus pyogenes* is considered to be the most common cause, although other types of bacteria have also been implicated.

MODE OF TRANSMISSION

Group A streptococci (GAS) are most commonly spread through direct person-to-person transmission, typically through saliva or nasal secretions from an infected person. Ill persons, such as those with a 'strep throat' (pharyngitis), scarlet fever or impetigo, are much more likely to transmit the bacteria than asymptomatic carriers.

Crowded conditions facilitate transmission such as those in schools, day care centres, or military training facilities. The incubation period for group A strep pharyngitis is approximately 2 to 5 days. Although rare, the spread of group A streptococcal infections may also occur via food. Foodborne outbreaks of pharyngitis have occurred due to improper food handling. Fomites, such as household items like plates or toys, are very unlikely to spread these bacteria. Humans are the primary *reservoir* for group A streptococcal and there is no evidence to indicate that pets can transmit the bacteria to humans.



FAST FACT: The *Streptococcus* bacterium is unique because its cell capsule is made of hyaluronic acid which is chemically almost identical to connective tissue in the skin, heart, joints, and brain tissue, allowing it to evade detection by the immune system. This is called "*molecular mimicry*."



Impetigo infection in a child



Acute infective endocarditis of the mitral valve. Note the bacterial vegetation (Indicated by arrows))



Necrotising fasciitis caused by *S. pyogenes*

RISK FACTORS AND COMPLICATIONS

Infection is most common in developing countries, where globally, GAS has been estimated to cause more than 500 000 deaths globally every year, making it one of the world's leading pathogens. Genetic predisposition, malnutrition and poor sanitation are added risk factors. In Western countries, rheumatic fever has become quite rare since the 1960's, most probably due to the widespread use of penicillin and antibiotics to treat streptococcal infections, and because laboratory facilities are available to confirm the diagnosis.

Group A streptococcal pharyngitis can occur in people of all ages, but it is most common among children between 5 and 15 years of age. It is rare in children younger than 3 years of age. The most common risk factor is close contact with another person with a 'strep throat'. Parents of school-aged children and adults who are often in contact with children will have a higher risk for group A streptococcal pharyngitis. Unfortunately, it is estimated that 325 000 children go onto develop **rheumatic fever** every year, approximately 3 weeks after a 'strep throat' infection. Up to 20% of first-time attacks can occur in adults, and interestingly, the underlying streptococcal infection may have gone undetected.

The recurrence of rheumatic fever is relatively common in the absence of maintenance of low dose antibiotics, which are especially important during the first three to five years after the first episode. Repeated bouts of rheumatic fever can lead to life-threatening valvular heart disease and heart failure, requiring **mitral or aortic valve replacement** in severe cases.

Post-streptococcal glomerulonephritis is a kidney disease which may develop 10 days - 3 weeks after a group A streptococcal infection. It is most common in children however, adults are more likely to have long-term problems if they develop glomerulonephritis. Note, it is not a group A streptococcal infection of the kidneys but is the result of the body's immune system attempting to fight off the group A 'strep throat' or skin infection.



SERIOUS COMPLICATIONS OF *S. PYOGENES* INFECTION

- Untreated episodes of group A streptococcal infection may trigger further complications referred to as '**post-streptococcal autoimmune disorders**'.
- Antibodies created by the immune system to fight off the streptococcal infection cross-react with tissue proteins in a variety of organ systems including the brain, heart, lungs, muscles and kidneys.
- Examples of these far-reaching complications include chorea (involuntary spasms and tics), myalgia (muscle pain), painful joints, valvular heart disease, acute glomerulonephritis and obsessive-compulsive psychiatric disorders.



KEY TERMS AND CONCEPTS

Haemolysis/haemolytic - the rupture of red blood cells caused by the toxic streptococcal enzyme '*streptolysin*'.

Toxic shock syndrome - a life-threatening complication of group A Streptococcal infection whereby bacterial exotoxins (poisons) enter the blood stream and cause shock and organ failure.

INFECTION PREVENTION AND CONTROL MEASURES

The main way to prevent post streptococcal complications is to prevent infections like 'strep throat', scarlet fever, and impetigo in the first place. Unfortunately, acquiring a group A streptococcal infection does not confer immunity against re-infection, and prophylactic vaccines are not available. These routine and lifestyle hygiene practices are recommended to prevent infection:



- Wash your hands with soap and running water often, and for at least 20 seconds.
- Perform hand hygiene especially after coughing or sneezing, before preparing food or eating.
- Use an alcohol-based hand rub especially if soap and water are not available.
- Cover your mouth and nose with a tissue when you cough or sneeze and dispose of used tissue safely in the waste bin.
- If you do not have a tissue, cough or sneeze into your upper sleeve or elbow, not your hands.
- Wash glasses, cups, plates and eating utensils with detergent and hot water after an ill person uses them. Allowing these to air-dry is preferable.

Antibiotic therapy

If you are diagnosed with a group A streptococcal infection, you should stay home from work, school, or day care until you no longer have a fever and have taken the antibiotic for at least 24 hours to prevent cross infection.

Good wound care is important

- Practice hand hygiene before and after contact with a wound.
- Don't delay first aid of even minor, non-infected wounds.
- Seek medical advice regarding the use of a topical antiseptic for the first 72 hours.
- Keep skin lesions clean and exuding or open wounds covered with dressings until healed.
- Avoid spending time in hot tubs, swimming pools, rivers or the ocean if you have an open wound or skin infection.
- Keep children's nails short and try to deter scratching of itchy lesions.
- Keep wash cloths and towels separate.
- Launder children's clothes daily and avoid the sharing of clothing.

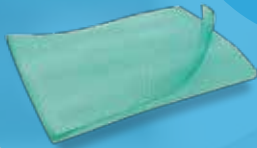
YOUR COMMENTS OR SUGGESTIONS FOR FUTURE TOPICS?

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1. The Centers for Disease Control and Prevention. Group A Streptococcal Disease. <https://www.cdc.gov/groupastrep/index.html> [Accessed 4.7.2018] 2. Khan, Z., Salvaggio, M.R. (2017) Group A Streptococcal (GAS) Infections. Infectious Diseases of America <https://emedicine.medscape.com/article/228936-overview#a3> [Accessed 4.7.2018]

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