

# Microbe of the month

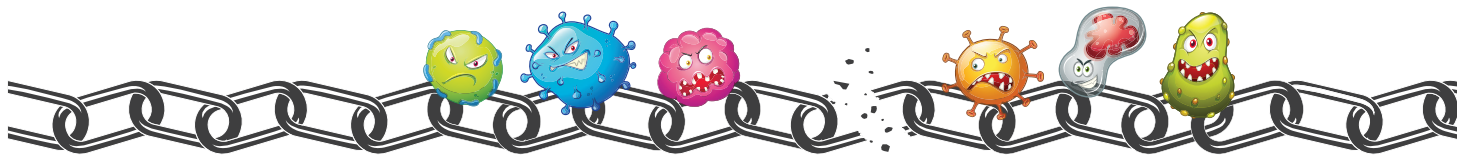
Breaking The Chain of Infection



FEBRUARY 2023 NEWSLETTER

Compiled by  
Helen Loudon IPC Consultant

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Featured  
this  
month:

## STREPTOCOCCUS PYOGENES ('GROUP A STREP')

*From impetigo and rheumatic fever to necrotising fasciitis!*

10-minute read + QUIZ

### Hello readers!

Wishing you a happy, healthy and rewarding 2023, and a warm welcome to all new recipients of Microbe of the Month!

This newsletter aims to provide a concise clinical resource, to help you keep up to date about pathogens of importance, in a readable and comprehensive format. Each issue covers the aetiology (sources) and epidemiology of topical bacteria, viruses, and fungi - the infections they cause, their mode/s of transmission, their antimicrobial resistance (AMR) capability, and the relevant Infection Prevention and Control measures which should be implemented to improve the safety of both patients and personnel.

*This year we are introducing a short quiz at the end of the newsletter – please use this content as a teaching tool in your workplace, and start an 'infectious dialogue' about topical issues in infection control!*

**Streptococcus pyogenes** ('pyo' from the ancient Greek for 'pus') is a Gram-positive coccus (spherical bacterium) which belongs to Group A in the Lancefield microbiological classification system for **beta-haemolytic streptococci**. Therefore, you may also hear it referred to as Group A Streptococcus (GAS) or abbreviated to 'Strep. A'.

During December 2022, at least five European countries reported outbreaks of invasive Group A Streptococcus (iGAS) disease to the World Health Organisation (WHO). Children under 10 years of age represent the most affected age group, and 164 deaths were reported in the United Kingdom alone. <sup>1</sup>

**Key words:** virulence, immune evasion, haemolysis, organ failure, post-streptococcal pyelonephritis, rheumatic fever, necrotising fasciitis, toxic shock syndrome, post-streptococcal autoimmunity, ydenham's chorea.



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## EPIDEMIOLOGY of Group A Streptococcal Disease

*Streptococcus pyogenes* (*S. pyogenes*) tends to colonise the throat and upper respiratory tract and is highly virulent as it can overcome the host's immune system. The most common forms of *S. pyogenes* disease include respiratory and skin infections; however, Group A Streptococcus (GAS) species are responsible for a wide spectrum of human diseases which range from mild, non-invasive infections, such as **pharyngitis** and **impetigo**, to *life-threatening, invasive conditions*, such as **otitis media**, **sinusitis**, **pneumonia**, **brain abscess**, **osteomyelitis**, **necrotising fasciitis**, **septicaemia**, and **toxic shock syndrome (TSS)**.<sup>1,2</sup>

GAS is the most common bacterial cause of acute pharyngitis ('strep throat'), accounting for 15%–30% of childhood cases and 10% of adult cases. The incidence of GAS pharyngitis usually peaks during winter months and early spring; and outbreaks in kindergartens and schools are common. Along with *Staphylococcus aureus*, Group A Streptococcus is one of the most common pathogens responsible for **cellulitis**.<sup>2,3,4</sup>

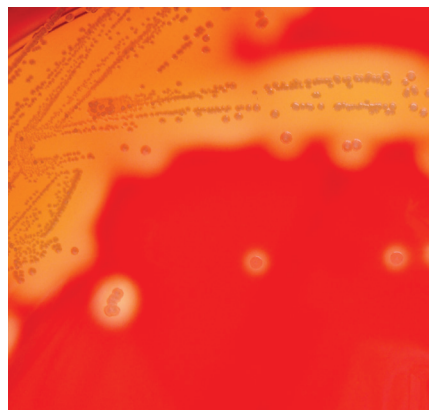
GAS is also responsible for non-suppurative (inflammation without the production of pus) complications of infection such as **acute rheumatic fever** and post-streptococcal **glomerulonephritis**.<sup>2,3,4</sup>

These infections place a high burden on the healthcare system and society because of doctor's visits, treatment costs, and the loss of working days.

The global impact of this disease has been estimated to be **> 500 000 deaths per year**, primarily due to rheumatic fever, rheumatic heart disease, and invasive GAS infection - making it one of the world's leading pathogens.<sup>2,4</sup>



Typical chain-like appearance of ***S. pyogenes*** (Group A Streptococcus)



Colonies of ***S. pyogenes*** on blood agar illustrating how the bacteria haemolyse (break down) erythrocytes



The yellow, painful skin crusts of impetigo infection caused by ***S. pyogenes***



## MODE OF TRANSMISSION

Group A Streptococci are spread through direct person-to-person transmission, typically through saliva or nasal secretions (**droplet** route) from an infected person, or from contact with a wound. Humans are the primary **reservoir** (i.e., the habitat in which the organism normally lives, grows, and multiplies) for Group A Streptococcus; and although rare, foodborne outbreaks of GAS pharyngitis have occurred due to improper food handling. 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, daycare centres, or military training facilities. The incubation period for GAS pharyngitis is 2 to 5 days. <sup>1,3</sup>



## PATHOPHYSIOLOGY of Group A Streptococcal (GAS) Infection

A virulence characteristic of *S. pyogenes* is the organism's ability to invade epithelial cells. Failure of penicillin therapy to eradicate *S. pyogenes* from the throats of patients with acute pharyngitis has been increasingly reported, resulting in **carrier states** (i.e., harbouring an infective organism without manifesting signs of infection). *The cell wall of S. pyogenes is 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.* <sup>3</sup>



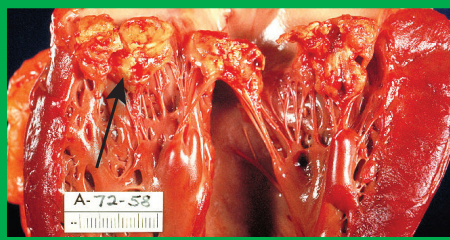
## RISK FACTORS and COMPLICATIONS of GAS INFECTION

Infection is most common in developing countries - genetic predisposition, malnutrition and poor sanitation are added risk factors. <sup>2,4</sup>



### Acute GAS pharyngitis ('Strep throat')

Group A Streptococcal (GAS) 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 '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. <sup>3</sup>



### Rheumatic heart disease – (also known as acute bacterial endocarditis). Note the bacterial vegetation on the heart valves (arrow).

It is estimated that at least 325 000 children go on to develop rheumatic fever every year, approximately three 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 if low dose antibiotics are not maintained 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.



### Necrotising fasciitis caused by invasive *S. pyogenes* infection (also referred to as 'flesh eating bacteria')

Necrotising fasciitis is caused by bacterial invasion into the subcutaneous tissue, resulting in vascular occlusion, tissue ischaemia, and tissue necrosis.

The rapid spread of iGAS is aided by the production of destructive bacterial toxins and enzymes.

Accurate diagnosis, prompt antibiotic treatment and surgery are important to halt this infection and prevent death through septicaemia. See a doctor right away if your skin becomes red, warm, swollen, or very painful soon after an injury or surgery. <sup>3, 4</sup>

- **Post-streptococcal glomerulonephritis** is a kidney disease which may develop between 10 days and 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. It is important to note that renal damage is not due to GAS infection of the kidneys, but results from the strong immune response attempting to fight off the Group A 'strep throat' or skin infection. <sup>4</sup>
- **Toxic shock syndrome (TSS)** is a life-threatening complication of Group A Streptococcal infection whereby bacterial exotoxins enter the bloodstream and cause shock and multi-organ failure. TSS often begins with symptoms such as fever and chills, muscle aches and/or nausea and vomiting. It only takes 24 - 48 hours for hypotension to develop, with tachycardia, an increased respiratory rate and organ failure. <sup>4</sup>
- **Central nervous system diseases:** The primary evidence for post-streptococcal autoimmune central nervous system (CNS) disease is provided by studies of Sydenham's chorea, a neurologic manifestation of rheumatic fever.

*Reports of obsessive-compulsive disorder (OCD), tic disorders, and other neuropsychiatric symptoms occurring in association with group A beta-haemolytic streptococcal infections suggest that various CNS complications may be triggered by post-streptococcal autoimmunity.* <sup>5</sup>



# THE BOTTOM LINE...

- ✓ 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 reinfection, and prophylactic vaccines are not yet available.
- ✓ Ensure adequate indoor ventilation (especially during the winter season).
- ✓ Practice good hand hygiene through hand washing and the use of alcohol-based hand rubs.
- ✓ Respiratory precautions - the importance of cough hygiene should be emphasised (i.e., cover your mouth and nose with disposable tissue when you cough or sneeze. If you don't have a tissue, cough or sneeze into your upper sleeve or elbow, not your hands).
- ✓ Use disposable facemasks in the clinic and hospital settings to prevent droplet transmission.
- ✓ Keep skin lesions clean and cover suppurating (oozing pus) wounds until they are 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 to prevent impetigo.
- ✓ Keep washcloths and towels separate.
- ✓ Ensure everyone in the household is up to date with influenza and chickenpox vaccines, since these infections can increase the risk of an invasive GAS infection.
- ✓ Wash glasses, cups, plates and eating utensils with detergent and hot water after an ill person uses them; air-drying is preferable.
- ✓ GAS pharyngitis is readily diagnosed with rapid antigen testing; but cultures should be obtained for suspected invasive (iGAS) infections, including blood, wound, and pleural fluid cultures, if clinically indicated.
- ✓ If you are diagnosed with a Group A Streptococcal infection, you should stay home from work, school, or the creche until you no longer have a fever - those with a mild illness will no longer be contagious after 24 hours of antibiotic treatment.
- ✓ Clusters of cases of iGAS should be reported to local, regional, or national health authorities to prompt further investigation and follow-up.
- ✓ Clinical laboratories should be encouraged to submit isolates from outbreaks to national reference laboratories for further characterisation and antibiotic susceptibility testing.



# Supply the correct answer!

1. *S. pyogenes* is classified as Group \_\_\_\_\_ (GAS).
2. Humans are the primary \_\_\_\_\_ of *Streptococcus pyogenes*.
3. Onward transmission of infections through saliva and respiratory secretions is termed the \_\_\_\_\_ route.
4. The incubation period for GAS pharyngitis is approximately 2 - 5 \_\_\_\_\_ .
5. Provide the term given to invasive GAS tissue destruction and necrosis.

ANSWERS: 1. Group A Streptococcus. 2. Reservoir. 3. Droplet. 4. Days. 5. Necrotising fasciitis.



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<sup>1</sup> Rippon MG, Rogers AA, et al. 2021. Antimicrobial stewardship strategies in wound care: evidence to support the use of dialkylcarbamoyl chloride (DACC)-coated wound dressings. J Wound Care. 30(4):284-296. <sup>2</sup> Gentili V, Giancesini S, et al. 2012. Panbacterial real-time PCR to evaluate bacterial burden in chronic wounds treated with Cutimed Sorbact. Eur J Clin Microbiol Infect Dis. 31(7):1523-1529. <sup>3</sup> Husmark J, Arvidsson A, et al. 2020. Antimicrobial effect of a DACC-coated bacteria-binding wound dressing against WHO pathogens. EWMA 2020. EP006. <sup>4</sup> Wounds UK (2020) Best Practice Statement: Antimicrobial stewardship strategies for wound management. Wounds UK, London. <sup>5</sup> Mosti et al., Comparative study of two antimicrobial dressings in infected leg ulcers: a pilot study, Journal of Wound Care, 2015 Mar;24(3):121-2; 124-7



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<sup>1</sup> Stanirowski J, Bizon M, Cendrowski K, et al (2016b) Randomized controlled trial evaluating dialkylcarbonyl chloride impregnated dressings for the prevention of surgical site infections in adult women undergoing caesarean section. *Surg Infect (Larchmt)* 17(4): 427-35

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