Agent

**Streptococcus pyogenes** Group A (β-hemolytic) streptococci (GAS), is an aerobic, gram-positive extracellular bacterium. It is made up of non-motile, non-sporing cocci that are less than 2 µm in length and that form chains and large colonies greater than 0.5 mm in size. It has a β-hemolytic growth pattern on blood agar and there are over 60 different strains of the bacterium.

1. **Disease/Infection**
   S. pyogenes is responsible for a wide array of infections, including streptococcal sore throat, strep throat, pharyngitis, scarlet fever, impetigo, erysipelas, puerperal fever, necrotizing fascitis, toxic shock syndrome, septicemia, acute rheumatic fever, acute post-streptococcal glomerulonephritis, and gas gangrene.

2. **Pathogenicity**
   There are at least 517,000 deaths globally each year due to severe S. pyogenes infections and rheumatic fever disease alone causes 233,000 deaths. 1,800 invasive S. pyogenes disease-related deaths are reported in the USA yearly, necrotizing fascitis kills about 30% of patients and streptococcal toxic shock syndrome has a mortality rate of 30-70%. Different clinical manifestations of this bacterium are more common in different parts of the world.
   - **Special Populations at Risk**
     Outside of the laboratory, crowding and poor hygiene increase the chance of an outbreak of GAS infections.

3. **Biosafety Information**
   - **Risk Group/BSL**
     Risk Group 2

4. **Biosafety Lab 2 Practices**

### Modes of Transmission

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<tr>
<th>Transmission</th>
<th>Description</th>
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<tr>
<td>Skin Exposure (Needlestick, bite, or scratch):</td>
<td>Yes, hand contact with nasal discharge and skin contact with impetigo lesions</td>
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<tr>
<td>Mucous Membrane Splash to Eye(s), Nose or Mouth:</td>
<td>Yes, direct contact with mucosal tissue</td>
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<td>Inhalation:</td>
<td>Yes, exposure to infected aerosols</td>
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<tr>
<td>Ingestion:</td>
<td>Yes, through contaminated food sources but rare</td>
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The pathogen can be found in its carrier state in the anus, vagina, skin and pharynx and contact with these surfaces can spread the infection.

- **Host Range/Reservoir**
  S. pyogenes is an exclusively human pathogen.

- **Symptoms**
  Symptoms vary depending on the type of infection and can affect a variety of organ systems. For streptococcal sore throat, symptoms are characterized by fever, enlarged tonsils, tonsillar exudate, sensitive cervical lymph nodes and malaise. Scarlet fever manifestations include fever and a pink-red rash. Impetigo will result in infection of the superficial layers of skin. Acute rheumatic fever will result in joint inflammation, carditis, and nervous system complications. Post—streptococcal glomerulonephritis causes hematuria, fever, edema, and hypertension. More serious complications may include severe skin infections and subsequent tissue destruction.
Streptococcus pyogenes

c. Incubation Period
   The incubation period is usually 1-3 days.

d. Viability
   This bacteria is susceptible to 1% sodium hypochlorite, 4% formaldehyde, 2% glutaraldehyde, 70%
   ethanol, 70% propanol, 2% peracetic acid, 3-6% hydrogen peroxide and 0.16% iodine. Bacteria are
   susceptible to moist heat (121 °C for at least 15 minutes) and dry heat (170 °C for at least 1 hour).

e. Survival Outside Host
   The bacterium can survive on a dry surface for 3 days to 6.5 months. In contaminated food: found to
   survive in ice cream (18 days), raw and pasteurized milk at 15-37 °C (96 hrs.), room temperature butter
   (48 hrs.), and neutralized butter (12-17 days). GAS has been found to last several days in cold salads at
   room temperature.

Information for Lab Workers

1. Laboratory PPE
   Personal protective equipment includes but is not limited to laboratory coats or gowns, disposable gloves, and
   safety glasses.

2. Containment
   Research should be conducted using Biosafety Level 2 practices, equipment, and facility design.

3. In Case of Exposure/Disease
   1. For injuries in the lab which are major medical emergencies (heart attacks, seizures, etc…):
      a. Medical Campus: call or have a coworker call the Control Center at 4–4144.
      b. Charles River Campus: call or have a coworker call campus security at 617-353-2121.
         You will be referred to or transported to the appropriate health care location by the emergency
         response team.
   2. For lab exposures (needle sticks, bite, cut, scratch, splash, etc…) involving animals or infectious
      agents, or for unexplained symptoms or illness call the ROHP 24/7 hour number (1-617-414-ROHP
      (7647); or, 4-ROHP (7647) if calling from an on-campus location) to be connected with the BU
      Research Occupational Health Program (ROHP) medical officer. ROHP will refer you to the
      appropriate health care location.
   3. Under any of these scenarios, always inform the physician of your work in the laboratory and the
      agent(s) that you work with.
   4. Provide the wallet-size agent ID card to the physician.

4. Vaccination
   None

Information for First Responders/Medical Personnel

1. Public Health Issues
   Person to person transmission is common. The bacterium can remain in the body in its carrier state without
   causing illness in the host for weeks or months and is transmissible in this state. In patients with strep
   pharyngitis, patients are infective in acute phase of the illness, usually 7-10 days, and for one week afterwards.
   With antibiotics, infective period is decreased to 24 hours. Standard precautions should be used. If cluster of
   cases is suspected, transmission based precautions are utilized.

2. Diagnosis/Surveillance
   Monitor for symptoms. Confirm infection by bacteriological and serological testing, latex bead agglutination,
   fluorescent antibody staining or ELISA.

3. First Aid/Post Exposure Prophylaxis
   Post exposure prophylaxis with antibiotics should be considered.
Perform one of the following actions:

| Skin Exposure (Needlestick or scratch): | Immediately go to the sink and thoroughly wash the wound with soap and water for 15 minutes. Decontaminate any exposed skin surfaces with an antiseptic scrub solution. |
| Mucous Membrane Splash to Eye(s), Nose or Mouth: | Exposure should be irrigated vigorously. |
| Splash Affecting Garments: | Remove garments that may have become soiled or contaminated and place them in a double red plastic bag. |

Percutaneous inoculation of GAS carries a significant risk for developing invasive infections, with the extreme instances of necrotizing fascitis and/or streptococcal toxic shock syndrome. Mucous membrane inoculation would be most concerning to the eyes. These injuries may appear benign early, but without proper management may evolve into serious infections even with a small inoculum.

4. Treatment
If any signs or symptoms of infection, admission should be considered, with Infectious Disease consult. Complete total of 2 doses of IV antibiotic (ceftriaxone 1g IV q24H or daptomycin 4 mg/kg IV q24h) before transitioning to oral antibiotics to complete a total of 7-10 days of treatment.
After IV course, preferred oral antibiotics would be cephalaxin 500mg PO q12h (if given ceftriaxone IV); clindamycin 450mg PO q8h or levofloxacin 750mg PO q24h (if intolerant of penicillins and/or cephalosporins).

5. References