GROUP A STREPTOCOCCUS INFECTIONS (GAS)
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OBJECTIVES

At the conclusion of this presentation, you will be able to:

1. Identify the epidemiology of Group A Streptococcus (GAS) infections.
2. List infections and sequela caused by GAS.
3. Recognize public health implications for outbreak management.
GAS INFECTION AND HEALTH CARE

Ignaz Philipp Semmelweis (1818-1865)

“All students or doctors who enter the wards for the purpose of making an examination must wash their hands thoroughly in a solution of chlorinated lime which will be placed in convenient basins near the entrance of the wards. This disinfection will be considered sufficient for this visit. Between examinations the hands must be washed in soap and water.” 1847

GAS INFECTION AND HEALTH CARE

Louis Pasteur (1822-1895)

“It is the nursing and medical staff who carry the microbe from an infected woman to a healthy one…. This water, this sponge, this lint with which you wash or cover a wound, may deposit germs which have the power of multiplying rapidly within the tissue…. If I had the honor of being a surgeon….not only would I use none but perfectly clean instruments, but I would clean my hands with the greatest care...” 1879
GAS CLASSIFICATION - LANCEFIELD

- Group A - S. pyogenes: human upper respiratory
- Group B - S. agalactiae: human urogenital
- Group C - S. milleri: zoo epidemics: from animal products
- Group D - S. faecalis: bile-resistant, fecal origin

GAS

- Streptococcus pyogenes – GAS- is one of the most frequent pathogens of humans.
- 5-15% of normal individuals harbor the bacterium, usually in the respiratory tract, without signs of disease.
- As normal flora, GAS can infect when defenses are compromised or when the organisms are able to penetrate the constitutive defenses.
GAS EPIDEMIOLOGY

Overall disease burden yearly:
- 11K-13,300 new US cases of serious infection
- 1,250-1,600 die annually in US
- 6% (soft tissue infection)
- 7% (necrotizing fasciitis)
- Worldwide 2.5-4.6 per 100,000 population

RISK FACTORS FOR INVASIVE GAS

- Advanced age
- Crowed living conditions
- Wounds
- Comorbidities (diabetes, kidney disease)
- LTCF residents 3 to 8X higher GAS risk than community elderly (poor infection control practices)
INFECTIONS CAUSED BY GAS

- **Superficial diseases**: pharyngitis, skin & soft tissue infx, erysipelas, impetigo, vaginitis, post-partum infx
- **Deep infections bacteremia**: necrotizing fasciitis, deep soft tissue infx, cellulitis, myositis, puerperal sepsis, pericarditis, meningitis, pneumonia, septic arthritis
- **Toxin-mediated scarlatina**: toxic shock-like syndrome
- **Immunologically mediated**: rheumatic fever, post-streptococcal GN, reactive arthritis

GAS CLINICAL SYNDROMES

Suppurative Infections:

a. Pharyngitis – Sore throat and fever
b. impetigo – superficial blisters covered with pus or honey–colored crust
b. erysipelas – acute superficial cellulitis of the skin with lymphatic involvement
GAS PHARYNGITIS

Common symptoms:
- Fever sore throat
- Petechia on soft palate
- Chills, vomiting, abdominal pain
- Painful anterior cervical lymphadenopathy
- Scarlatiniform rash.
  - Begins on trunk and spares extremities
  - Skin has rough feel like sandpaper quality

IMPETIGO

- 2 common forms: with or without fluid-filled bubbles on the skin (blisters).
- 10% adults
- Most commonly to sites of minor trauma
- Highly contagious
GAS ERYSIPELAS

Common Symptoms
- shiny, raised, indurated, and tender plaque-like lesions with distinct margins.

GAS NECROTIZING FASCIITIS

Invasive disease
- necrotizing fasciitis ("flesh-eating bacteria")

Most commonly occurs in the arms, legs and abdominal wall
- rapid development of shock, multiple organ system failure
- high fatality rate (30% to 40%)
GAS NECROTIZING FASCIITIS RISK FACTORS

Breaks in the Skin Can Allow Bacteria to Enter including:

- Cuts and scrapes
- Burns
- Insect bites
- Puncture wounds (including those due to intravenous or IV drug use)
- Surgical wounds

Blunt trauma

GAS NECROTIZING FASCIITIS SIGN AND SYMPTOMS

Early symptoms include:

- Red, warm, or swollen area of skin that spreads quickly
- Severe pain, including pain beyond the area of the skin that is red, warm, or swollen
- Fever
GAS NECROTIZING FASCIITIS

Later symptoms include:

- Ulcers, blisters, or black spots on the skin
- Changes in the color of the skin
- Pus or oozing from the infected area
- Dizziness
- Fatigue (tiredness)
- Diarrhea or nausea

GAS NECROTIZING FASCIITIS

- Necrotizing Fasciitis is rarely contagious
- Most cases of necrotizing fasciitis occur randomly.
- It is very rare for someone with necrotizing fasciitis to spread the infection to other people.
GAS CLINICAL SYNDROMES PNEUMONIA

Pneumonia – rapidly progressive & severe
• most commonly a sequela to viral infections like influenza or measles

GAS SCARLET FEVER

Scarlet fever – a complication of pharyngitis if the causative agent is capable of producing erythrogenic toxin
• initial symptoms of pharyngitis, diffuse erythematous rash with sparing of the palms & soles
• Circumoral pallor
• “strawberry tongue”
RHEUMATIC FEVER

- Diagnosis is based on symptoms and is difficult
  - Small painless nodules
  - Painful joints
  - Nosebleeds and fatigue
  - Heart problems
- Occurs most frequently between ages of 6 and 15
- US it is about 0.05% of pop having strep infections
- 100x more frequent in tropical countries

RHEUMATIC FEVER

Rheumatic Fever
- Most common cause of permanent heart valve damage in children
- Exact cause not yet known but there appears to be some antibody cross reactivity between the cell wall of S. pyogenes and heart muscle
GAS SEQUALAE

• Heart valve damage (rheumatic heart disease)
  – < 3% of people with strep throat, weeks after sore throat
  – migrating arthritis; heart valve damage (50%), some fatal
  – recurrences common, lifelong penicillin therapy
  – Acute glomerulonephritis or Bright’s Disease-

GLOMERULONEPHRITIS

• Diagnosis based on history of Strep throat and clinical findings.
• Symptoms include
  - fever and malaise
  - edema and hypertension
  - blood or protein in urine
• Occurs in 0.5% of those having strep throat
GAS SEQUALAE GLOMERULONEPHRITIS

Glomerulonephritis - symptoms 10 days after 1° infection:
− edema, decreased urination, hematuria, hypertension
− young children: self-limiting disease
− teenagers/adults: rare permanent kidney damage, chronic glomerulonephritis

TOXIN-MEDIATED SCARLATINA: TOXIC SHOCK-LIKE SYNDROME

• Signs and symptoms:
  - Rapid onset, 
  - fever, 
  - low blood pressure, 
  - kidney failure, 
  - multi-system organ involvement 
  - Profuse watery diarrhea, vomiting and rash
DIAGNOSIS AND TREATMENT OF STREP THROAT

Diagnosis of Strep Throat:
• Tell tale symptoms are slight fever associated with sore throat and visual of pus in back of throat
• Quick diagnostic tests (Molecular) available but must be confirmed by throat swab and growth on blood agar

LAB DIAGNOSIS

• Specimens: throat swab, pus, blood
• Microscopy: Gram stain - GPC in chains
• Culture: beta hemolytic colonies
  Identification tests
  – Catalase Negative
  – Bacitracin sensitive
  – Penicillin sensitive
GAS DIAGNOSIS

1. Microscopy
2. Culture – Bacitracin Test (Taxo-A)
3. Antigen detection tests – Enzyme-linked immunosorbent assay (ELISA) or agglutination tests
4. Antibody detection –
   ASO titer – for respiratory disease
   antiDNAse & antihyaluronidase – for skin infections

TREATMENT

• Penicillin G – drug of choice
• Erythromycin - Antistreptococcal chemoprophylaxis in persons who have suffered an acute attack of rheumatic fever.
• Penicillin G 1.2 M units IM every 3-4 weeks or daily oral penicillin or oral sulfonamide
GAS TRANSMISSION

Strep throat is highly contagious!
- Anal, vaginal skin, and pharyngeal carriers
- Respiratory droplet - most common
- Direct contact - common
- Ingestion possible (contaminated milk and eggs)
- Indirect contact – rare
- Incubation – 2 to 5 days (pharyngitis)

TRANSMISSION BASED PRECAUTIONS

- Contact Precautions and Droplet Precautions first 24 hours of antimicrobial therapy if invasive Group A streptococcal disease is suspected
- Note: untreated strep pharyngitis carriage or purulent wound drainage communicability can last weeks to months. Untreated impetigo communicability last 10-21 days.
  [https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/transmission-precautions.html](https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/transmission-precautions.html)
GAS OUTBREAKS

Most common clusters in US occur in long-term care facilities.

Other types of outbreak investigations include:
• Clusters of pharyngitis (strep throat) among daycare and school-aged children
• HAI postpartum and post-surgical infections
• Foodborne rare in US

One in ten cases of severe GAS infection is healthcare-associated

NC GAS OUTBREAKS

Number of Invasive GAS Outbreaks by Year

Year
2018
2019
2020
2021*

Number of Outbreaks
0
1
2
3
4
5
6
7
8
NORTH CAROLINA

GAS OUTBREAK CONTROL MEASURES

- **Vaccination** - There is currently no vaccine to prevent group A strep infections, although several vaccines are in development.

- **Prophylaxis** - Most exposures to group A strep infection should not receive prophylaxis. However, in some situations, providers may recommend prophylaxis for someone exposed to an invasive GAS infection. The invasive GAS infections include pneumonia, necrotizing fasciitis and streptococcal toxic shock syndrome.

https://www.cdc.gov/groupastrep/outbreaks.html
GAS OUTBREAK RESPONSE

- Screening of epidemiologically linked HCWs for healthcare-associated cases of GAS infection where no alternative source is readily identified.
- Conjugate facilities baths, hydrotherapy, and showers should be cleaned and decontaminated between all residents.
- Continuous screening
- GAS isolates should be saved for six months to facilitate outbreak investigation.

GAS OUTBREAK INVESTIGATIONS

- Genotyping of GAS isolates through pulse-field gel electrophoresis typing and multi-locus sequence typing

Prolonged Outbreaks
- Whole genome sequencing
EDUCATION AND AWARENESS

• Education and awareness – staff with history of GAS staff infection should be aware to not come to work when ill. https://www.cdc.gov/groupastrep/diseases-public/strep-throat.html

SUMMARY

Group A *Streptococcus* (GAS) or *Streptococcus pyogenes* is:

• commonly found in the throat and on the skin
• a relatively mild illnesses for most
• elderly and immunosuppressed most at risk for severe invasive disease
• a frequent source of clusters in conjugate settings
RESOURCES


RESOURCES

• CDC Diseases Caused by Group A Strep https://www.cdc.gov/groupastrep/index.html

• CDC Outbreaks and Public Health Response https://www.cdc.gov/groupastrep/outbreaks.html


• Centers for Disease Control and Prevention. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group A Streptococcus, 2015
THANK YOU!

Questions???