Aerobic Gram-positive Rods

CLS 511 Medical Microbiology
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General Information
- Several genera - most common
  - Bacillus sp.
  - Corynebacterium sp.
  - Listeria sp.
- Gram stain morphology often first clue in identification

General Information – Gram stain
- Bacillus sp. the only aerobic gpr that can form spores
- Clostridium sp. the only anaerobic gpr to form spores

Gram-positive Rods – Bacillus sp.
- Large gram-positive rods, can produce spores
- Only gpr form spores
- Spores are resistant, survival form of organism
- Spores formed when organism is stressed (drying, temperature, lack of nutrients)

Gram-positive Rods – Bacillus sp.
- Bacillus sp.: because of spores, everywhere in environment, soil
- Usually don’t cause disease and seen as contaminants in wound cultures
- Two species that are primary pathogens:
  - Bacillus cereus
  - Bacillus anthracis

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- Bacillus sp.: because of spores, everywhere in environment
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- Rapid growers, good colony growth in 24 hours
  - Bacillus sp. at 24 hours of incubation
  - Non-pathogenic species are usually beta-hemolytic

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**Gram-positive Rods – *Bacillus cereus***

**General Information**
- *Bacillus cereus*
  - Food poisoning:
    - emetic (vomiting) w/1-6 hr incubation (rice)
    - diarrheal forms w/24 to 48 hr incubation (meat, vegetables)
  - Must culture food not stool, usually self-limiting
- Ocular infections: penetrating injury w/soil contaminated object, loss of light perception within 48 hours
- Drug abusers and immunosuppressed: septicemia, pneumonia, endocarditis
- Dx: culture (not food poisoning)

**Gram-positive Rods – *Bacillus anthracis***

**General Information**
- Three forms of anthrax
  - Cutaneous: organism inoculated
  - Gastrointestinal: organism ingested
  - Inhalation: organism inhaled (biological weapon) – most common
    - Person-to-person transmission does not occur (organism multiplies in the lymph nodes and not the lungs)

**Gram-positive Rods – *Bacillus anthracis***

**General Information**
- Anthrax
  - Ulcers develop, painful lymphadenopathy, massive edema
  - Organism becomes systemic
- Dx: culture, growth within 18-24 hrs
  - If suspect *B. anthracis* – must inform lab, very dangerous organism to work with
  - Specialized labs confirm identity

**Gram-positive Rods: *Bacillus anthracis***

**Treatment**
- Prophylaxis post-exposure: ciprofloxacin
  - Cutaneous: ciprofloxacin
  - Inhalational & GI: ciprofloxacin, clindamycin & rifampin
- Once cultured – if susceptible to penicillin, treat with amoxicillin

**Gram-positive rods: *Corynebacterium sp.*

**General**
- Normal flora of skin and mucous membranes
- Usually ‘grouped’ together and reported as ‘diphtheroids’ or *Corynebacterium* sp. as not clinically significant
- Characteristic Gram stain
  - Organisms club-shaped
  - Arranged ‘Chinese letters’ & parallel to each other, referred to as ‘palisading’

**Gram-positive rods: *Corynebacterium diphtheriae***

**Diphtheria: Respiratory & Cutaneous**
- Humans are only reservoir
  - carry as asymptomatic carriers & infected patients
- Person-to-person spread via respiratory droplets or skin contact
- Disease in unvaccinated and those with waning immunity
- Rare in US
- Cutaneous: wound will not heal, sometimes covered with grayish membrane
Diphtheria: Respiratory & Cutaneous

- **Respiratory**
  - Exudative pharyngitis with thick pseudomembrane developing
- **Person-to-person spread via** respiratory droplets or skin contact
- **Disease in unvaccinated and those** with waning immunity
- **Dx:** culture pseudomembrane

**Gram-positive rods:** *Corynebacterium diphtheriae*

**Culture** = screen, must specifically order diphtheria culture
- Submit aerobic culture swab of throat (pseudomembrane) or wound
- **Growth** rapid: 18-36 hours
- **To confirm** diphtheria, must prove organism is a exotoxin producer
  - Toxin production usually detected via nucleic acid tests

**Prevention:** DPT vaccine
  - 5 doses: 2, 4, 6, 15 and 18 months
  - Boosters w/tetnus toxoid every 10 years

**Treatment:**
  - Diphtheria antitoxin to neutral exotoxin
  - Penicillin or erythromycin to eradicate organism
  - Susceptibility testing not performed – standardized methods not available

**General**

- Opportunistic pathogen in immunocompromised
- Septicemia related to intravascular catheters
- Very resistant to antibiotics
- Vancomycin drug of choice

**Listeria monocytogenes**

**General**

- Widely distributed in nature
- Short, coccobacilli rods, can be mistaken for gram-positive cocci
- Causes meningitis, septic abortion
- Human disease usually restricted to specific populations
  - Neonates & pregnant women
  - Elderly
  - Immunocompromised

**Disease**

- Contaminated food common source
  - Milk, ice cream, cheese, cold cuts, unwashed raw vegetables
- Mortality rate = 20-30%
  - Higher than almost all other foodborne diseases

**Gram-positive rods:** *Corynebacterium jeikeium*
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<thead>
<tr>
<th>Gram-positive rods: <em>Listeria monocytogenes</em></th>
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<tbody>
<tr>
<td><strong>Disease</strong></td>
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<tr>
<td>• Neonates</td>
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<td>– Early onset: acquired in utero can result in abortion, stillbirth or premature birth</td>
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<td>– Late onset: meningitis or septicemia 2-3 wks after birth (similar to Group B Strep)</td>
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<tr>
<td>• Other populations: meningitis, bacteremia</td>
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<tr>
<td>• Dx: culture</td>
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<td>• Treatment: gentamicin w/penicillin or ampicillin</td>
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<td>– Pathogens: <em>B. anthracis</em> and <em>B. cereus</em></td>
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<td><strong>Corynebacterium</strong> – club-shaped, palisade</td>
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