Suggestions on what to do with tiny gram negative coccobacilli

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Clinical presentations
- Meningitis
- Cellulitis in the buccal and periorbital region
- Epiglottitis
- Pneumonia
- Pericarditis
- Septic arthritis
- Occult bacteremia

Underlying medical conditions
- Pulmonary disease, HIV, alcoholism, pregnancy & malignancy

Haemophilus cont
- Clinical presentations—neonatal
  - Usually present within 24 hours after birth
  - Usually NTHi
  - Manifestations may be nonspecific and may include:
    - Bacteremia
    - Sepsis
    - Meningitis
    - Pneumonia
    - Respiratory distress
  - Underlying conditions
    - Premature birth, premature membrane rupture, low birth weight

Characteristics of Haemophilus
- Small, pleomorphic gram-negative coccobacilli
- Positive for cytochrome oxidase
- No growth on MacConkey or Sheep blood agar (BA)
- Growth in culture requires exogenous hemin (X factor) and/or nicotinamide adenine dinucleotide (NAD) (V factor)
- Media of choice—Chocolate
  - Can use BA with hemolytic organism—Satellitism

Common Species of Haemophilus
- Haemophilus influenzae
- Haemophilus parainfluenzae
- Haemophilus aphrophilus
- Haemophilus ducreyi
### Haemophilus Biochemicals

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<thead>
<tr>
<th></th>
<th>X Factor</th>
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<tr>
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<th>Oxidase</th>
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<tr>
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<td>+</td>
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<tr>
<td>H haemolyticus</td>
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<td>H aegyptius</td>
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### HACEK Organisms
- Haemophilus species
- Actinobacillus actinomycetemcomitans
- Cardiobacterium hominis
- Eikenella corrodens
- Kingella species

### Clinical
- Have an enhanced capacity to produce endocardial infections (IE)
  - Approximately 3% of native valve endocarditis
- Most common cause of gram negative endocarditis in non drug users
- Also associated with
  - Periodontal infections, Bacteremia, Abscesses, Peritonitis, Otitis media, Conjunctivitis, Septic arthritis, Osteomyelitis, UTI, Brain abscess
  - Infections frequently associated with dental procedure

### Haemophilus IE
- Cause up to 1% of IE
- Of these:
  - 10% due to H. aphrophilus, followed by H. parainfluenzae
  - H. influenzae rarely causes IE despite the frequency of it being associated with bacteremia
- Up to 10% of cases of IE include a second pathogen
  - Either a Streptococcus viridans or Staphylococcus aureus

### Actinobacillus Clinical
- Frequently associated with localized juvenile periodontitis
  - Manifestation of early-onset periodontitis (EOP)
- Also associated with gingivitis
  - Can mimic clinical picture of Actinomycetes
- IE infections
  - 86% have underlying heart disease
  - 25% have infection of prosthetic valve (aortic)
  - Arterial embolism occurs in 43% of cases
**Eikenella Clinical**
- Usually associated with mixed bacterial infections
- Cellulitis from human bites or clenched-fist injuries
- Also associated with osteomyelitis and various pulmonary infections (empyema, pneumonia)
- Soft tissue infections and endocarditis in drug abusers
  - Most patients have underlying valve lesions

**Kingella Clinical**
- Frequently associated with diseases in children
  - Osteomyelitis & septic arthritis in young children
  - Bacteremia in infants
  - IE in school aged children and adults
  - Vary rapid progression is characteristic
  - Rarest of the HACEK organisms causing infection

**Haemophilus Hints**
- New Name: Haemophilus aphrophilus is Aggregatibacter aphrophilus
  - Also includes H. paraphrophilus
- Short Gram – bacillus that may form filaments
- Require 5-10% CO₂
- Growth maybe enhanced by hemin but X factor not absolute requirement, V variable
- Colonies opaque, granular & yellow
- Catalase & Urease – Neg, Oxidase – variable

**Actinobacillus Hints**
- New name: Aggregatibacter actinomycetamcomitans
- Short gram negative coccobacillus, may stain irregularly, cells arranged, singly & in pairs
- Does not require X or V factors
- Microaerophilic, optimal temp 37⁰C
- Colonies firm, star shaped, rough and pitting
- Slime maybe produced, colonies sticky
- Catalase & Oxidase – Pos, Urease – Neg
- Floating colonies in TSB

**Cardiobacterium Hints**
- Two species: hominis & valvarum
- Pleomorphic or straight rods with round ends, may give rosette clusters
- May find some of these cells are gram +
- Growth on BA poor, does not require X or V factors. May require X initially
  - Very small colonies, need humidity & 5% CO₂
  - Optimal temp 30 to 37⁰C
- Colonies smooth, opaque, butyrous
- Oxidase – Pos, Catalase & Urease – Neg

**Eikenella Hints**
- Monospecies: corrodens
- Straight, unbranched, non-spore forming
- May take several days to grow, bleach odor
- Flat colonies maybe surrounded by spreading
  - Pitting common, yellow color in older cultures
  - Non hemolytic but slight greening maybe seen
  - Optimal temperature 35-37⁰C,
  - Twitching “motility” maybe seen
- Oxidase – Pos, Catalase & urease – Neg
Kingella hints

- Three species—kingae, dentrificans, oralis
- Straight rods with rounded or square end
  - Tendency to decolorize poorly
- Two colony types: Neither requiring X or V
  - Spreading corroding
  - Smooth convex
  - Zone of beta hemolysis
- Optimal temperature—33-37°C
- Oxidase —Pos, Catalase & Urease— Neg

HACEK Organisms

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1. Colonies show central opaque dot that with incubation forms a star-like configuration like “crossed cigars.” Child strain often medium such as brain heart infusion supplemented with serum at 10X magnification; may show light growth on MacConkey agar
2. Irregularly staining gram-negative rods with bulbous (swollen) ends; indole detected by xylene extraction
3. Cultures smell of hypochlorite (bleach)
4. Colonies show small but distinct zones of β-hemolysis
5. X-factor requirement lost with passage in culture

Slide taken from Dr. J. Warren lecture, Northwestern University

References

- Identification of Haemophilus species and HACEK group of organisms. NHS, National Standard Method. BSOP ID 12
- E-medicine.medscape.com/article/218158-overview
- Dr. John R. Warren, Department of Pathology
- Northwestern University, Feinberg School of Medicine June 2007