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The Thistle QA CEU No is: **MT-18/063**

Each attendee should claim **ONE** CEU points for completing this Quality Control Journal Club exercise, and retain a copy of the relevant Thistle QA Participation Certificate as proof of registration on a Thistle QA EQA.

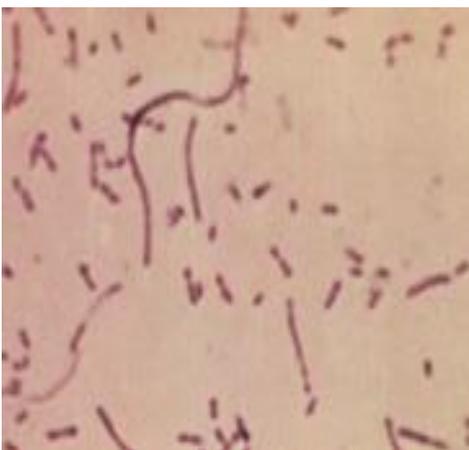
## MICROBIOLOGY LEGEND

### CYCLE 44 ORGANISM 2

## Haemophilus influenzae

Haemophilus influenzae is a small (1 µm × 0.3 µm), pleomorphic, gram-negative coccobacillus. Most strains of *H. influenzae* are opportunistic pathogens; that is, they usually live in their host without causing disease, but cause problems only when other factors (such as a viral infection, reduced immune function or chronically inflamed tissues, e.g. from allergies) create an opportunity. They infect the host by sticking to the host cell using trimeric autotransporter adhesins.

Some strains of *H. influenzae* possess a polysaccharide capsule, and these strains are serotyped into 6 different types (a-f) based on their biochemically different capsules. The most virulent strain is *H. influenzae* type b (Hib). Some *H. influenzae* strains have no capsule and are termed nonencapsulated *H. influenzae* or nontypeable *H. influenzae* (NTHi).



**Figure 1:** Gram negative coccobacillus *H. influenzae* from a sputum specimen.

### Signs and symptoms

Naturally acquired disease caused by *H. influenzae* seems to occur in humans only. In infants and young children, *H. influenzae* type b (Hib) causes bacteremia, pneumonia, epiglottitis and acute bacterial meningitis. On occasion, it causes cellulitis, osteomyelitis, and infectious arthritis. It is one cause of neonatal infection.

**a. Occult bacteremia**

Fever, anorexia, and lethargy occur in persons with occult bacteremia

**b. Meningitis**

Meningitis is the most serious manifestation of *H influenzae* type b (Hib) infection. Symptoms of antecedent URTI are common. Altered mental status and fever are the most common presenting features. Headache and photophobia are usually present in older children.

*H influenzae* accounts for 5-10% cases of adult meningitis, and patients can present with at least one of the classic triad of fever, neck stiffness, and altered mental status.

**c. Cellulitis**

The buccal and periorbital regions are most commonly involved with associated fever. Orbital cellulitis is uncommon and tends to be a complication of ethmoid or sphenoid sinusitis.

**d. Pneumonia**

*H influenzae* pneumonia is clinically indistinguishable from other bacterial pneumonias, but insidious onset and a history of fever, cough, and purulent sputum production are usually noted.

**e. Epiglottitis**

Clinical manifestations in children include a toxic anxious appearance, progressive respiratory difficulty, and the inability to swallow secretions while sitting in the tripod position (ie, sitting with arms back, trunk leaning forward, neck hyperextended and chin forward in an attempt to open the airway fully).

Physical examination findings include change in voice (90%), stridor (81%), neck tenderness (65%), pharyngitis (61%), and adenopathy (39%).

**f. Neonatal infections**

Neonates with *H influenzae* disease present within 24 hours of birth; these infections are caused by NTHi strains, which colonize the maternal genital tract.

Premature birth, premature rupture of membranes, low birth weight, and maternal chorioamnionitis are associated with *H influenzae* disease.

Manifestations may be nonspecific and may include those of bacteremia, sepsis, meningitis, pneumonia, respiratory distress, scalp abscess, conjunctivitis, and vesicular eruption.

**g. Septic arthritis**

Patients with *H influenzae* septic arthritis note joint pain, swelling, and decreased mobility.

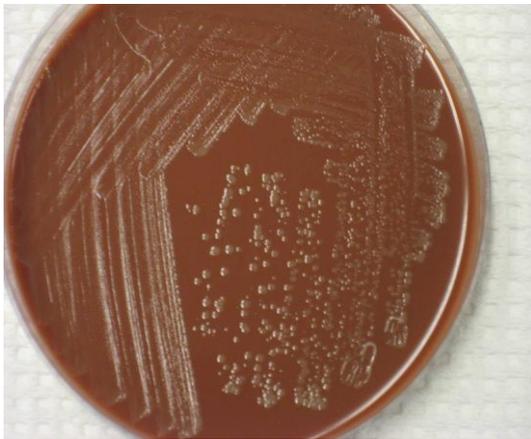
**Diagnosis**

Clinical diagnosis of *H. influenzae* is typically performed by bacterial culture or latex particle agglutinations. Diagnosis is considered confirmed when the organism is isolated from a sterile body site. In this respect, *H. influenzae* cultured from the nasopharyngeal cavity or sputum would not indicate *H. influenzae* disease, because

these sites are colonized in disease-free individuals. However, *H. influenzae* isolated from cerebrospinal fluid or blood would indicate *H. influenzae* infection.

Bacterial culture of *H. influenzae* is performed on agar plates, the preferable one being chocolate agar, with added X (hemin) and V (nicotinamide adenine dinucleotide) factors at 37 °C in a CO<sub>2</sub>-enriched incubator. Blood agar growth is only achieved as a satellite phenomenon around other bacteria. Colonies of *H. influenzae* appear as convex, smooth, pale, grey or transparent colonies. Another way of identifying *H. influenzae* is by observing its growth on an agar plates with X,V and XV discs. *H. influenzae* will show a halo of growth around XV disk; and no growth around the X and V discs.

Gram-stained and microscopic observation of a specimen of *H. influenzae* will show Gram-negative coccobacillus. The cultured organism can be further characterized using catalase and oxidase tests, both of which should be positive. Further serological testing is necessary to distinguish the capsular polysaccharide and differentiate between *H. influenzae* b and nonencapsulated species.



**Figure 2:** H. Influenzae on Chocolate agar



**Figure 3:** H. Influenzae showing growth around XV disc and not on X and V disc.

### **Prevention**

Effective vaccines for *Haemophilus influenzae* Type B have been available since the early 1990s, and is recommended for children under age 5 and asplenic patients. The World Health Organization recommends a pentavalent vaccine, combining vaccines against diphtheria, tetanus, pertussis, hepatitis B and Hib. There is not yet sufficient evidence on how effective this pentavalent vaccine is in relation to the individual vaccines.

Hib vaccines cost about seven times the total cost of vaccines against measles, polio, tuberculosis, diphtheria, tetanus, and pertussis. Consequently, whereas 92% of the populations of developed countries was vaccinated against Hib as of 2003, vaccination coverage was 42% for developing countries, and only 8% for least-developed countries.

### **Treatment**

*Haemophilus influenzae* produces beta-lactamases, and it is also able to modify its penicillin-binding proteins, so it has gained resistance to the penicillin family of antibiotics. In severe cases, cefotaxime and ceftriaxone delivered directly into the bloodstream are the elected antibiotics, and, for the less severe cases, an association of ampicillin and sulbactam, cephalosporins of the second and third generation, or fluoroquinolones are preferred.

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### **References**

1. <https://emedicine.medscape.com/article/218271-clinical>
2. [http://en.wikipedia.org/wiki/Haemophilus\\_influenzae](http://en.wikipedia.org/wiki/Haemophilus_influenzae)

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### **Questions**

1. Discuss the morphological characteristics of H. influenzae.
  2. Discuss the signs and symptoms of H. influenzae in disease.
  3. Discuss the lab diagnosis of H. influenzae.
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