Haemophilus influenzae

*Haemophilus influenzae* is a non-motile Gram-negative rod-shaped bacterium. *H. influenzae* can cause serious invasive disease especially in young children. Invasive disease is usually caused by encapsulated strains of the organism. Six typeable capsular serotypes (a-f) are known to cause disease; non-typeable encapsulated strains can occasionally cause invasive disease.

**Epidemiology**

- The most virulent strain is *H. influenzae* type b (Hib), which accounts for more than 95% of *H. influenzae* infections in children and half of infections in adults.
- Hib may cause bacteremia, meningitis, cellulitis, epiglottitis, septic arthritis, pneumonia, pleural or gallbladder empyema, endophthalmitis, urinary tract infection, abscesses, cervical adenitis, glossitis, osteomyelitis and endocarditis. [1]
- The number of cases in children has dropped dramatically since the introduction of the Hib immunisation programme in the UK in 1992. [2]
- Non-encapsulated and non-typeable *H. influenzae* strains cause mucosal infections, including:
  - Exacerbations of chronic bronchitis.[3]
  - Otitis media.
  - Conjunctivitis.
  - Sinusitis.
  - Bronchitis.
  - Pneumonia.

**Risk factors**

- Hib bacteria are carried in the nose and throat without showing any signs of infection. Hib is spread through coughing, sneezing or close contact with an infected person.
- Before the Hib vaccine was introduced, about four in every 100 pre-school children carried the Hib organism; after the vaccine was introduced, carriage rates fell below the level of detection. [4]
- Hib infections are uncommon in patients older than 6 years. However, the frequency of Hib infections is increased in patients with asplenia, splenectomy, sickle cell disease, malignancies and congenital or acquired immunodeficiencies.

**Presentation**[1]

- The most common presentation (60% of all cases) of invasive Hib disease is meningitis, frequently accompanied by bacteremia. Hib meningitis primarily affects children younger than 2 years, with a peak frequency rate occurring in infants aged 6-9 months.
- 15% of cases present with epiglottitis. Epiglottitis most commonly occurs in children aged 2-7 years but can also occur in adults.
- Bacteremia without any other concomitant infection occurs in 10% of cases. The remainder is made up of cases of septic arthritis, osteomyelitis, cellulitis, pneumonia and pericarditis.
- Hib pneumonia typically occurs in children aged 4 months to 4 years.
- Hib causes septic arthritis and cellulitis in children younger than 2 years. Hib septic arthritis also occurs in adults.
- Neonatal infection:
  - Often due to non-typeable *H. influenzae*, which colonises the maternal genital tract.
  - Infection is associated with premature birth, premature rupture of membranes, low birth weight and maternal chorioamnionitis.
  - Presentations include meningitis, pneumonia, respiratory distress, scalp abscess, conjunctivitis and vesicular eruption.
Investigations\textsuperscript{[5]}

- Gram stain: small, Gram-negative, pleomorphic coccobacilli with polymorphonuclear cells.
- Bacterial or other relevant body fluid cultures.
- Slide agglutination with type-specific antisera is used for serotyping \textit{H. influenzae}.
- Detection of the polyribosyl ribitol phosphate (PRP) polysaccharide capsule: methods include countercurrent immunoelectrophoresis and enzyme-linked immunosorbent assay; important for providing a rapid diagnosis and is not affected by prior antibiotics.\textsuperscript{[6]}
- Cerebrospinal fluid (CSF) features in meningitis: pleocytosis with a predominance of neutrophils, decreased CSF glucose levels, increased CSF protein, detectable capsular antigen in 90\% and a positive CSF Gram stain result in 80\%.
- CT scan: may be required, particularly to identify a possible subdural effusion, in patients with meningitis, to exclude raised intracranial pressure, if there are focal neurological findings or failure of expected improvement with appropriate antibiotics.
- CXR: Hib pneumonia tends to cause more pleural and pericardial involvement compared with other bacterial pneumonias. Community-acquired pneumonias due to non-typeable \textit{H. influenzae} are characterised by alveolar infiltrates in patchy or lobar distributions.
- Other investigations will depend on the site of infection - eg, echocardiogram if pericarditis is suspected, joint aspiration for septic arthritis.

Management\textsuperscript{[7]}

Management includes treating all aspects of the infection, including fever, dehydration and any other specific interventions such as oxygen therapy in respiratory tract infections. Recommendations for antibiotic treatment include:

- \textit{H. influenzae} epiglottitis: intravenous cefotaxime or chloramphenicol.
- Exacerbations of chronic bronchitis (treat if there is increased sputum production, purulent sputum or dyspnoea): treat for five days (longer in severely ill patients) with amoxicillin, tetracycline or clarithromycin; some \textit{H. influenzae} strains are tetracycline-resistant and 20\% of \textit{H. influenzae} strains are resistant to amoxicillin.
- Meningitis: cefotaxime - treat for at least 10 days; use chloramphenicol instead if there is a history of anaphylaxis to penicillin or to cephalosporins or if the organism is resistant to cefotaxime; dexamethasone may also be required; give rifampicin for four days before hospital discharge.

Prognosis

- The sequelae following Hib meningitis may include deafness, convulsions and intellectual impairment.
- Between 8\% and 11\% of children who develop Hib meningitis will develop permanent neurological sequelae.\textsuperscript{[8]}
- The case fatality rate from Hib meningitis is 4-5\%.\textsuperscript{[1]}
- The mortality rate for epiglottitis is 5-10\% (due to acute respiratory tract obstruction).\textsuperscript{[9]}
- There were no deaths in the UK in children under the age of 16 in the year 2012.\textsuperscript{[10]}

Prevention

\textbf{Hib immunisation}

See also separate articles \textbf{Hib Vaccination} and \textbf{Immunisation Schedule (UK)}.

\textbf{Prevention of a secondary case of Hib disease}\textsuperscript{[7]}

- Prophylactic antibiotics should be given to close contacts of patients who have invasive Hib disease.
- Adults: rifampicin 600 mg once daily for four days.
- Child aged 1-3 months: 10 mg/kg once daily for four days; child aged over 3 months: 20 mg/kg once daily for four days (maximum 600 mg daily).
Further reading & references

- Chest infections - adult; NICE CKS, August 2012 (UK access only)
- Immunizations - childhood; NICE CKS, November 2012 (UK access only)
- Haemophilus influenzae; Public Health England
- Haemophilus influenzae and Hib Meningitis; Todar's Online Textbook of Bacteriology

1. Immunisation against infectious disease - the Green Book (latest edition); Public Health England
2. Graph showing Haemophilus influenzae type b laboratory reports: England, 1990-2012; Health Protection Agency
7. British National Formulary
10. Health Protection Report; Health Protection Agency; March 2013

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