Introduction to Microbiology

Title:
Gram negative coccobacilli and cocci

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#:

18

Slides
Handout
Sheet

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Gram negative coccobacilli and cocci

- **Haemophilus Group:**
  - many types associated with normal flora of upper respiratory tract
  - might look like small bacilli or long bacilli consist of small bacilli attached together. no single cocci or bacilli.

**Haemophilus influenzae type b** :-
- haemophilus :- haemo --- blood / philus --- loving, means blood-loving organism (love to be associated with blood)
- influenzae : in relation to outbreak of influenza in 1918-1920 in Europe (in that time they didn't know that influenza caused by virus and found H.influenzae in the respiratory tract of the patients)
- more invasive than other species which can produce localized infections but less pathogenic
- it's an fastidious organism which means require certain environmental factors (not easily cultured), can be easily die at room temperature due to activation of lysins in cell wall (specimens must be cultured without delay)
- requires 2 nutritional factors (V,X factors) which found in cell membrane of red blood cells

*Virulence factors :
1) presence of capsule.
2) endotoxins, part of cell wall similar to lipopolysaccharide in gram –ve cells but in less amount
3) certain pili for attachment and investment

*Pathogenesis :-
- common cause of children meningitis (especially 6 months to 5 years)
- first causes sore throat, then might disseminated to blood stream causing sepsis, and to CSF causing meningitis
- might also cause otitis media, sinusitis, conjunctivitis and bronchopneumonia (if there is immunodeficiency)
- type b is responsible of 90% of H.influenae infections.
*lab diagnosis:
1) to detect it, we collect specimens as the following:
*in case of meningitis --- CSF sample
*in case of sore throat --- throat swap
*in case of sepsis ---- blood sample
*but in children < 5 years --- all of these types.
2) gram staining
3) culture:
* blood agar with growth factors V (NAD), X (part of hemoglobin - hemin)
* chocolate agar (which is heated blood which causes the destruction of red blood cells
   and releasing of growth factors)
* blood agar with hemolytic staph: hemolytic staph will cause hemolysis of RBCs,
   releasing growth factors, H.influenzae appear in colonies surrounding the white color
   of staph, this is called **satellitism**

- this picture shows the growth of H.influenzae in blood agar with Hemolytic staph

Satellitism: small colonies around large ones

4) biochemical test (in case of CSF sample) to recognize if there is **increase of the amount of protein and decrease of the amount of sugar**
Because any organism multiplication in CSF utilizes glucose and causes lysis of cell, releasing proteins
5) pathological test to look for the presence of white blood cells, polymorphic nuclear cells which indicates the presence of infection
*Clinical feature of meningitis: fever and rigidity in the neck

**Treatment and Vaccination**:

- Treatment by antibiotics
- There is a vaccine called Hib-vaccine, recently added to the triple vaccine
- Rare now in Jordan for causing meningitis
- This picture shows a CSF sample containing H.influenzae

- **Bordetella pertussis**:
  - Bordetella: scientist from Belgium, who discovered it
  - Pertussis = whooping cough which is form of prolong cough for 2 min and might reach 30 min.
  - Release pertussis toxin which produce a form of hemolytic reaction to the hair like structures in bronchi of lung + can damage RBC.
  - Child suffer from cyanosis (lack of O2 in blood) --> distress --> paralysis in respiratory tract --> death
  - If adult no immunized can gain the disease from their children.
  - Might result in damage of respiratory tract
  - Killer number 1 for children who aren't immunized
  - Any delay in the treatment will result in long life damage and allergic reactions in the respiratory tract (asthma)
  - If the person isn't immunized the body might to some extent produce antibodies originated from organisms which has similar pathogenicity called bordetella para-pertussis (produce less toxins)
- **Vaccination**: triple vaccine (DTP) with diphtheria and tetanus in form of inactivated or depleted pertussis cells (not virulent)
- **Treatment**: antibiotics (at early stage) before releasing of large amount of toxins.
- **Diagnosis**: very difficult
- less culture (lab diagnosis).
- by using a molecular technique called PCR
- symptoms: fever, pale face
- but might be confused with other cases such as b. Para-pertussis (newest physicians haven't seen cases of pertussis that's why they might misdiagnose similar diseases and think it's para-pertussis)
- no pertussis in Jordan due to immunization

- **Neisseria and Moraxella group** :-
  - gram–ve diplococci (kidney-shape)
  - oxidase and catalase +ve
  - susceptible to environmental factors, damaged autolysis, can't survives in cold temperatures, must be cultured without delay.
  - many Neisseria group are not pathogenic, part of respiratory tract normal flora such as (N.sicca, N.flava, N.subflava, N.mucosa)
  - the pathogenic species are:

1) **Neisseria gonorrhoea** :
- related to genital tract of humans and animals.
- intracellular organism
- causative agent for gonorrhea (مرض السيلان)
- gonorrhea: in relation to flow of fluids

*Virulent factors:
- attach to mucosa by pili
- release of enzyme called IgA-protease (damage receptor that prevent attachment, which allow to attach firmly)
- release endotoxins (Lipooligopolysaccharides) which are shorter chains than lipopolysaccharides but produce the same effect which is endotoxicity which contributes to the inflammatory process

*Pathogenesis:*
- gonorrhea: sexually transmitted disease can be in form of:-
*Acute inflammation : severe inflammatory reaction in the urethra associated with high fever and severe abdominal pain and pain during urination

*subacute
*chronic or asymptomatic: more in women without symptoms (and if there is symptoms like vaginal discharge, might be from other organisms such as candida).

*men often develop acute infection while women often develop chronic.
-causes urethritis (inflammation in the urethra), cervicitis (inflammation of the cervix), salpingitis
-rarely produce sepsis (generally not invasive)
-might produce localized infection in the oral cavity

*Lab diagnosis:
-can be detected from urethral discharge in men and vaginal discharge in women
-means releasing of thick yellowish fluid contain large amount of polymorphic nuclear cells in addition to the organism (pus)
-if we do gram staining we will recognize the following:
  Intracellular presence of gram–ve diplococci, if it's outside the cell it's other than Neisseria
-culture media in blood agar - chocolate agar (to confirm)
-no vaccine available
-Treatment by antibiotics (generally no resistance)

2) *Neisseria meningitidis* :
-in relation to meningitis
-might found in the respiratory tract without producing inflammation
-in children ages 6 months – 5 years are susceptible to meningitis if they aren't immunized
*This is because infants before 6 months have immunity from the mother called maternal immunity.
-start infection as sore throat, tonsillitis then might reach blood stream causing sepsis and CSF causing meningitis
-similar in invasiveness with H.influnzae but more than group A streptococcus
*always acute
*Virulence factors: 1) Presence of capsule 2) Presence of IgA-protease 3) LPS
- There are serotypes A, B, C (Middle East A+B / Sub-Saharan Africa – A+B+C and other)
- Not common in Jordan, acquired from outside
- If one case discovered in any community we have to expect other 100 cases asymptomatic (other 100 cases undetectable) (highly infectious).
- Close family members should be treated with antibiotics to prevent developing of other cases
*Treatment: Antibiotics in hospital with supportive fluids and isolation for at least 48 hours (same thing as H. influenza and Strep. Pneumoniae)
- There is a vaccine especially for persons going to endemic areas for at least one year

3) Moraxella catarrhalis
- First called Neisseria catarrhalis but then it's changed due to change of classification of this organism
- Catarrhalis: In relation to catarrhal stage – inflammation in the larynx
- Moraxella same as Neisseria gram –ve diplococci
- In certain persons who are heavy smokers or have damage in lungs (have compromised lung)
- Despite that it's part of the normal flora, of less pathogenicity compared to N. meningitidis and H. influenzae but might be associated with infection in the larynx and might produce pneumonia
*Lab diagnosis:
1) Gram staining
2) Culturing
3) Biochemical test (oxidase and catalase) --> +ive
4) Full biochemical test
*Treatment: Antibiotics.

GOOD LUCK