Notes

30

BORDETELLA

30.1 INTRODUCTION

The genus *Bordetella* are small Gram negative, non-motile, coccobacilli. This genus contains three species - *Bordetella pertussis, B. parapertussis, B. bronchiseptica. B. pertussis*is associated with classical whooping cough or pertussis and is the most fastidious of the three species. *B. parapertussis* causes milder form of pertussis. In contrast to *Haemophilus* influenzae they do not need X and V factors.

OBJECTIVES

After reading this lesson, you will be able to:

- describe the characteristics of *Bordetella*.
- describe the diseases produced by it.
- explain the laboratory diagnosis.

30.2 MORPHOLOGY

Bordetella was identified by Bordet and Gengou. As mentioned earlier *B. pertussis* is a small ovoid Gram negative coccobacilli 1-1.5 µm by 0.3?m. It is non-motile and non-sporing. When isolated from a clinical sample it is capsulated but rapidly loses it on subculture. In smears from culture, the bacilli are arranged in loose clumps with clear spaces in between giving a thumb print like pattern.

30.3 CULTURE CHARACTERISTICS

Bordetella are aerobes and facultative anerobes. They grow best at 35-36^{o}C. *Bordetella* are sensitive to various inhibitory substances. Bordet and Gengou

developed a special media for growing *Bordetella* which is called Bordet Gengou medium. It consists of glycerine potato blood agar. A higher concentration of blood is added not to provide additional nutritive factors but to neutralize inhibitory substances. The plates are incubated for 48-72 hours as the growth is slow. The colonies are small, dome shaped, opaque, greyish, refractile and glistening resembling the appearance of bisected pearls or mercury drops.They are surrounded with hazy haemolysis. Regan and Lowe is a selective medium comprising of charcoal, cephalexin, amphotericin along with horse blood.

30.4 BIOCHEMICAL REACTIONS

Bordetella pertussis is oxidase and catalase positive. Biochemically it is inert.

30.4.1 Antigenic Structure

While diphtheria and tetanus are singe toxin diseases, bordetella is a multitoxin disease. It produces eight different antigenically defined virulence factors.

- Agglutinogens
- Lipopolysaccharide
- Heat labile toxin
- Tracheal cytotoxin
- Pertusssis toxin
- Adenylatecyclase
- Filamentous haemagglutinin
- Haemolysin
- Pertactin

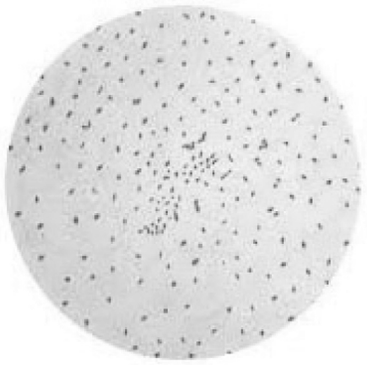

Fig. 30.1

Pertussis toxin, adenylatecyclase and filamentous hemagglutininare the major virulence factors which also exhibit excellent immunogenicity.

INTEXT QUESTIONS 30.1

1. *Bordetella* are Gram ..... bacilli.
2. Culturally Bordetella are facultative .....
3. Bordetella are grown in ..... media.
4. Bordetella are oxidase and catalase .....

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30.5 PATHOGENESIS

Like diphtheria, measles and chicken pox, pertussis is a childhood disease. *B. pertussis* causes whooping cough in 95%, *B. parapertussis* in 5% and *B. bronchiseptica* in 0.1% cases. The route of infection is respiratory. It is amongst the most contagious diseases. Incubation period is 1-2weeks. The disease can be divided into three stages-**catarrhal, paroxysmal** and **convalescent**. The infectivity is maximal during the incubation period and the catarrhal stage. Unfortunately the symptoms are non-specific and *Bordetella pertussis* cannot be diagnosed at this stage when treatment is most effective if given in this phase. Untreated the disease continues for 6-8 weeks. During the paroxysmal stage the violent paroxysm or spasm of continuous coughing leaves the lungs depleted of oxygen. This is followed by a long inrush of air in the near empty lungs in the inspiratory stage with the characteristic whoop. At this stage the patient may even become cyanosed and vomit. The eyes may bulge and drooling from mouth can occur. During convalescent stage, the frequency and severity of coughing slowly decrease.

30.6 LABORATORY DIAGNOSIS

Specimen collection

Cough plate method, nasopharyngeal aspirate, pernasal swab, West's post-pharyngeal swab are the methods used for collection of specimen. The swab should not be of cotton. It should be either of calcium alginate or dacron on a nichrome wire.

Cough plate method: Culture plate is held 10-15 cm in front of the patient's mouth while coughing.

Pernasal swab: Here a flexible swab is passed gently along the floor of the nasal cavity till resistance is felt. It is left there for 30 seconds and then withdrawn. This method collects specimen from the roof of the pharyngeal wall.

Microscopy

Smears may be made from respiratory specimen and stained by Gram's stain or preferably by fluorescent antibody technique.

Culture

The samples are plated on Bordet Gengou medium or Regan and Lowe's medium and incubated for 48-72 hours. Colonies are identified by biochemical tests and slide agglutination.

Serological investigations

Four fold rise in titre of antibodies is diagnostic. It can be demonstrated by agglutination, complement fixation and immunofluorescent test.

30.7 TREATMENT

Erythromycin is the drug of choice. Other drugs which can be used are tetracycline, chloramphenicol and ampicillin.

30.8 PROPHYLAXIS

Vaccination by whole cell killed vaccine in the triple vaccine combination (DPT) is very effective. Three intramuscular doses at 4-6 month intervals starting at 6 weeks of age is the recommended schedule. The booster dose should be given at 15-18 months of age. *B. pertussis* also acts as an adjuvant for the tetanus and diphtheria toxoids enhancing the immunogenicity of the vaccines. Now an acellular vaccine comprising of pertussis toxin, pertactin and filamentous hemagglutinin is also being used. It has fewer side effects but is costlier.

30.9 BORDETELLA PARAPERTUSSIS

It is non fastidious and grows on nutrient agar. Colonies are pigmented. Urease is positive. Whooping cough in 5% cases is attributed to it.

30.10 BORDETELLA BRONCHISEPTICA

In contrast to the other two species, it is motile with peritrichous flagella. It also grows on nutrient agar. It reduces nitrate to nitrite, hydrolyses urea and is oxidase and catalase positive. It is known to cause pertussis in 0.1% cases.

INTEXT QUESTIONS 30.2

1. Bordetella causes ..... in children.
2. The route of infection of pertussis is .....
3. Swab used for specimen collection contains ..... or .....
4. Staining technique preferred for identification by .....

WHAT YOU HAVE LEARNT

- *Bordetella* are Gram negative, ovoid shaped coccobacilli. They are aerobes, non-motile and catalase and oxidase positive.
- *Bordetella pertussis* is the most important species.

Notes

- When isolated from a clinical sample it is capsulated but rapidly loses it on subculture.
- In smears from culture, the bacilli are arranged in a thumb print like pattern.
- *Bordetella* can be cultured on Bordet Gengou medium and has the appearance of bisected pearls or mercury drops
- Pertussis is a childhood disease, with route of infection as respiratory.
- Cough plate method, nasopharyngeal aspirate, pernasal swab, West's post-pharyngeal swab are the methods used for specimen collection.
- Erythromycin is the drug of choice.
- Vaccination by whole cell killed vaccine in the triple vaccine combination (DPT) is very effective.

TERMINAL QUESTIONS

1. What are the species of *Bordetella*?
2. What are the stages of Pertussis?
3. What are the virulence factors of *B. pertussis?*
4. How should a sample from a case of suspected pertussis be collected?
5. Describe the laboratory diagnosis of whooping cough?
6. Write in brief about the vaccines for pertussis?

ANSWERS TO INTEXT QUESTIONS

30.1

1. Negative
2. Anaerobes
3. Bordet Gengou
4. Positive

30.2

1. Whooping cough
2. Respiratory
3. Calcium alginate, Dacron
4. Fluorescent antibody