University of Mosul
Lecture No.:
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Unit of Scientific Affairs
Website:

Lecture title: Brucella spp.

Lecturer Affiliation: Department of Microbiology, College of Veterinary Medicine, University of Mosul, Mosul, Iraq. **ihsanahmad@uomosul.edu.iq**

Summary: Brucella spp.

Key points

1. Classification (According to Bergey's Manual)

2. General characteristics

3. Usual habitat

4. Differentiation of Brucella species

5. Pathogenesis and pathogenicity

6. Diagnostic procedures

7. Treatment and control

8. Brucellosis in humans

Key Points

1. Small Gram-negative coccobacilli

2. Stain red using the modified Ziehl-Neelsen (MZN) method

3. Aerobic and capnophilic

4. Non-motile, catalase-positive

5. Most isolates are oxidase-positive

6. Intracellular pathogens

7. Target reproductive organs.

8. Some species cause undulant fever in humans

1. Classification (According to Bergey's Manual)

Family: Brucellaceae

Genus: Brucella

Brucella abortus

B. melitensis

B. suis

B. ovis

B. canis

B. neotomae

B. ceti

2. General characteristics

1. Brucella spp. are small (0.6 × 0.6 to 1.5 µm), non-motile,

coccobacillary, Gram-negative bacteria.

2. They stained red by modified Ziehl-Neelsen (MZN). In MZN-stained

smears of body fluids or tissues, they characteristically appear as

clusters of red coccobacilli.

3. Brucella has six main species. However, new species,

including brucellae of sea mammals and voles, have been

characterized in recent years (Table 1).

4. Brucella melitensis, B. abortus and B. suis are subdivided into

biovars based on cultural and serological properties.

5. Brucella species are aerobic, capnophilic (require 5 to 10%

CO2

for primary isolation) and catalase-positive. All Brucella

spp. are urease-positive except B. ovis.

6. Media enriched with blood or serum are required for culturing B. abortus biotype 2 and B. ovis.

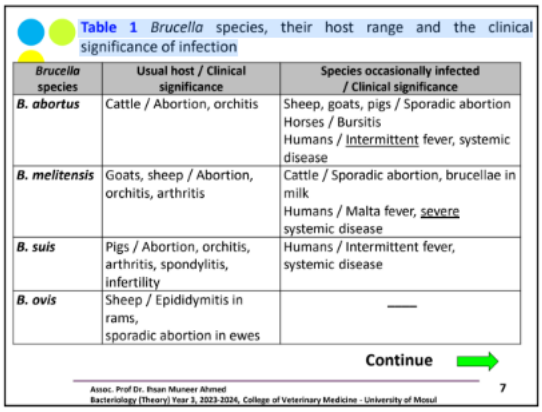

Table 1 *Brucella* species, their host range and the clinical significance of infection

Brucella species	Usual host / Clinical significance	Species occasionally infected / Clinical significance
B. abortus	Cattle / Abortion, orchitis	Sheep, goats, pigs / Sporadic abortion Horses / Bursitis Humans / Intermittent fever, systemic disease
B. melitensis	Goats, sheep / Abortion, orchitis, arthritis	Cattle / Sporadic abortion, brucellae in milk Humans / Malta fever, severe systemic disease
B. suis	Pigs / Abortion, orchitis, arthritis, spondylitis, infertility	Humans / Intermittent fever, systemic disease
B. ovis	Sheep / Epididymitis in rams, sporadic abortion in ewes	—

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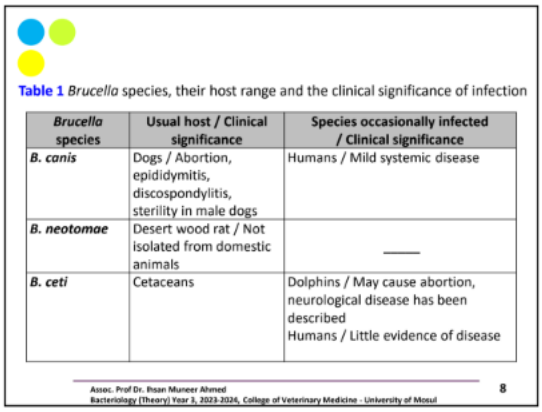

Table 1 *Brucella* species, their host range and the clinical significance of infection

Brucella species	Usual host / Clinical significance	Species occasionally infected / Clinical significance
B. canis	Dogs / Abortion, epididymitis, discospondylitis, sterility in male dogs	Humans / Mild systemic disease
B. neotomae	Desert wood rat / Not isolated from domestic animals	—
B. ceti	Cetaceans	Dolphins / May cause abortion, neurological disease has been described Humans / Little evidence of disease

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3. Usual Habitat

1. Brucellae have a preference for both female and male reproductive organs in sexually mature animals and each Brucella species tends to infect a particular animal species.

2. Infected animals serve as reservoirs of infection.

4. Differentiation of Brucella species

Brucella species are differentiated by colonial appearance, biochemical tests, specific cultural requirements and growth inhibition by dyes.

• In addition, agglutination with monospecific sera, susceptibility to bacteriophages and molecular methods are employed for definitive identification.

Slide agglutination tests with monospecific antisera are used to detect the presence of important surface antigens, abortus antigen A and melitensis antigen M.

5. Pathogenesis and pathogenicity

1. Brucellae persist within macrophages but not within neutrophils.

2. Inhibition of phagosome–lysosome function is a major mechanism for intracellular survival and an important determinant of bacterial virulence.

3. In the next phase of infection, virulent brucellae are transported to regional lymph nodes. Intermittent bacteraemia results in spread and localization in the reproductive organs and associated glands in sexually mature animals.

4. Erythritol, a polyhydric alcohol which acts as a growth factor for brucellae, is present in high concentrations in the placentae of cattle, sheep, goats and pigs.

6. Diagnostic procedures

1. Specimens for laboratory examination should relate to the specific clinical condition encountered.

2. MZN-stained smears from specimens, particularly cotyledons, fetal abomasal contents and uterine discharges, often reveal characteristic MZN-positive coccobacilli. In specimens containing cells, the organisms may appear in clusters.

3. Columbia agar, supplemented with 5% serum and appropriate antimicrobial agents, is used for isolation. Plates are incubated at 37°C in 5 to 10% CO2 for up to 5 days.

4. Serological testing is used for international trade and for identifying infected herds or flocks and individual animals in national eradication programs

Test	Comments
Brucella milk ring test (MRT)	Conducted on bulk milk samples for monitoring infections in dairy herds.
Rose-Bengal plate test (RBPT)	Useful screening test. Antigen suspension is adjusted to pH 3.6, allowing agglutination by IgG_1 antibodies. Qualitative test only, positive results require confirmation by CFT or ELISA
Complement-fixation test (CFT)	Widely accepted confirmatory test for individual animals
Indirect enzyme linked immunosorbent assay (I-ELISA)	Reliable screening and confirmatory test
Competitive ELISA (C-ELISA) (using monoclonal antibodies)	Recently developed test with high specificity; capable of detecting all immunoglobulin classes and can be used to differentiate infected animals from S19-vaccinated cattle
Serum agglutination test (SAT)	A tube agglutination test which lacks specificity and sensitivity; IgG_1 antibodies may not be detected, leading to false-negative results

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