

CORYNEBACTERIA

- Gram-positive, pleomorphic bacteria: In stained smears, they occur singly, in pallisades of parallel cells and in angular clusters resembling Chinese letters
- Fastidious, requiring enriched media
- Majority are commensals on mucous membranes
- Cause pyogenic infections
- Non-motile
- facultative anaerobes
- Catalase positive
- Oxidase negative
- The type species is *Corynebacterium diphtheriae*, the causes of diphtheria in children.



Usual habitat

- ✓ Many *Corynebacterium* species are commensals on mucous membranes.
- ✓ *Corynebacterium pseudotuberculosis* (formerly *C. ovis*) can survive for months in the environment.

Differentiation of the corynebacteria

Most pathogenic corynebacteria are relatively host specific and produce identifiable clinical syndromes. The host species and the nature of the disease may suggest the causal agent.

Identification criteria include:

- Bacterial cell morphology
- Colonial appearance
- Biochemical reactions.
- An enhancement of haemolysis test is used for the identification of *C. pseudotuberculosis*.

Colonial characteristics:

- ❖ *Corynebacterium bovis* is a lipophilic bacterium which produces small, white, dry, non-haemolytic colonies in the well of plates inoculated with a bovine milk sample.
- ❖ *Corynebacterium kutscheri* produces whitish colonies. Occasional isolates are haemolytic.
- ❖ *Corynebacterium pseudotuberculosis* has small, whitish colonies surrounded by a narrow zone of complete haemolysis, which may not be evident for up to 72 hours. After several days, the colonies become dry, crumbly and cream-colored.
- ❖ Members of the *C. renale* group produce small non-haemolytic colonies after incubation for 24 hours.

Pigment production after incubation for 48 hours is one of the differentiating features of the three species in the renale group (Table below).

Biochemical reactions:

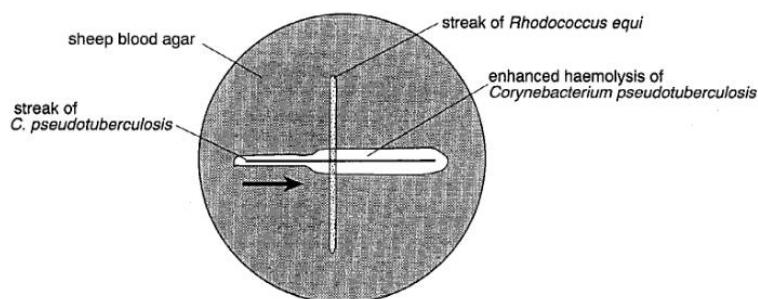
- ❖ Conventional or commercially-available biochemical tests can be used to differentiate the corynebacteria.
- ❖ Two biotypes of *C. pseudotuberculosis* are recognized. The ovine/caprine strains lack nitrate-reducing capacity, while the equine/bovine strains usually reduce nitrate.
- ❖ Urease is produced by all pathogenic corynebacteria with the exception of *C. bovis*.
- ❖ The biochemical reactions used to distinguish members of the *C. renale* group are indicated in Table below

Differentiation of bacteria in the *Corynebacterium renale* group.

Feature	<i>C. renale</i> (type I)	<i>C. pilosum</i> (type II)	<i>C. cystitidis</i> (type III)
Colour of colony	Pale yellow	Yellow	White
Growth in broth at pH 5.4	+	-	-
Nitrate reduction	-	+	-
Acid from xylose	-	-	+
Acid from starch	-	+	+
Casein digestion	+	-	-
Hydrolysis of Tween 80	-	--	+

Enhancement of haemolysis test:

The haemolysis produced by *C. pseudotuberculosis* is enhanced when the organisms are inoculated across a streak of *Rhodococcus equi*.



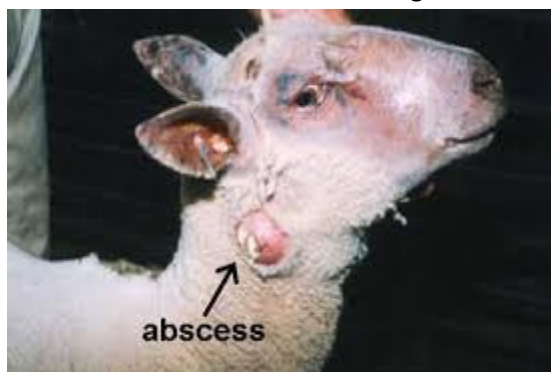
Enhancement of haemolysis test for *Corynebacterium pseudotuberculosis*. When a streak of *C. pseudotuberculosis* is drawn at right angles (arrow) across a streak of *Rhodococcus equi*, enhancement of haemolysis occurs.

Caseous lymphadenitis

- Caused by the non-nitrate-reducing biotype of *C. pseudotuberculosis*
- Is a chronic suppurative condition of sheep, goats and rarely cattle.
- Infection results in abscessation and enlargement of superficial or internal lymph nodes.
- The incubation period is about 3 months.
- The disease is prevalent in Australia, New Zealand, the Middle East, Asia, Africa and parts of North and South America. Caseous lymphadenitis is being reported more frequently in Britain and other European countries.
- Infection is spread by pus from ruptured abscesses and from nasal and oral secretions. The organism can survive in the environment for several months.
- *Corynebacterium pseudotuberculosis* has been isolated from the milk of affected goats.
- Sheep become infected through contamination of shearing wounds or by arthropod bites.
- Affected lymph nodes are enlarged and exhibit characteristic encapsulated abscesses which have an 'onion ring' appearance in cross-section. The abscess material is caseous, initially greenish and later putty-coloured.



- Haematogenous spread can lead to abscessation of internal lymph nodes without obvious superficial lesions. Pneumonia may be present.
- The visceral form of the disease may not be detectable antemortem.
- Goats usually develop the superficial form of the disease with subcutaneous abscesses in the head and neck regions.



Diagnosis

- The disease may be suspected on clinical grounds or at postmortem examination.
- Smears from lesions may reveal Gram-positive coryneform bacteria.
- Isolation and identification of *C. pseudotuberculosis* from abscess material is confirmatory.
- A sandwich ELISA, which detects circulating antibodies directed against the exotoxin, has been developed for identifying infected sheep.

Treatment

Because of the chronic nature of lesions and the ability of the organisms to survive intracellularly, therapy is usually ineffective.

Control Appropriate control measures for individual countries are determined by the prevalence of the disease.

Exclusion of caseous lymphadenitis from countries free of the disease:

- Sheep and goats should be imported only from countries which are either free of the disease or have a low incidence of infection. Animals must be selected from flocks or herds officially certified to be free of infection for 3 years.
- Animals should be subjected to pre-importation ELISA testing.
- Imported animals should be quarantined for several months and infected animals should be slaughtered.

Eradication of caseous lymphadenitis from countries with a low prevalence of the disease:

- Animals with obvious lesions should be segregated and culled.
- Regular testing of flocks or herds using ELISA should be followed by culling of animals with positive or doubtful results.
- Lambs can be removed from seropositive dams at birth and reared artificially.
- Contaminated buildings and equipment should be thoroughly disinfected.

Control measures in countries with a high prevalence of caseous lymphadenitis:

- Strict hygienic measures should be applied in buildings such as shearing sheds.
- Shearing and docking equipment should be regularly and thoroughly disinfected.
- Inactivated vaccines, available for use in some countries, may have a place in control programs.

Ulcerative lymphangitis

- The nitrate-reducing biotype of *C. pseudotuberculosis* causes sporadic cases of ulcerative lymphangitis in horses and cattle.
- Ulcerative lymphangitis occurs in Africa, the Americas, the Middle East and India.
- Infection occurs through skin wounds, arthropod bites or by contact with contaminated harness.
- The condition presents either as lymphangitis of the lower limbs or abscessation in the pectoral region.
- The onset of lymphangitis is slow and the condition usually becomes chronic.
- Affected lymphatic vessels are swollen and firm and nodules form along their length.
- Oedema develops in affected limbs, and ulcerated nodules exude thick, odourless, greenish, blood-tinged pus.

- Infection in cattle manifests as lymphadenitis and lymphangitis with abscess formation and ulceration.



Diagnosis is based on isolation and identification of *C. pseudotuberculosis* from lesions, since lymphangitis can also result from infection with other pyogenic bacteria.

Systemic antibiotic therapy may be combined with topical treatment using an iodophor shampoo. Affected animals must be isolated and contaminated areas should be disinfected.

Bovine pyelonephritis

- Organisms belonging to the *C. renale* group can be isolated from the vulva, vagina and prepuce of apparently normal cattle.
- The stress of parturition and the shortness of the urethra in the cow predispose to infection of the urinary tract.
- Although infection by any member of the group can cause cystitis, the most severe form is associated with *C. cystitidis*.
- Ascending infection from the bladder through the ureters can result in pyelonephritis. Clinical signs of pyelonephritis include fever, anorexia and decreased milk production.
- Restlessness and kicking at the abdomen may indicate renal pain.
- Dysuria, an arched back and blood-tinged urine are invariably present.
- Long- standing infections lead to extensive renal damage.

Diagnosis

- Clinical signs may suggest urinary tract disease.
- Thickened ureters and enlarged kidneys may be detected by rectal palpation. The condition is often unilateral.
- Red blood cells and protein are present in the urine.
- Culture of *C. renale* from urinary deposits, in association with characteristic clinical signs, is confirmatory.

Treatment

1. Antibiotic therapy, based on susceptibility testing, must be instituted early in the disease and should be continued for at least 3 weeks.
2. Because penicillin is excreted in the urine, treatment with this antibiotic is particularly effective for susceptible isolates.

Ulcerative balanoposthitis

- Ulcerative (enzootic) balanoposthitis (pizzle rot), particularly common in Merino sheep and Angora goats, is caused by ***C. renale*** and characterized by ulceration around the preputial orifice, with a brownish crust developing over the lesion.
- Similar lesions sometimes occur on the vulva in ewes.
- ***Corynebacterium renale*** can hydrolyze urea to ammonia which may cause mucosal irritation and ulceration. A high urinary urea level, a consequence of high protein intake, may predispose to the development of disease.
- A heavy wool or mohair cover around the prepuce predisposes to infection.
- Untreated cases may progress to total occlusion of the preputial orifice.