

Second Professional Year

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Corynebacterium
Trueperella
Rhodococcus

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Salient features:

- *Corynebacterium* species are:
 - Gram positive with *pleomorphic morphology*
 - small, non-spore forming,
 - non-motile,
 - catalase positive
- They appear as coccoid, club shaped, straight or slightly curved rods
- Arranged singly or in pairs or in *palisades of parallel cells*
- They may appear as ‘V’ or ‘Y’ shaped and also shows *Chinese letter*
- They have reserves of poly-phosphates called *metachromatic granules*



<https://www.google.com/search?q=corynebacterium&sxsrf=>

Salient features:

- Facultative anaerobe
- Required enriched media for growth
- The type species of the genus is *Corynebacterium diphtheriae*
- Important human pathogen causing diphtheria in children
- Diphtheria is a serious throat infection leading to impaired breathing
- The *C. diphtheriae*, lysogenized with *tox* gene containing *corynephage beta*, produces a very potent “diphtheria toxin”

Habitat

- Corynebacterium species are found ubiquitously in nature:
 - Soil,
 - Water,
 - Food products etc.
- Many of the corynebacteria remain as commensal on mucous membranes or skin of mammals

Important Species:

- Three important pathogenic species causing disease in animals and human are:
 - *Corynebacterim pseudotuberculosis*
 - *Corynebacterim renale*
 - *Corynebacterim diphtheriae*

C. pseudotuberculosis:

- **Facultative intracellular parasite**
- Commensal on normal skin and mucous membrane of sheep and goats
- **Biochemically *two strains are known:***
 - Non nitrate reducing **ovine /caprine** strain causes **Caseous lymphadenitis**
 - Nitrate reducing **equine / bovine** strain causes **Ulcerative lymphangitis**

Corynebacterium renale:

- Normal commensal on genital tract mucous membrane of bovine male and female.
- *C. renale* is classified into three types *i.e.*,
 - type I (renale);
 - type II (pilosum); and
 - type III (cystitidis)

They cause ascending infection affecting bladder, ureter and kidneys causing cystitis and pyelonephritis

Pathogenicity:

- Causes suppurative infections
- Present as commensal on mucous membranes and tissue trauma allows them to invade and establish infection
- The major virulence factor of *C. pseudotuberculosis* is *Phospholipase D (PLD)*, a potent exotoxin
- The organism of *C. renale* group produces urease which hydrolyses urea into ammonia which causes mucosal irritation and damage.
- *Mycolic acid present in cell wall prevent destruction within phagocytes* and also cytotoxic for phagocytes.

Caseous lymphadenitis:

- A chronic suppurative condition of sheep and goats
- Caused by non-nitrate reducing biotype of *C. pseudotuberculosis*
- Important disease primarily of sheep with worldwide occurrence
- Goat population also affected; affects most the sheep in the flock
- Sub-clinically infected animal– Pus discharged from a affected LNs-
Source of organism
- Affected animals with lung abscess may generate aerosol

Clinical presentation:

- Formation of pyogranulomas
- Caseous abscessation of lymph nodes
- In sheep, lymph nodes show characteristics encapsulated abscessation
- Giving classical “*Onion ring appearance*” in cross section (pathognomonic lesion)
- The two possible forms are:
 - External and
 - Visceral form known which may also coexist

Clinical presentation:

- The majority of infections are external in nature affecting **superficial lymph nodes**
- In external form, lymph nodes that may be palpated externally are affected.
- The visceral form is ch / by abscession of internal lymph nodes and organs
- In sheep, **lung parenchyma and mediastinal lymph nodes** are primarily affected
- However, in **goats, superficial nodes of the head and neck** regions primarily are affected

C. renale:

- Associated with bovine pyelonephritis
- Present in vulva, vagina and prepuce- normal healthy cattle
- Stress, injury, High protein diet predisposes infection- Ascending infection
- Most severe form of cystitis – *C. cystitidis*
- *Clinical Symptoms: Fever, Anorexia, Kicking at belly, blood tinged urine , dysurea*
- *Ulcerative balanoposthitis (Pizzle rot) : ulceration around the preputial orifice*

Diagnosis:

- History along with clinical sign and symptoms are suggestive of this condition.
- Coryneform morphology may be seen in Gram stained smear.
- Isolation of *Corynebacterium pseudotuberculosis* may be attempted on blood agar.
- **Enhancement of hemolysis test-**
A synergistic haemolytic activity called “Enhancement of hemolysis” is observed when *C. pseudotuberculosis* is streaked across the line of *Rhodococcus equi*.
- **PLD based ELISA** have been developed for diagnosing the disease
- PCR test have also been developed and used for diagnosis

Trueperella pyogenes

General Characteristics

- *Trueperella pyogenes*: A pleomorphic, Gram positive, non-motile, non-spore forming, non-capsulated facultative anaerobe
- shows fermentative metabolism; exhibit strong proteolytic activity
- Previously, the organism was known as *Corynebacterium pyogens* - causing “*Summer mastitis*” in cattle
- Renamed as *Actinomyces pyogens* and again as *Arcanobacterium pyogenes*

Classification:

- *Species: Trueperella pyogenes*
- *Family: Actinomycetaceae*
- *Order: Actinomycetales*
- *Class: Actinobacteria*

General Characteristics

- Required media enriched with blood or serum for culture
- On blood agar, the colonies are surrounded by zone of beta-haemolysis
- Part of normal microflora of skin and upper respiratory, genital and gastro-intestinal tracts of animals

Epidemiology:

- Considered as an important opportunistic pathogen
- *Trueperella pyogenes* is implicated in **polymicrobial infections**
- It is frequently isolated from mixed infections with
 - *Fusobacterium necrophorum*,
 - *Bacteroides* spp.,
 - *Peptostreptococcus indolicus* etc.
- Causing clinical conditions such as mastitis, uterine infections, liver abscess, foot rot etc.

Synergistic association:

- *T. pyogens* decreases the *oxidation-reduction potential* which promotes the growth of *F. necrophorum*
- Leukotoxin produced by *F. necrophorum* protects *T. pyogenes* from phagocytosis
- Lactic acid produced by *T. pyogenes*, can be used by *F. necrophorum* as an energy substrate

Virulence factors:

- The virulence factors of *T. pyogenes* are:
 - **pyolysin (a toxin)**
 - adhesion molecules (fimbriae, neuraminidases)
 - extracellular matrix-binding proteins
 - extracellular enzymes
(serine proteases, gelatinase, caseinase, DNase etc)

Clinical conditions:

- *In cattle*: mastitis, metritis, endometritis, pneumonia, pyelonephritis and liver abscesses
- Uterine infections usually follow parturition
- Mastitis is caused in both lactating as well as dry cows

Clinical conditions:

- *In swine:* Pneumonia, mastitis, pleuritis, endocarditis, arthritis, reproductive tract infections, and septicaemia
- *In small ruminants:* foot rot and abscesses
- *In horses:* metritis, mastitis, septicaemia, orchitis, umbilical infection in foals, wound infection etc

Rhodococcus

Rhodococcus equi

- Earlier k/a- *Corynebacterium equi* (*Intracellular Pathogen*)
- Affect foals below 6 months of age
- Causes – Bronchopneumonia
- Produces – Salmon Pink colonies

Suppurative Bronchopneumonia:

- Infection acquired by inhalation of contaminated dust
- Virulence factors include- capsular polysaccharides and mycolic acids
- Acute condition is seen in foals – 1 month age
- Clinical symptoms: Fever, Coughing, Anorexia, Dyspnoea, Moist rales etc.
- The *R. equi* gives positive CAMP test with β -hemolytic staphylococci

THE END

The images for slides are taken from resources available on internet and used for the purpose of teaching students