Poxviridae
(Lecture-2)

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Infections caused by cowpox virus - Cowpox

- Reservoir hosts – rodents

- From reservoir host, virus occasionally spreads to domestic cats, cows, humans and zoo animals

- Clinical cowpox disease in cattle extremely rare, but occurs sporadically in enzootic areas

- Produces lesions on teats and the contiguous parts of udder of cows

- Spread through herds by the process of milking
In domestic cats—infection may be systemic and more severe than in cattle or humans

- First small papules appear on head or forelimbs, eventually ulcerate

- Scab formation and then complete resolution in about six wks

- Few animals have signs of coryza or conjunctivitis

- Rarely, pneumonia and pleural exudation develop

**Diagnosis:** By histopathology, EM or virus isolation
Members of the genus Parapoxvirus

- Parapoxviruses infect a wide range of species
- Generally causing only localized cutaneous or mucocutaneous lesions
- These viruses are zoonotic
- **Orf virus**
  (contagious ecthyma/contagious pustular dermatitis virus)
- **Pseudocowpox virus**
- **Bovine papular stomatitis virus**
**Orf virus** (contagious eczema/ contagious pustular dermatitis virus)

- Disease – **Orf** (syn. contagious pustular dermatitis, contagious eczema, scabby/sore mouth)
- Important disease of **sheep and goats**, primarily affects young animals
- Camels and humans – also susceptible to infection
- Virus transmitted – through direct or indirect contact
- Under dry environmental conditions, virus stable, survive in scab material for months
Virus entry through skin abrasions

Virus is epitheliotropic, produces proliferative wart like lesions

Virus replicates in epidermal keratinocytes

Infected cells release an endothelial growth factor which is implicated in epithelial cell proliferation

Papular lesions progress to vesicles, pustules and eventually to scab formation
Proliferation of cells underlying scabs produces verrucose masses

In absence of secondary bacterial infection, lesions usually heal within four weeks

**Clinical Signs & Lesions**

- Incubation period– up to seven days
- Severely affected animals may lose weight and be predisposed to secondary infections
- Morbidity– high in young animals
- Mortality– usually low unless buccal cavity lesions prevent lambs and kids from suckling or to eat
Lesions most often occur on commissures of the lips and on the muzzle.

Also develop in mouth (affecting gums, palate and tongue), on feet, genitalia and teats.

Mild lesions may go unnoticed.
Diagnosis

- Based on characteristic appearance and distribution
- Virus present in lesion material can be identified by electron microscopy

Treatment and control

- No specific treatment
- Antibiotic therapy reduces effect of secondary bacterial infection
- In endemically infected flocks, control is based on the use of live vaccine
- Ewes vaccinated several weeks before lambing
- Commercial non-attenuated virus vaccines derived from infected scabs collected from sheep or from virus grown in cell culture used
Infections caused by pseudocowpox virus

- Causes **Pseudocowpox**, common cause of teat lesions in milking cows

- Transfer of infection can occur through teat cups and on milkers' hands, also mechanically by flies

- Healing at the centre of the lesions produces **characteristic ring or horseshoe shaped scabs**

- **Diagnosis**— Typical **parapoxvirus** particles demonstrated in scab material using electron microscopy

- **Control**— appropriate hygienic measures at milking, use of effective teat dips

- causes **milker's nodule** in humans
Bovine papular stomatitis virus

- **Disease** – Bovine papular stomatitis
- Transmitted by direct or indirect contact
- Produces mild papular lesions on the muzzle and in oral cavity of young cattle
- **Virions** – demonstrated in skin scrapings by electron microscopy
- Transmissible to humans
Genus– Avipoxvirus

(Fowlpox and other avian poxviruses)

- Fowlpox, pigeonpox and turkeypox viruses—closely related, not strictly host-specific

- Mechanical transmission by arthropods, especially mosquitoes, provides a mechanism for transfer of viruses between different species of birds

- Fowlpox virus—highly infectious for chickens and turkeys

- Turkeypox virus is virulent for ducks

- Other avian poxvirus infections are typically cutaneous form

- In canaries, the systemic form is common, produce 80–90% mortality
Fowlpox

- Disease of domestic poultry (chickens, turkeys etc.)
- Caused by infection with fowlpox virus
- Infection is slow-spreading
- Factors such as malnutrition, debilitation and stress may contribute to the severity of disease
- Persistence as latent infection and reactivation by stress may occur in a few birds
- Two forms of fowlpox—
  - Cutaneous form (dry pox)
  - Diphtheritic or wet form of fowlpox
Cutaneous form (dry pox)

- The most common form

- Results from infection by biting arthropods or mechanical transmission to injured or lacerated skin

- Nodular lesions develop on comb, wattles and unfeathered areas of skin

- Lesions occasionally develop on the legs and feet and around the cloaca

- The nodules become yellowish and progress to a thick dark scab

- Multiple lesions often coalesce
Involvement of the skin around the nares may cause nasal discharge

Lesions on eyelids can cause excessive lacrimation and predispose poultry to secondary bacterial infections

In severely affected birds, lesions may involve both feathered and unfeathered areas of skin

involvement of the eyelids may lead to complete closure

In uncomplicated cases, healing occurs within 03 weeks
Diphtheritic form of disease (Wet form)

- Caused by infection via droplets
- Involves infection of mucous membranes of mouth, pharynx, larynx, esophagus, and sometimes trachea
- Yellowish necrotic lesions (cankers) develop
- Lesions coalesce and result in necrotic pseudomembrane—can cause death by asphyxiation
- Oral lesions may interfere with eating
- Tracheal involvement may lead to laboured breathing and rales
- **Cutaneous infection**- little mortality and flocks return to normal production on recovery

- **Diphtheritic form**- Mortality up to 50% in severe outbreaks, particularly when accompanied by secondary bacterial or fungal infection

- Recovered birds- immune to subsequent folwpox virus infections

- Economic losses are largely due to a transient drop in egg production in laying birds and reduced growth in young birds
Large intracytoplasmic inclusions (Bollinger bodies) containing small elementary bodies (Borrel bodies) may be demonstrable in epithelial cells

- Immunofluorescence and immunoperoxidase techniques to identify viral antigen in intracytoplasmic inclusions

- Typical poxvirus particles demonstration by electron microscopy in material from lesions

- Virus isolation:
  - by the inoculation of avian cell cultures
  - on the CAM of 9 to 12 day old embryonated eggs
Serological tests—ELISA, virus neutralization, agar gel precipitation and passive haemagglutination

The diphtheritic form—more difficult to diagnose, because it can occur in the absence of skin lesions

Diphtheritic form may be confused with
- Vitamin A, pantothenic acid, or biotin deficiencies
- T–2 mycotoxicosis—induced contact necrosis
- Several other respiratory diseases caused by viruses
Treatment and control

- No specific treatment

- Control of secondary bacterial infection desirable

- In endemic areas, improved management and hygiene along with regular vaccination reduce the effect of disease

- Modified live fowlpox or pigeonpox virus vaccines, produced in avian cell cultures or chick embryo are available commercially

Thanks