Contagious ecthyma (contagious pustular dermatitis, orf, scabby mouth, soremouth)

Etiology

Orf is associated with the orf virus, a type species of the genus Parapoxvirus (family Poxviridae). In addition to the **orf virus (parapox ovis)**,

-the genus includes the viruses of **bovine papular stomatitis (parapox bovis 1),**

- **pseudocowpox (parapoxvirus bovis 2)**

,- **and a parapox virus of deer**.

The orf virus withstands drying and is capable of surviving at room temperature for at least 15 years. Restriction endonuclease digests of DNA shows considerable heterogeneity between different field isolates.

Epidemiology Occurrence

- The disease occurs worldwide in sheep and goats.

-It causes unthriftiness, varying degrees of pain, and some economic loss.

It occurs most commonly in 3- to 6-month-old lambs at pasture, although lambs 10 to 12 days of age and adult animals can be severely affected.

-Outbreaks involving the lips and face of young lambs and the udders of the ewes are common.

-This disease can occur at any time, but outbreaks are most common in grazing sheep during dry conditions, lambs in feedlots, and penned sheep being fed from troughs.

-The disease has occurred in musk ox, in which it causes heavy losses, and in reindeer, mountain goats and bighorn sheep, chamois, caribou, Dall sheep, buffalo, wild goats, and camels.

-The virus can be passaged in rabbits if large doses are placed on scarified skin or injected ID.

- Mild lesions develop on the chorioallantois of the 9- to 12-day-old chick embryo.

- Guinea pigs and mice are not susceptible.

- The disease also occurs in humans working among infected sheep. In abattoir workers it is most common in those handling wool and skins.

- Morbidity and Case Fatality Outbreaks may occur in sheep and goats, with morbidity rates approaching 100% and case-fatality rates from 5% to 15%. The deaths that occur are a result of the extension of lesions in the respiratory tract, but the case fatality rate may reach 15% if severely affected lambs are not provided with adequate care and support, or if secondary infection and cutaneous myiasis (flystrike) are allowed to occur.

- In the rare outbreaks where systemic invasion occurs, the case-fatality rate averages 25% and may be as high as 75%.

-Under field conditions, recovered animals are immune for 2 to 3 years, but no antibodies appear to be passed in the colostrum, and newborn lambs of immune ewes are susceptible.

- **Methods of Transmission**

-Scabs that fall off from healing lesions contain the virus and remain highly infective for long periods in dry conditions, but survival of the disease in a flock may be the result of chronic lesions that exist for long periods on individual animals.

- Infection can be from environmental persistence of the virus or from infected sheep.

-**Spread in a flock**

- is very rapid and occurs by contact with other affected animals or by contact with contaminated inanimate objects, such as feed troughs or ear-tagging pliers.

-An outbreak of lesions on the tail has been recorded in association with the use of docking instruments.

-It has been assumed that natural infections on pasture are the result of invasion of the virus after skin damage induced by prickly plants or stubble; application of a viral suspension to scarified skin is the established method of inducing orf.

-However, an outbreak has occurred in groups of lambs collected from several farms and transported in a vehicle over a period of 23 hours when there was no evidence of injury to their mouths.

- Experimental Reproduction The disease is readily reproduced by introduction of the virus onto scarified areas of skin.

- Immunity to reinfection is relatively solid at the site of initial infection, but shorter-duration lesions can be reproduced by rechallenge of these sheep at other sites.

-**Risk Factors**

-The primary risk factors are the presence of the virus and the immune status of the sheep.

-Mixing of sheep, such as occurs in a feedlot with sheep originating from several sources, allows transmission of the infection.

-Intercurrent infections may exacerbate the occurrence of disease on rare occasions. For example, the disease has spread from clinically normal ewes to susceptible 2- to 4-yearold ewes that were persistently infected with border disease virus.

-Lambs experimentally infected with Ehrlichia phagocytophilia and subsequently challenged with orf virus developed more severe lesions with a longer course than those in control lambs.

-**Economic Importance** The disease produces only a minor setback, except when it affects young sucking lambs with associated lesions on the teats and udders of their ewes.

-Loss from lamb mortality and secondary mastitis in these circumstances can be significant.

--**Zoonotic Implications Orf virus** is readily transmitted to humans and historically has been a risk for industrial workers handling raw wool.

- Lesions occur at the site of infection, usually an abrasion infected while handling diseased sheep for shearing, crutching, or drenching, or

- by accidental inoculation with live scabby mouth vaccine. Lesions progress from macular to papular stages, are usually single, and are localized on the hands, arm, or face. The lesions are self-limiting and heal without scaring after 6 to 7 weeks.

-They are pruritic and respond poorly to local treatment.

-Orf is also a zoonotic consideration in petting zoos and fairs where children allow lambs to suck their fingers or otherwise become infected from handling sheep in interactive exhibits.

Pathogenesis

Damage to the skin is essential for the establishment of orf infection and the development of typical lesions. Following viral challenge of mildly abraded skin, the virus does not establish in the damaged epidermis, but instead replicates in the cells of an underlying replacement epidermal layer derived from the walls of the wool follicles. Following scarification of ovine skin and topical application of the orf virus, antigen cannot b detected in the skin during the period when the

epidermis is being renewed. The virus can first be detected in the center of the newly differentiated epidermis immediately below the stratum corneum, 72 hours after infection.

The location of the virus during the eclipse stage is unknown. The infection spreads laterally and uniformly from the new epidermis, initially in the outer stratum spinosum and subsequently throughout the entire depth of the epidermis.

-The skin reaction consists of a cellular response with necrosis and sloughing of the affected epidermis and underlying stratum papillare of the dermis.

-The cutaneous response to infection includes a delayed-type hypersensitivity reaction and an influx of inflammatory cells involving neutrophils, basophils, and possibly mast cells.

- Class II dendritic cells are also involved and appear to form the basis of a highly integrated local dermal defense mechanism. The lesions evolve through the stages of macule, papule, vesicle, pustule, scab formation, and resolution.

The pustules develop within a few days and then rupture, resulting in ulcers and subsequently the formation of a thick overlying crust or scab that is shed within 3 to 4 weeks, leaving no scar. Immunity is solid but will last only about 8 months. Although there is an antibody immune response to the virus, recovery is the result of cell-mediated immune mechanisms.

Experimentally, a secondary infection, following recovery from a primary infection, is milder and accelerated. During the secondary challenge, pustules and scabs develop earlier, the lesions resolve more rapidly, and no vesicular stage may occur.

Clinical findings

-Sheep Lesions develop initially as papules and then pustules, stages that are not usually initially seen, and progress to a raised and moderately proliferative area of granulation and inflammation covered with a thick, tenacious scab.

Time from the initial lesions to the formation of scabs is approximately 6 to 7 days.

-New lesions will develop during the first 10 days of infection. The first lesions develop at the oral mucocutaneous junction, usually at the oral commissures, and are accompanied by swelling of the lips.

-here they spread to the muzzle and nostrils, the surrounding haired skin, and, to a lesser extent, o the buccal mucosa.

- They may appear as discrete, thick scabs 0.5 cm in diameter, or coalesce and be packed close together as a continuous plaque.

- Fissuring occurs, and the scabs are sore to the touch.

-They crumble easily but are difficult to remove from the underlying granulation. Affected lambs suffer a severe setback because of restricted sucking and grazing.

- **In benign cases**: the scabs dry and fall off, and recovery is complete in about 3 weeks. Affected lambs sucking ewes may cause spread of the disease to the udder, where a similar lesion progression is seen on the teats

Lesions on the teats predispose to mastitis, and secondary infection of the skin lesions by bacteria or fly larvae occurs in some cases.

- In rams, lesions on the scrotum may be accompanied by fluid accumulation in the scrotal sac and associated temporary infertility.

-A high incidence of infection can also occur where the dominant lesions are on the feet, occurring around the coronary band, the dew claws, and on the volar areas of the intervening skin.

- Occasionally severe edema of the face can occur in association with oral lesions.

-In a severe case, over 50% of 4-month-old Texel lambs grazing good-quality pastures in Ireland were affected.2 The edema resolved after 10 days but appeared quite similar to that seen with experimental bluetongue infections.

- Rarely, systemic invasion occurs and lesions appear on the coronets and ears, around the anus and vulva or prepuce, and on the nasal and buccal mucosae.

-There is a severe systemic reaction, and extension down the alimentary tract may lead to a severe gastroenteritis; extension down the trachea may be followed by bronchopneumonia.

- Lesions may also occur in the mouth, involving the tongue, gums, dental pad, or a combination of those sites. These are more commonly seen in outbreaks affecting lambs less than months of age. In the mucosa of the mouth these lesions do not scab but are papular erosive and surrounded by an elevated zone of hyperemia. Extensive painful and proliferative lesions occur on the gingival margins of the incisor teeth.

In some outbreaks the lesions on the skin are highly proliferative and present as raw, raised, granulating lesions without an overlying scab. This manifestation appears more common in Suffolk sheep, and lesions are present on the lips, bridge of the nose, and around the eyes.

-Cases of this proliferative form involving the feet are also recorded.

- **A malignant form of the disease**

has also been observed in sheep. It begins with an acute episode manifested by oral vesicles, followed by extension of these lesions down the gastrointestinal tract, followed later by granulomatous lesions and shedding of hooves.

-**An atypical case of the disease**

in sheep after extensive cutaneous thermal injury has been described. The virus was present in proliferative verrucous tissue lesions at the periphery of the original thermal injury. The lesions consisted of tightly packed 0.5-mmdiameter papillary projections.

-Goats An unusual case in a group of female goats has been described, with multifocal lesions over the head, neck, thorax, and flanks of each animal. The lesions developed approximately 2 weeks after the animals returned from a show at which the does were housed for 3 days in pens previously occupied by sheep. The lesions began as plaques, followed by epidermal proliferation and severe encrustation. Affected areas were discrete and approximately 2 to 7 cm in diameter. There were no lesions of the muzzle, lips, udders, or teats. Recovery occurred uneventfully within 3 to 6 weeks without treatment. The skin crusts gradually dried and fell off, leaving areas of alopecia and depigmented skin. Regrowth of hair followed.

- Clinical pathology

-Electron microscopic identification of the virus is quick and generally reliable with multiple samples from an affected herd or flock.

- Viral DNA can also be detected by a number of PCR assays, including real-time PCR and a multiplex PCR to differentiate orf, sheeppox, and capripox viruses.

- LAMP assays have also been developed.

These are comparable to a real-time PCR but require less sophisticated equipment and thus may be a suitable test where resources are limited but rapid differentiation of orf virus and poxviruses is necessary.

-Recovered animals have elevated neutralizing antibodies in their serum that are detectable by a gel diffusion test. Other serologic tests have been developed but are not widely available and probably of little clinical value.

Necropsy findings

In malignant cases there are irregularly shaped lesions with a hyperemic border in the oral cavity and the upper respiratory tract, with rare involvement of the mucosae of the esophagus, abomasum, and small intestine.

-Typical lesions are actually proliferative, with subsequent loss of centrally located cells creating an ulcer-like appearance.

Microscopically, the hyperplastic epithelium contains swollen degenerate cells, some of which may house eosinophilic cytoplasmic inclusion bodies. Samples for Confirmation of Diagnosis • Histology—formalin-fixed lesions (LM)

• Virology—vesicle fluid, scraping from lesion (EM).

differential diagnosis

In most outbreaks of ecthyma, the cases are sufficiently mild to cause no real concern

about losses or about diagnosis.Dramatic outbreaks of a very severe form of the disease may occur and may be confused with

1-bluetongue.

2-Very severe cases are also commonly seen in housed experimental sheep, especially colostrum-free lambs.

3- Ulcerative dermatosis is sufficiently similar to cause confusion in diagnosis, but this

disease has not been reported for many years.

4- Mycotic dermatitis usually occurs on woolled skin, but lesions can occur on the lips and feet (strawberry footrot), have a thick dry asbestos-like scab, and are easily differentiated by laboratory

culture.

5-Facial eczema is distinguished by diffuse dermatitis and severe edema and damage

to the ears.

6-Papillomatosis (warts) need also to be considered in the differential diagnosis for

the proliferative manifestations of contagious ecthyma, although warts are extremely uncommon in sheep.

7-Bluetongue is always accompanied by a high mortality rate and a severe systemic reaction, and lesions occur on the muzzle, the coronets, and extensively on the buccal mucosa. It is more common in adults than sucking lambs. Because it is transmitted by insect vectors, the morbidity rate is usually much less than the 90% commonly seen in contagious ecthyma.

8- Sheeppox may present a rather similarclinical picture, but the lesions are typical and there is a severe systemic reaction and heavy mortality rate.

9-Foot-and-mouth disease. The classic developed lesions of orf are easily differentiated from foot-and-mouth disease, but the papular and vesicular stages seen early in the course of orf, particularly lesions in the mouth, can be difficult to differentiate, especially when a prompt on-farm differentiation is required. The raised, firm, papular erosive nature of the lesion with the surrounding zone of hyperemia is a crucial differentiating feature in the field.

Ulcerative dermatosis of sheep

Ulcerative dermatosis of sheep is an infectious disease characterized by the destruction of epidermal and subcutaneous tissues and the development of raw, granulating ulcers on the skin of the lips, nares, feet, legs, and external genital organs.

- The lesions on the lips occur between the lip and the nostril, those on the feet occur in the interdigital space and above the coronet, and the genital lesions occur on the glans and the external opening of the prepuce of rams and the vulva of ewes.

-A virus, very similar to but antigenically different from the ecthyma virus, is the cause of the disease, which is likely to be confused with contagious ecthyma.

-**However, the lesions are ulcerative and destructive, rather than proliferative as in ecthyma, and bleed easily.**

- It is not highly infectious like bluetongue or sheeppox, and the “lip-and-leg” distribution of the lesions differentiates it from balanoposthitis of wethers,

strawberry footrot (dermatophilosis),

footrot, and

interdigital abscess.

The presence of lesions on the glans penis and their absence from mucosae, the typical ulcerative form of the lesion; the absence of pus; and the susceptibility of recovered animals to infection with ecthyma virus are diagnostic features of ulcerative dermatosis.

The typical morbidity rate is 15% to 20%, but up to 60% of a flock may be affected. Mortality is low if the sheep are in good condition and the lesions don't get secondary bacterial infection or flystrike.

- Physical contact at breeding time seems to be the most probable method of spread.

-The lip cutaneous form of this disease is very rare and possibly has disappeared since its original description, or is very uncommon.

- A clinically similar disease to the **genital infection of ulcerative dermatosis, with balanoposthitis and vulvovaginitis, is associated with Mycoplasma mycoides**

poxvirus infections in horses (horsepox, uasin gishu, viral popular dermatitis, equine molluscum contagiosum)

Equids can be infected by horsepox virus or vaccinia virus. Infection is associated with **classical horsepox, equine molluscum contagiosum, viral papular dermatitis, or Uasin Gishu disease and possibly a form of "greasy heel" in horses and donkeys.**

Classical horsepox, caused by infection of horses by a specific poxvirus (horsepox virus, HSPV), was common before the twentieth century and was considered a rare, if not extinct, disease of horses until it was again identified in Brazil in 2010.

-The genome of HSPV has been determined and demonstrates that although it is closely related to vaccinia viruses, it contains additional genetic material that appears to confer some host specificity and pathogenicity. HSPV, with cowpox virus, was used for vaccination of humans against smallpox before introduction of use of vaccinia virus.

Whereas most poxviruses are highly host adapted and do not cross species lines (e.g., variola virus causing smallpox in humans does not naturally infect animals), this is not the case with cowpox, horsepox, and vaccinia viruses, which can be zoonoses or anthroponoses.

-Widespread use of vaccinia virus live vaccines in humans was associated with a pox-like disease in horses. This disease has largely not occurred since the cessation of the smallpox vaccination program, but other poxvirus diseases in animals are reported, and infection appears to have the potential to be zoonotic for horsepox and cowpox viruses, or anthroponotic (reverse zoonosis) for vaccinia viruses.

The eradication of smallpox and the discontinuation of human vaccination in most countries were accompanied by a gradual reduction of the number of horse cases, although the disease is not eradicated, and infections involving cattle, horses and humans occur in Brazil.

-Horses infected with the vaccinia virus used in human vaccine programs develop a transient and self-limiting disease characterized by pox-like lesions (papulopustular) in the mucous membranes of the mouth and in the skin of the lips and nose.

- **Clinical signs**

- last approximately 6 to 12 days. The overall duration of the outbreak is 90 days. Infection by classical HSPV causes either a relatively benign disease or a more severe, sometimes fatal, disease.

- **The benign or localized form (contagious pustular stomatitis)** causes lesions in the muzzle and buccal cavity.

-The more severe form (equine papular stomatitis) is a generalized, highly contagious disease causing fever, skin lesions that can involve the udder, and death in some animals.

- Both adults and foals are susceptible.

- Immunity after an attack is solid. Typical pox lesions develop in a leg form or in a buccal form. In the leg-form nodules, vesicles, pustules, and scabs develop, in that order, on the back of the pastern and cause pain and lameness.

- There may be a slight systemic reaction, with elevation of temperature. In the buccal form, similar lesions appear first on the insides of the lips and then spread over the entire buccal mucosa, sometimes to the pharynx and larynx and occasionally into the nostrils.

-In very severe cases, lesions may appear on the conjunctiva, the vulva, and sometimes over the entire body. The buccal lesions cause a painful stomatitis, with salivation and anorexia as prominent signs. Most cases recover, with lesions healing in 2 to 4 weeks