Diagnostic Exercise

From The Davis-Thompson Foundation*

Answer Sheet

Case #:**198**; Month: **October**; Year: **2022**

Title: Contagious ecthyma in goats

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Clinical history: A technical visit to a goat farm was requested because two does and four kids had severe skin lesions. One week before, 2 kids died with similar lesions.

Clinical findings: During the visit to the farm, several does had lesions in the skin of the udder and teats (Figs. 1A and B), while most kids had lesions in skin of the lips (Figs. 1A and 2A), muzzle, eyelids, ears, and around the eyes (Fig. 2B). In most animals, the lesions consisted of irregular to round, multifocal to coalescing brown to black crusts, measuring between 0.5 cm and 4 cm diameter. In one dam, the lesions consisted of multifocal round areas of erythema and ulcers, measuring 0.3 cm to 0.5 cm. These ulcers had clear and depressed centers, which were surrounded by elevated brown to black crusts (Fig. 1A and 1B).

Necropsy findings: Four days after the visit to the farm, two kids died and were necropsied. Gross lesions in the skin were similar to those described above under clinical findings. No additional significant gross abnormalities were observed in either kid. Samples from the skin of udder and lip of the kids were collected and routinely processed for histopathology. Microscopic images of HE-stained sections from lips are shown in Figs. 3 and 4.

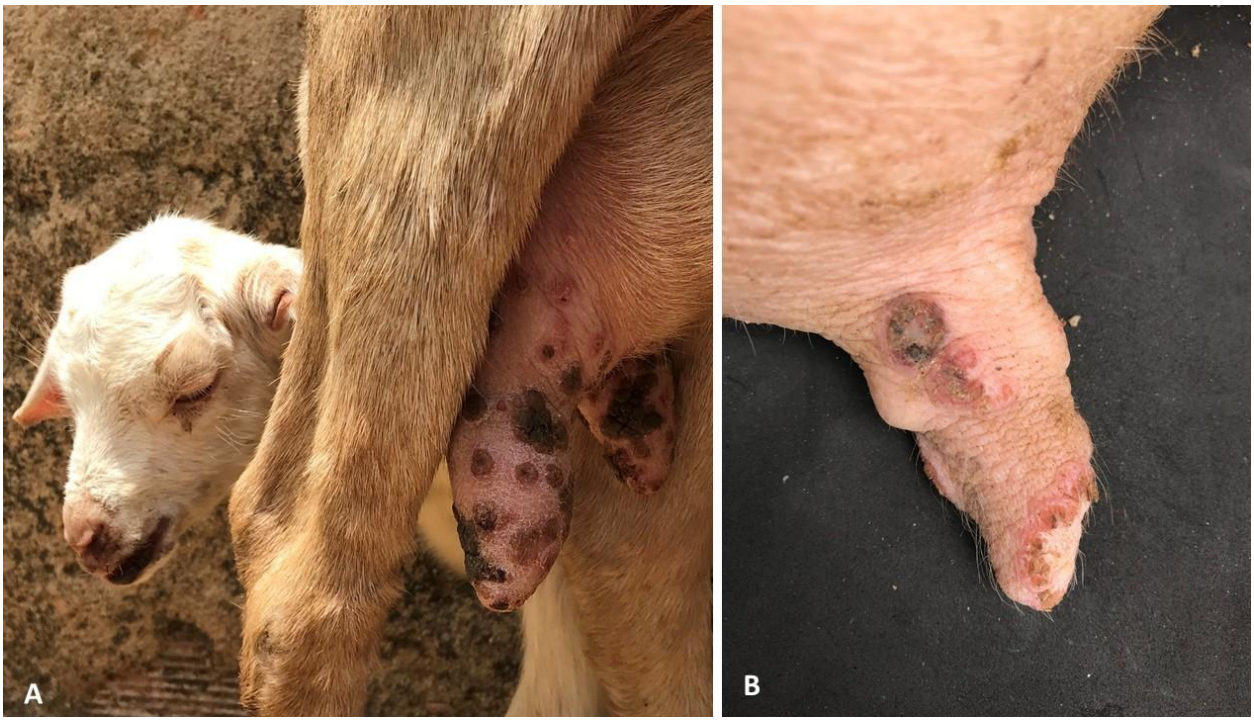

Figure 1. Contagious ecthyma, goat (A). Udder and teats skin. Multifocal to coalescing brown to black irregular to round shaped crusts, and erythema (thickened and black crusts are also observed in the kid's lips). (B) Teat skin. Multifocal to coalescing ulcers, and brown to black crusts.

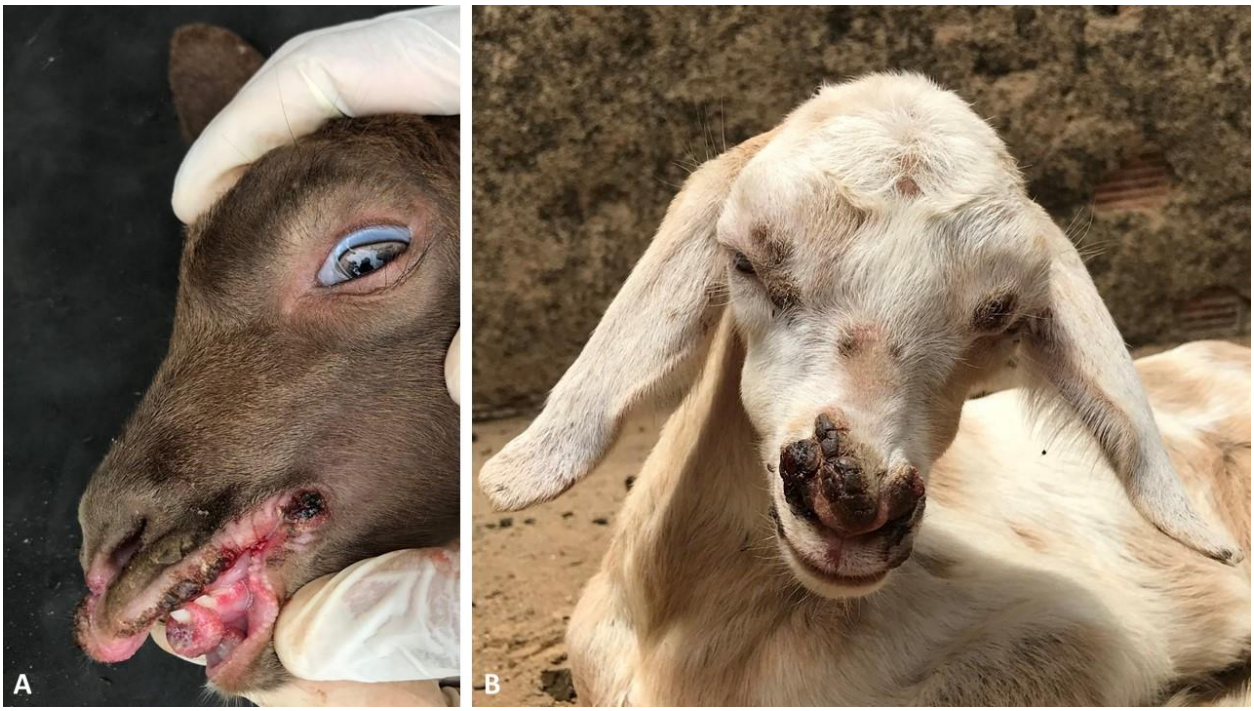

Figure 2. Contagious ecthyma, goat kids. (A) Lips. Multifocal to coalescing, irregularly shaped black crusts and ulcers. An ulcerated nodule near to the incisors and small round ulcers are seen in the gingiva. (B) Haired skin. Brown to black elevated and irregularly shaped crusts on the lips, muzzle and eyelids.

Microscopic Images:

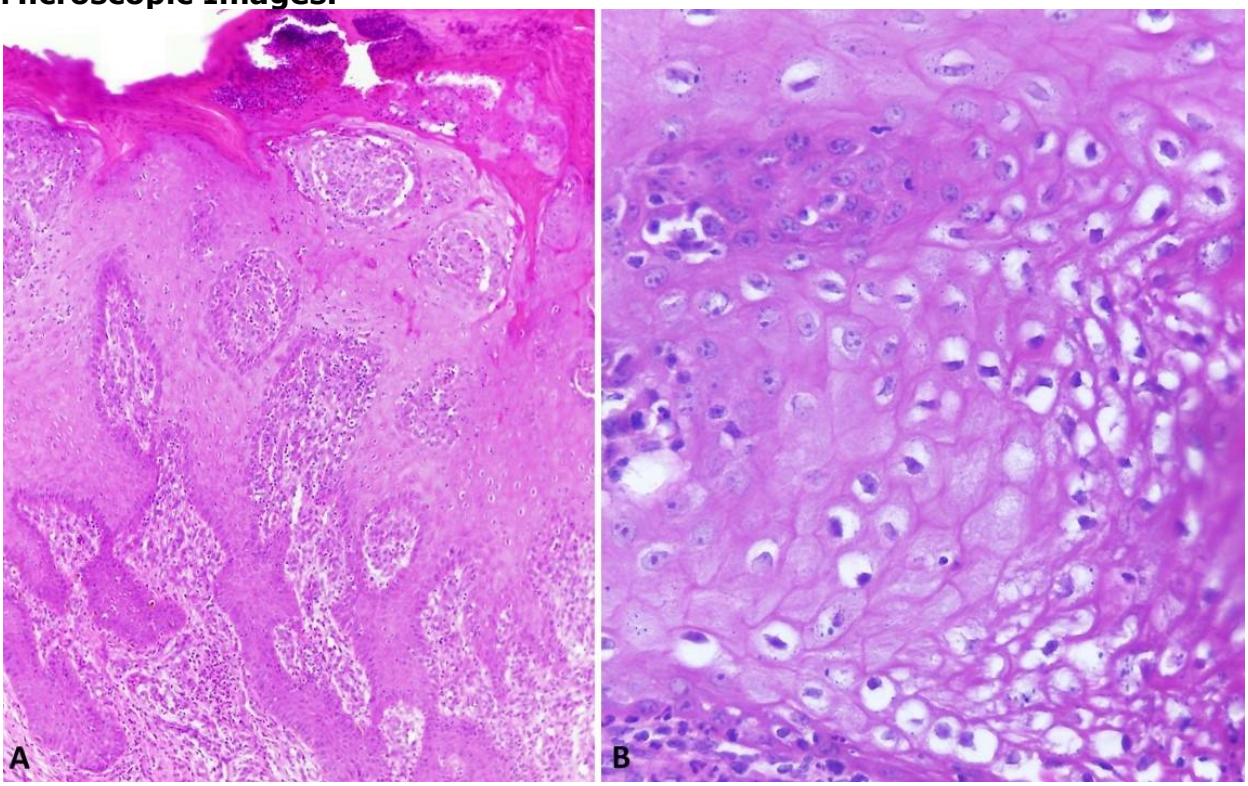

Figure 3. Contagious ecthyma, goat. (A) Mucocutaneous junction, lip: Epidermal hyperplasia with intraepidermal multifocal areas of inflammatory cell infiltration, and

desquamated keratinocytes. The *stratum corneum* is thickened and contains nuclei (parakeratotic hyperkeratosis). H&E, 10X. (B) Higher magnification of A. Keratinocytes in the *stratum spinosum* are severely vacuolated and swollen, and small numbers of neutrophils, lymphocytes and plasma cells are observed. H&E, 40X.

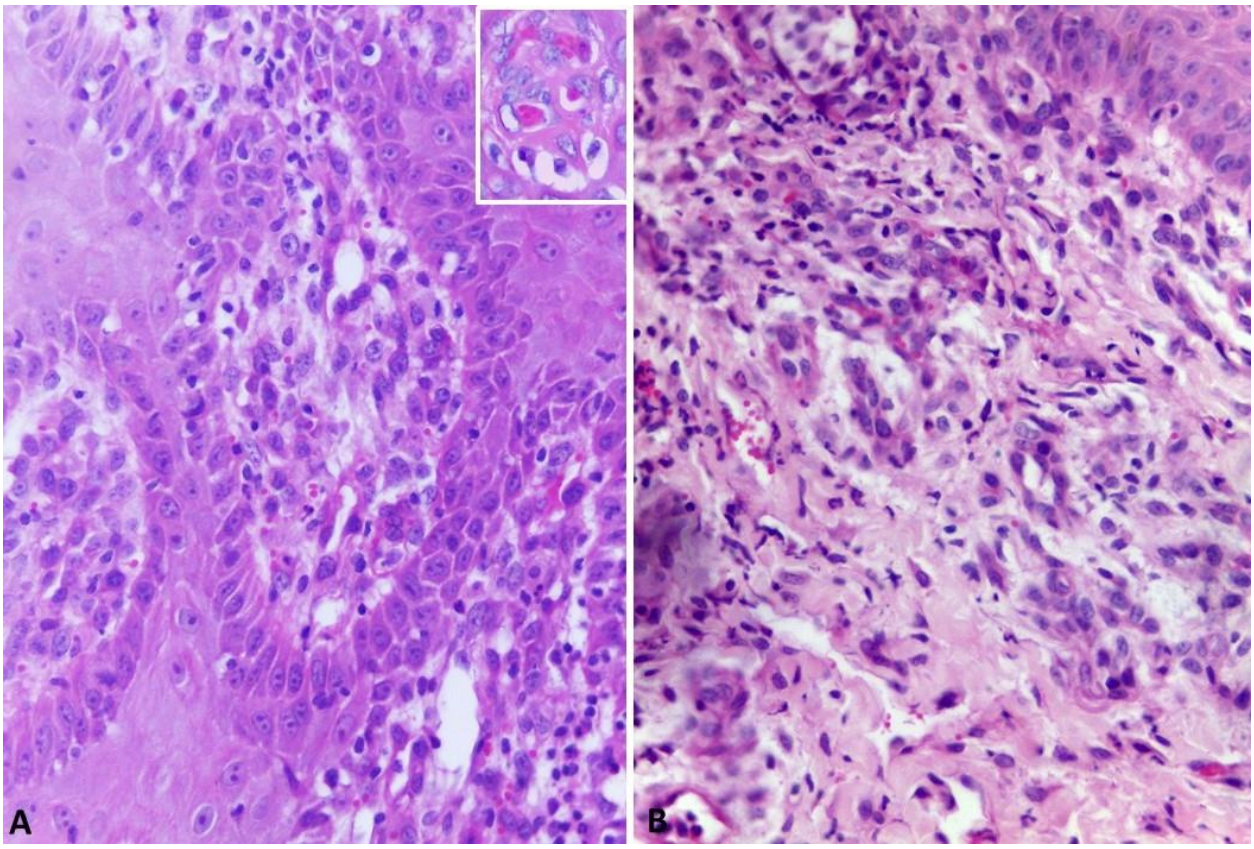

Figure 4. Contagious ecthyma, lip, goat. (A) The s*tratum basale* is thickened and markedly expanded, with intraepidermal multifocal areas of inflammatory cell infiltration, and vacuolated and swollen keratinocytes. Rare intracytoplasmic and acidophilic inclusion bodies are observed in the keratinocytes (*inset)*. H&E, 40X. (B) Dermis. Marked and diffuse infiltration of lymphocytes, plasma cells, histiocytes, degenerating neutrophils and cell debris. H&E, 40X.

Follow up questions:

(1) Histologic description: Mucocutaneous junction, lip: There is an extensive area of epidermal hyperplasia with intraepidermal multifocal areas of inflammatory cell infiltration including lymphocytes, plasma cells, viable and degenerating neutrophils, and desquamated keratinocytes (Figs. 3A-B, and 4A). The *stratum corneum* is thickened and contains nuclei. Keratinocytes in the *stratum spinosum* are severely vacuolated and swollen, and rarely contain intracytoplasmic eosinophilic inclusion bodies (Figs. 3A-B, and 4A *inset*). The *stratum basale* is thickened and markedly expanded (Fig. 4A). In the dermis, there is infiltration of lymphocytes, plasma cells, histiocytes, degenerating neutrophils and cell debris (Fig. 4B).

(2) Morphologic diagnosis: Dermatitis, hyperplastic, diffuse, severe, with intracellular edema of keratinocytes, acanthosis, intraepidermal parakeratotic hyperkeratosis and rare intracytoplasmic eosinophilic inclusion bodies

(3) Etiology: Orf virus (ORFV), Parapoxvirus.

(4) Pathogenesis: The ORF virus is epitheliotropic and replicates in regenerating epidermal keratinocytes. Infection is established through cutaneous abrasions, where the virus gains access to the systemic circulation via the lymphatic system. Other possible route of infection is by multiplication at the site of injection in the skin, which may lead to direct entry into the blood and primary viremia. Secondary viremia disseminates the virus back to the skin with viral replication in epidermal cells. At this phase, the virus induces epidermal hyperplasia along with degenerative changes resulting in erythematous macules, followed by papular, and then vesicular formations. Vesicles develop into flat pustules with a depressed center and a raised, often erythematous border. After the pustules rupture, crust forms on the surface; eventually the crusts become brown to black and very thick. The mucosal lesions are briefly vesicular, which then develop into ulcers. Lesions eventually heal and often leave a residual scar.

(5) Five names for this condition: Contagious ecthyma, Orf, contagious pustular dermatitis, infectious labial dermatitis, sore mouth.

Comments: Contagious ecthyma (CE) is a highly contagious infectious disease of small ruminants widespread worldwide wherever sheep and goats are raised (4,5). The disease is occasionally zoonotic, and also affects a wide range of domestic and wild animals including cattle, camelids, musk ox, reindeer, Japanese serow, seals, and sea lions (1,2,3,7,8,9). In sheep and goats, CE is predominantly a disease of lambs and kids, although adult animals may occasionally be affected. (4). CE may cause great economic losses associated mainly with loss of condition, because affected animals are unable to suckle or graze (5). Morbidity may reach 90%, but mortality rarely exceeds 1% unless secondary infections occur by agents such as *Fusobacterium necrophorum, Dermatophilus congolensis* and *Cochliomyia hominivorax,* in which case the mortality may be higher. Other secondary problems such as pododermatitis, mastitis, and aspiration pneumonia may also occur (5).

ORFV is a parapoxvirus and like other members of the family it expresses at least five immunomodulatory proteins that subvert or suppress elements of the host immune and inflammatory response, including the following: GM-CSF/IL-2-inhibitory factor (GIF), ORFV interferon resistance protein (OVIFNR), virus IL-10 protein (vIL-10) and viral vascular endothelial growth factor (VEGF) (2).

Clinically, CE is characterized by lesions that begin with papules and progress to form vesicles and pustules, before forming thick crusts that ulcerate easily. Focal or multifocal proliferative lesions are mostly confined to the epithelium of the oral mucosa, and the skin of the lips and around the nostrils, but they can also be found on the teats of nursing animals, and rarely on the tongue and gums (2,5).

CE is usually diagnosed based on clinical signs. However, several other diseases causing oral lesions can sometimes be confused with CE. The main differential diagnoses include capripoxvirus infection (11), bluetongue, foot and mouth disease, staphylococcal dermatitis and dermatophilosis. Laboratory tests are necessary to confirm the diagnosis. Commonly employed laboratory tests include:

direct electron microscopy, ELISA, cell-free translations (CFTs), serum neutralization tests, histopathology and PCR (2).

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