Diagnostic Exercise
From The Davis-Thompson Foundation*

Case #: **200**; Month: **Novembe**r; Year:**2022**
Answer sheet

Title: Infectious bovine rhinotracheitis in a calf

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Clinical History: A two-year-old Aberdeen Angus heifer presented an abrupt onset of tachypnea, mucopurulent nasal discharge, dyspnea, and fever (41□C). Twenty-four hours after the onset of clinical signs, the heifer had ruminal atony, severe dehydration, hypothermia (35□C), and died. A few days before this heifer died, another two steers from the same herd had similar clinical signs and died. The herd was composed of 200 cattle, confined in an outside pen in a feedlot operation. Cattle were purchased from many properties and introduced to the herd without any type of quarantine or testing. The heifer had been on the property for 39 days and had no vaccination history.

Gross Findings: The nasal epithelium had severe hyperemia and was covered by thick fibrillar yellow material (fibrin). Severe hyperemia and fibrin deposition were observed in the mucosa of the trachea (**Figure 1**) and large bronchi. Additionally, the lumen of airways contained thick mucoid material and blood clots. The lung was non-collapsed (**Figure 2**) with intense interlobular edema (**Figure 3**). In the cranioventral regions of the lungs, areas of atelectasis and dark purple-red discoloration were evident.

Gross and Histological Images:

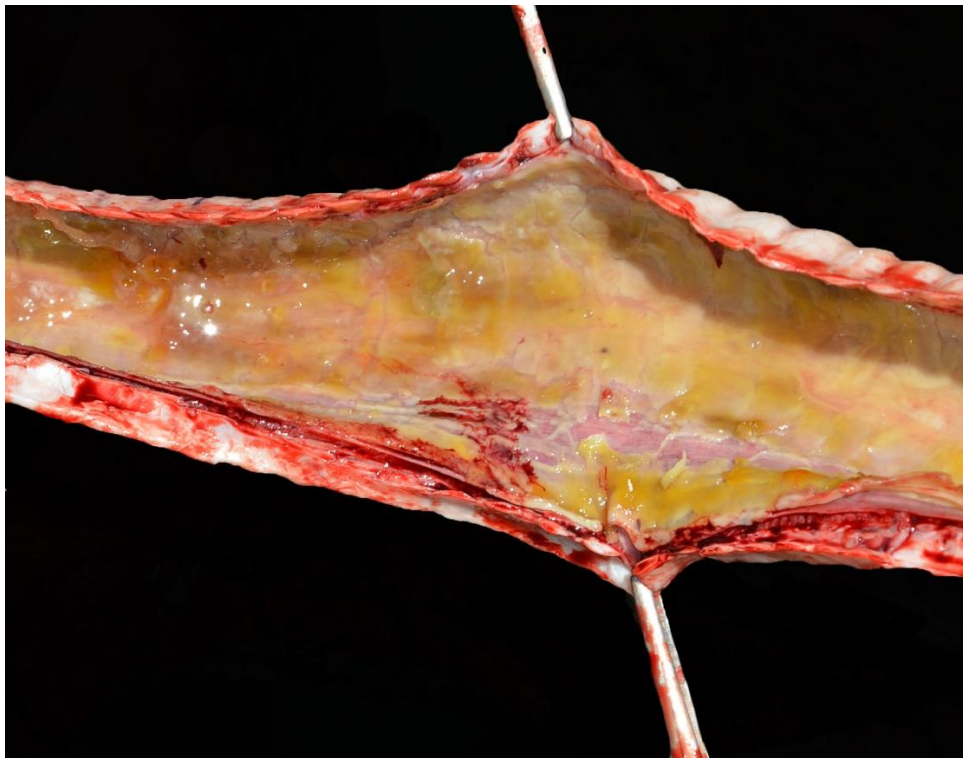

Figure 1. Severe fibrin deposition in the mucosa of the trachea.

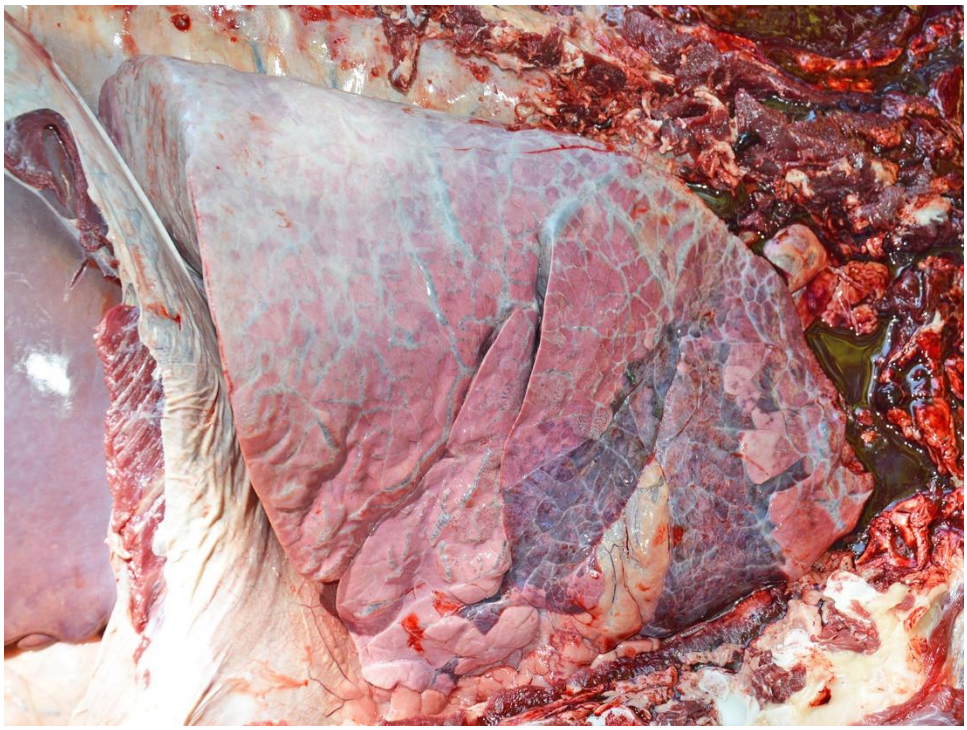

Figure 2. Non-collapsed lung with intense interlobular edema. In the cranioventral regions of the lung, there are evident areas of atelectasis and dark purple-red discoloration.

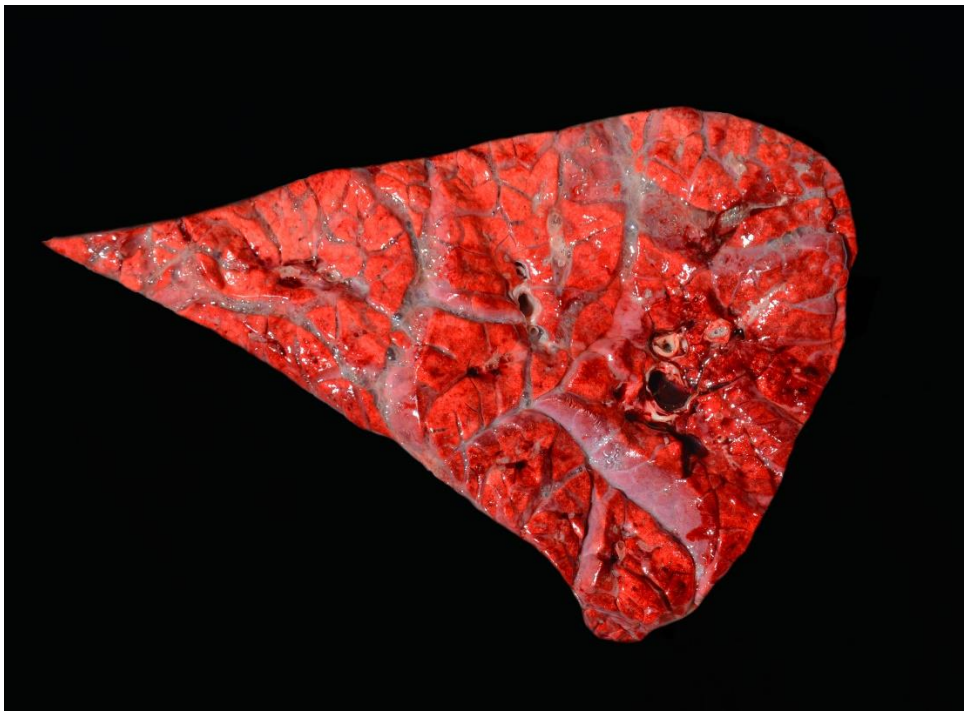

Figure 3. Cut surface of the lung demonstrating severe interlobular edema.

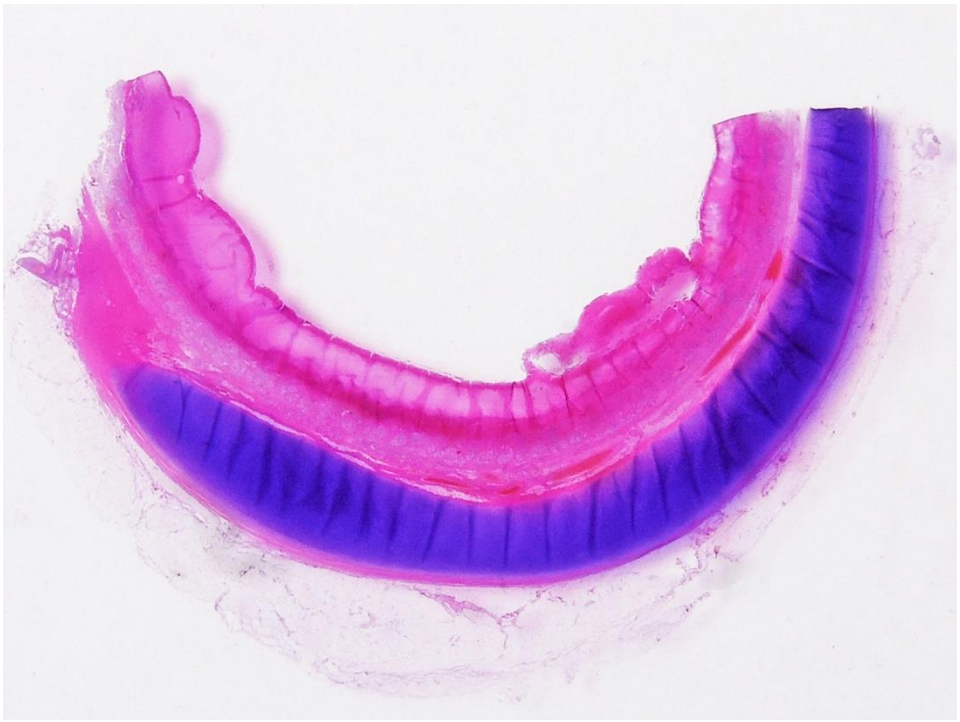

Figure 4. Trachea, heifer, sub gross photomicrograph. Hematoxylin and eosin (HE). Severe fibrin deposition in the mucosa of the trachea.

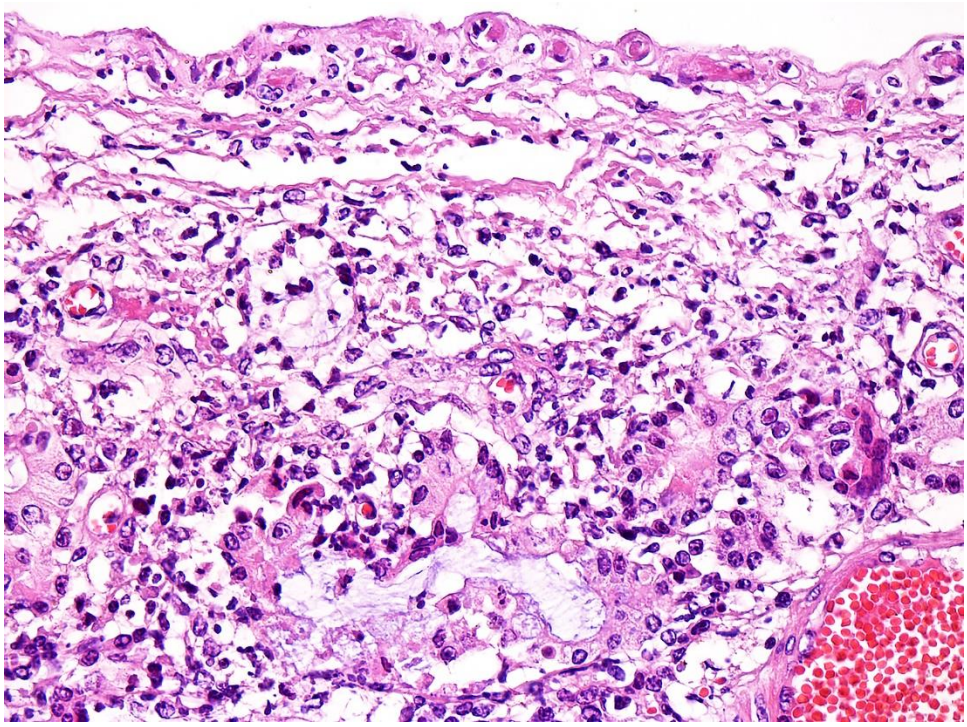

Figure 5. Nasal cavity, heifer. Hematoxylin and eosin (HE), 200x. The mucosa presents severe and diffuse necrosis, with necrotic debris, and degenerate neutrophils. Amphophilic intranuclear inclusion bodies measuring 8-15 µm are present in the nasal glands.

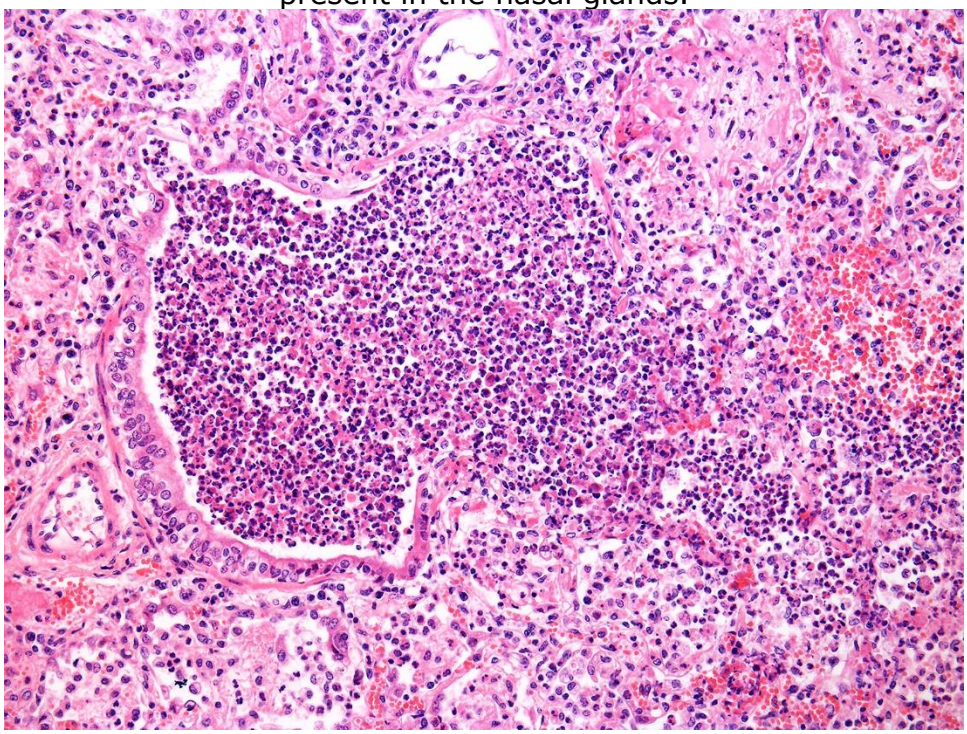

Figure 6. Lung, heifer. Hematoxylin and eosin (HE), 200x. In the lung, multifocal and severe necrosis are observed in alveolar septa, bronchi, and bronchioles, with fibrin deposition, inflammatory infiltrate of degenerate neutrophils, and macrophages.

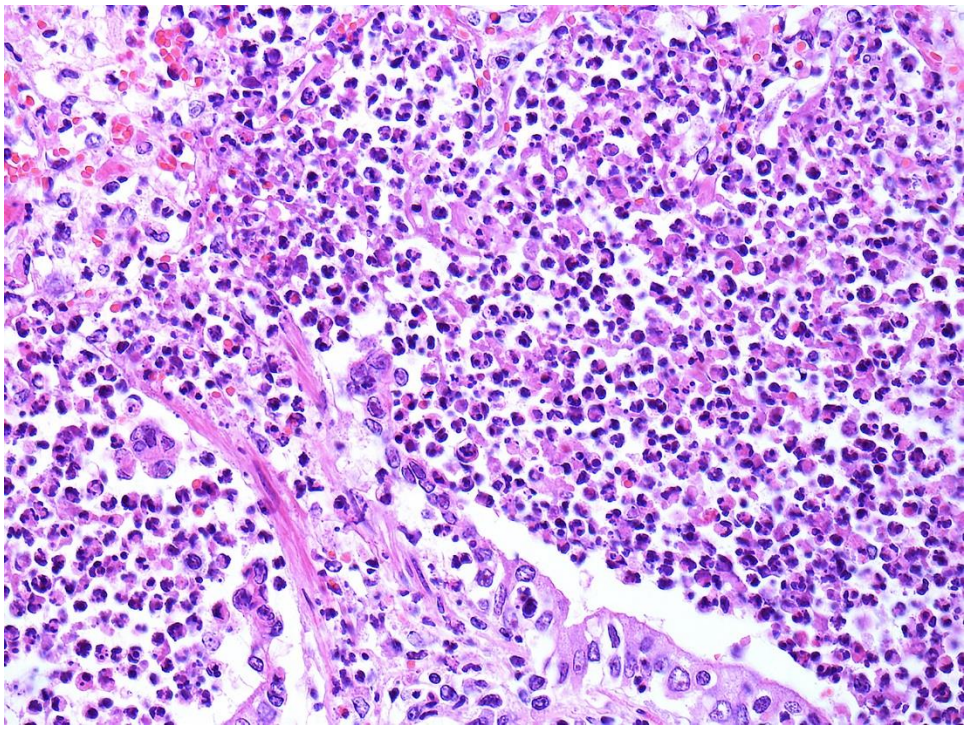

Figure 7. Lung, heifer. Hematoxylin and eosin (HE), 400x. In addition to the necrosis and neutrophilic infiltrate, many amphophilic intranuclear inclusion bodies are observed in the bronchiole epithelium.

Follow-up questions: Histological description, name of the condition, etiology, two etiological differential diagnoses

Histological Description: Sub grossly, the trachea mucosa is expanded by a severe amount of eosinophilic material (**Figure 4**). Microscopically, the nasal turbinates had severe multifocal necrosis of the respiratory epithelium, associated mainly with neutrophils, as well as fewer lymphocytes and macrophages, fibrin deposition, and necrotic debris (**Figure 5**). In the trachea and larynx, there was severe and diffuse necrosis of the mucosa, with deposition of a large amount of fibrin, necrotic debris, and degenerate neutrophils. In the lung, multifocal and severe necrosis was observed in alveolar septa, bronchi, and bronchioles (**Figure 6**), with fibrin deposition, inflammatory infiltrate of degenerate neutrophils, macrophages, and occasional bacterial aggregates. Multifocal areas of hemorrhage, severe alveolar, and interlobular edema, and thrombosis were also observed. Amphophilic intranuclear inclusion bodies measuring 8-15 µm were present in the epithelium of nasal glands, and bronchiole (**Figure 7**).

Ancillary tests:
We performed molecular tests (PCR) for Bovine Herpesvirus type 1 (BoHV-1) which was positive. We also tested for Bovine Respiratory Syncytial Virus (BRSV), *Parainfluenza* type 3 virus, and *Mycoplasma bovis*, which all presented negative results. In addition, we sent a swab sample of the respiratory tract (trachea) for aerobic culture, and *Trueperella pyogenes* was heavily cultured.

Name of the condition: Infectious bovine rhinotracheitis (IBR)

Etiology: Bovine Herpesvirus type 1 (BoHV-1)

2 Etiological Differential diagnoses:
- *Ovine herpesvirus type 2 (OvHV-2)*
- *Bovine coronavirus (BCoV)*

Comments: In our case, the Bovine Herpesvirus type 1 (BoHV-1) diagnostic was confirmed through the association of clinical and pathological findings, and the detection of viral DNA through molecular analysis. Bovine herpesvirus 1 (BoHV-1), is a member of the family *Herpesviridae*, subfamily *Alphaherpesvirinae*, genus *Varicellavirus* (2). BoHV-1 is a pathogen of cattle associated with two major syndromes, called infectious bovine rhinotracheitis (IBR) and infectious pustular vulvovaginitis (IPV), and a variety of clinical signs, such as conjunctivitis, encephalitis, and abortions (2, 4). BoHV-1 is responsible for significant losses incurred by disease and trading restrictions in the cattle industry (1). BoHV-1 is widespread in cattle populations, but the clinical disease IBR is uncommon in areas where vaccination is practiced, and areas where extensive grazing is common. The disease is more common in animals over six months of age, probably due to a decline in passively acquired immunity, and consequent exposure to the virus. IBR outbreaks are more frequently observed in calves and are associated with stressful situations, such as transportation and confinement (2, 7). Larger herds are generally at greater risk from infection because they have more potential transmission contacts both within the herd and with other herds through cattle purchases and a higher number of visitors (6, 8). Infection is transmitted by aerosol, direct contact with nasal, ocular, or vaginal secretion, or by indirect contact with fomites, semen, feed, or water. Sources of BoHV-1 infection include clinically or subclinically infected cattle and reactivation of latent infections. In uncomplicated cases of IBR, characteristic signs include fever (41 to 42°C), increased respiratory rate, varying degrees of inappetence, occasional coughing, and serous to mucopurulent nasal discharge, as described in our case. The course of the disease is variable among individual animals and secondary bacterial infection will both increase the severity of the disease and the duration of clinical signs. Following infection with BoHV-1, there is a high probability of secondary colonization of the respiratory tract with bacteria, especially *Mannheimia haemolytica*, which is often present in the nasopharynx of cattle (2). In our case, the calf had a secondary bacterial infection by *Trueperella pyogenes*. BoHV-1 infections also cause transient immunosuppression, which, together with damage to the respiratory mucosa, makes BoHV-1 an important pathogen in Bovine Respiratory Disease Complex (BRDC), the most important respiratory disease in cattle (3). The gross appearance of IBR is highly suggestive of the causative agent. A definitive diagnosis of disease due to BoHV-1 is best achieved with the association of clinical signs, and virus detection (3). Among differential diagnoses for viral tracheitis in cattle we must include Ovine Herpesvirus type 2 (OvHV-2) the causative agent of malignant catarrhal fever (MCF), and Bovine Coronavirus (BCoV). Clinical disease and gross lesions are similar for BoHV-1, MCF, and BCoV; therefore, the differentiation between these agents is made based on histological lesions, and molecular tests. BCoV is an important cause of enteric disease in young calves, and the same strains occasionally induce respiratory disease in calves 2-16 weeks of age. The main histological finding is ulceration and attenuation of the epithelium, with

areas of squamous metaplasia (2, 5). While MCF usually affects older cattle (8 to 24 months) and presents widespread lesions as a consequence of systemic vasculitis. Also, the lesions in the trachea are characterized as fibrinoid necrotizing vasculitis, erosive tracheitis, and lymphoproliferation (2).

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