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## Concurrent infection of PPRV and bacterial pathogens in sheep: Clinical, pathological, and microbiological characterization

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### Abstract

Peste des petits ruminants (PPR) is a highly contagious and fatal viral disease of sheep and goats. The disease causes fever, eye and nasal discharges, sores in the mouth, diarrhea, and respiratory signs. The diagnosis of PPR is based on clinical signs, pathological lesions, and laboratory tests. This study investigated the occurrence of PPRV infection in a six-month-old sheep that died after showing clinical signs of high fever and diarrhea. The necropsy findings revealed severe lesions in the lungs and lymph nodes, and the microbiological examination revealed mixed bacterial flora in the lung abscess. The study emphasized the importance of early detection and treatment of PPRV infection in sheep, as well as the potential risk of secondary bacterial infections and abscess formation.

**Keywords:** Clinical signs, pathological lesions, and laboratory tests

### Introduction

Peste des petits ruminants (PPR) is an acute contagious viral disease, that primarily affects small ruminants i.e., sheep, and goats (Dhar *et al.*, 2002) <sup>[1]</sup>. The disease is characterized by high fever, conjunctivitis, stomatitis, gastroenteritis, and pneumonia (Gibbs *et al.*, 1979) <sup>[2]</sup>. It is caused by the Peste des petits ruminants virus which belongs to the family Paramyxoviridae, genus Morbillivirus. It is closely related to the rinderpest virus, measles virus, and canine distemper virus (Muniraju *et al.*, 2014) <sup>[3]</sup>. The morbidity rate is as high as 100% with a mortality of 90% in infected animals (Abu-Elzein *et al.*, 1990) <sup>[4]</sup>. It is on the list of notifiable diseases according to the World Organisation for Animal Health (WOAH) and the Food and Agriculture Organization (FAO) (Rojas *et al.*, 2021) <sup>[5]</sup>. WOAH and FAO have jointly developed a strategy to eradicate PPR by 2030 (woah.org).

### History

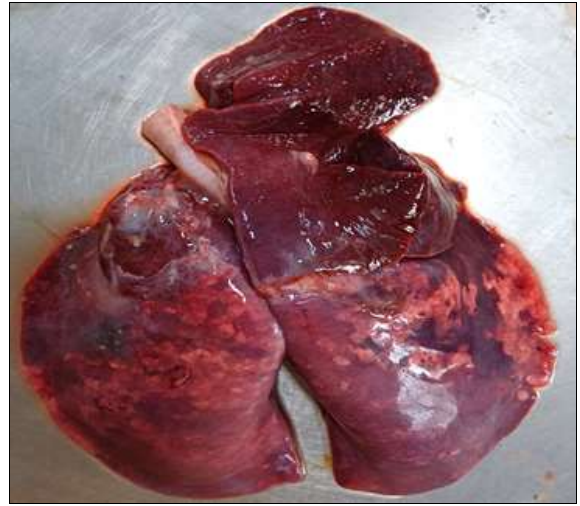
A six-month-old sheep that had died with clinical signs of high fever and diarrhea was presented for necropsy. Upon investigation for clinical signs, it was found that the sheep was dull, and depressed, with a high fever of 103-104°F, diarrhea, and pale mucus membranes for the past seven days and is being treated symptomatically for PPR for the past 5 days. External examination of the carcass has revealed rigor mortis in hind limbs, and a pale mucus membrane (Fig 2) with no nasal discharges was observed.

### Necropsy findings

The carcass was examined to determine the cause and extent of the disease. Necropsy findings of the carcass showed signs of infection and inflammation in the sheep's respiratory and digestive systems which are the main targets of the PPRV. Necropsy of the lungs has revealed a pus-like semisolid mass oozing from the right lung (Fig 3) indicating serious and chronic infection.



**Fig 1:** Dead sheep presented for necropsy



**Fig 4:** Right cranial lung lobe showing multiple localized abscess



**Fig 2:** Figure showing pale conjunctival mucus membrane of the carcass

Multiple localized abscesses on the right cranial lung lobe and the caudal lobes were consolidated with pale elevated areas of emphysema observed, the abscesses were scattered on the lung surface, showing that the infection had spread throughout the organ (Fig 4).

Lymphadenopathy of the mediastinal and mesenteric lymph nodes, which are associated with the respiratory and digestive systems respectively, indicated an overwhelmed immune response to the high viral load (Fig 5, and Fig 6).



**Fig 5:** Enlarged mediastinal lymph nodes



**Fig 3:** Semisolid pus oozing from right lung



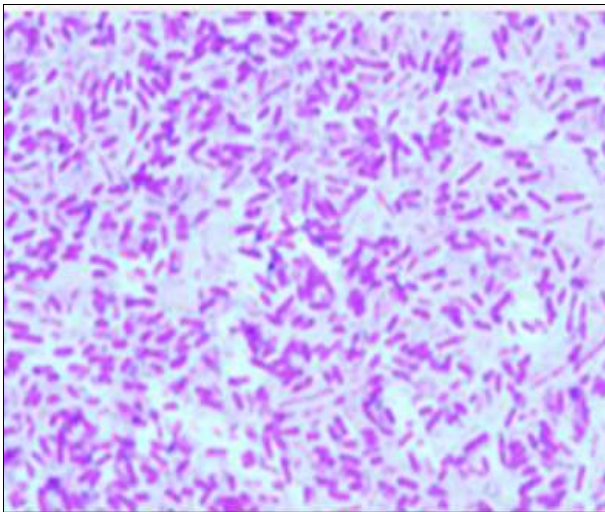
**Fig 6:** Enlarged mesenteric lymph nodes

### Microbiological examination

Microbiological examination was performed by streaking the abscess from the lungs on the MacConkey agar. The Culture has revealed one lactose fermenting pinkish, convex, smooth colonies and other non-lactose fermenting colonies, indicating the presence of mixed bacterial flora (Fig 7). Later on upon performing IMViC test and Gram staining has revealed slender gram negative bacilli (Fig 8).



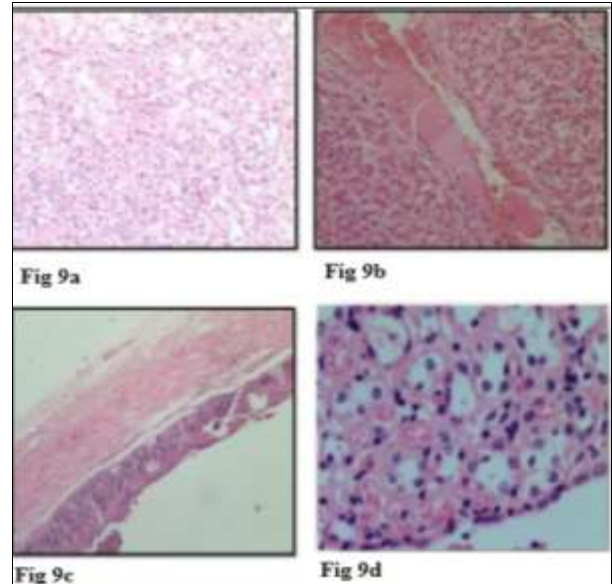
**Fig 7:** Culture of abscess on MacConkey agar showing two different colonies



**Fig 8:** Gram staining showing slender gram-negative bacilli, 100x

### Histopathological findings

Histopathological findings have revealed accumulation of inflammatory cells mainly neutrophils in alveolar septa and desquamated bronchial epithelium with bronchiole filled with epithelial debris and few inflammatory cells (Fig 9a) in the lungs. Fig 9b shows sections of the liver showing congested blood vessels and mild leukocytic accumulation and congestion within sinusoids. Fig 9c shows sections of intestine showing stunting and fusion of villi with epithelium sloughing and presence of some bacterial colonies, and fig 9d shows sections of kidney showing increased glomerular space with congested renal blood vessels and necrotic renal epithelial cells.



Based on the above histopathological findings and microbiological findings we have concluded that the possible reason for the death of the sheep is due to secondary bacterial infection. Further to identify the actual cause of death, differential diagnosis was done and PPRV specific tests were performed (Which are not discussed here) have shown that the animal is indeed died because of PPRV infection.

### Discussions

In current study we have investigated clinical, histopathological, and microbiological findings in the sheep carcass that was presented for post mortem. The animal has showed high fever and diarrhea. Necropsy findings have revealed extensive necro-hemorrhagic lesions in various organs, especially in lungs and lymph nodes. The culture of the virus from lung abscess on MacConkey agar have yielded mixed bacterial flora including lactose-fermenting and non -lactose fermenting bacteria. Necrops results have showed that the sheep was suffering with serious chronic secondary bacterial infection that has resulted in the death of the animal. Further, differential diagnosis and PPRV specific tests have shown that the primary cause of the death is the infection of the sheep with Peste des petits ruminant Virus. The study further highlighted the need for early diagnosis and treatment of PPRV infection in sheep, as well as the risk of secondary bacterial infections and abscess formation.

### Conclusion

In conclusion, this study demonstrated the occurrence of PPRV infection in a six-month-old sheep that died after showing clinical signs of high fever and diarrhea. The necropsy findings revealed severe lesions in the lungs and lymph nodes, and the microbiological examination revealed mixed bacterial flora in the lung abscess. The study emphasized the importance of early detection and treatment of PPRV infection in sheep, as well as the potential risk of secondary bacterial infections and abscess formation.

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