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Pathomorphological study of aspiration pneumonia in cattle: A case report

Rakshita Sharma, Paras Saini, BL Jangir, Deepika Lather and Gulshan Narang

Department of Veterinary Pathology, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

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Corresponding Author: Rakshita Sharma

Abstract

Respiratory diseases are a prime cause which contribute to mortality and economic loss in bovines, with aspiration pneumonia being a particularly severe condition. This study investigates the pathomorphological alteration in a dairy cow suffering from aspiration pneumonia. During the necropsy, grossly, lung tissues revealed emphysema, congestion, and fibrinous adhesions. On microscopic examination, it was identified as broncho-interstitial pneumonia characterized by inflammatory cell infiltration and necrotic debris in the bronchiolar lumen and the lung interstitium. On the etiological basis, this pneumonia is categorised as aspiration pneumonia. The presence of foreign material in the bronchi and bronchiolar lumen confirmed aspiration pneumonia. Bacteriological examination isolated *Klebsiella pneumoniae* and *Staphylococcus chromogenes* from the lung tissue and tracheal lumen, lighting bacterial involvement. These findings emphasize the multifactorial etiology of aspiration pneumonia and the importance of management practices to mitigate severe respiratory conditions in cattle.

Keywords: Aspiration, broncho-pneumonia, lungs, post-mortem examination

Introduction

Respiratory system affections are one of the major causes of mortality leading to economic losses in bovines. Respiratory disease complex (RDC) is a multifactorial syndrome that arises from the complex interaction among the host, environmental factors, and pathogens [1]. Various stressors, including crowding, shipping, limited food and water access, and exposure to multiple pathogens, associated with intensive management, can increase the susceptibility of cattle to bovine respiratory diseases (BRD) [2]. Respiratory diseases, particularly pneumonia, are common in all domestic animals and cause considerable economic losses, following diarrhoea [3]. Aspiration pneumonia is a severe and certainly life-threatening inflammatory condition of the lungs [4]. Inhalation of secretions, forestomach contents or foreign material, in particular liquids, into the larynx and the lower respiratory tract can result in aspiration pneumonia [5]. Pneumonic lung lesions depend on the nature and distribution of the material, as well as the extent and type of bacterial contamination. Additionally, lung parenchyma can be damaged by inhaling foreign substances leading to severe and often fatal aspiration pneumonia [1]. Aspiration of the ruminal contents is one of the most common causes of aspiration pneumonia in cattle[6]. The present study describes the pathomorphological changes due to aspiration pneumonia, which was observed in a dairy cow.

Materials and Methods

The present study was undertaken to study the pathology of respiratory affection in an adult female cattle carcass that was presented to the Department of Veterinary Pathology, College of Veterinary Sciences of the Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar for necropsy. After complete post-mortem examination, lung tissue samples were collected in 10% neutral buffered formalin for histopathology and in sterile container for bacterial isolation and molecular examination. Isolation of organisms was attempted from heart blood, tracheal swab, and lung tissue on 5% blood agar. The different types of bacterial colonies obtained were restreaked on a fresh plate to obtain pure colony of the bacteria. Gram's staining was performed using Gram Stains – Kit (Himedia) as per manufacturers instructions. Based on the results of Gram's staining further confirmation of the pure isolated bacterial colony was done by VITEK 2 system (BioMerieux India Pvt. Ltd.).

After fixation, tissues were processed by paraffin embedding technique [7]. Paraffin embedded tissues were cut into of 4 µm thick sections using semi-automatic rotary microtome (Yorco YSI 060 semi-automatic rotary microtome). The sections were then stained with haematoxylin and eosin (H&E) stain as per method described elsewhere [7]. Then slides were examined under light microscope and histopathological interpretation was carried out.

Results

Grossly, trachea revealed mild congestion along with presence of froth. Lungs were emphysematous, diffusely congested and consolidated along with deposition of fibrin and adhesions (Fig. 1). On histopathological examination, it was categorised as broncho-interstitial pneumonia.

Microscopic examination revealed emphysema and distended interlobular septa with presence of lymphocytes and macrophages along with infiltration of mixed inflammatory cells in bronchiolar lumen and alveolar interstitium (Fig. 2). Sloughed epithelial cells and necrotic cellular debris were evident in the bronchiolar lumen along with some serous fluid in alveolar lumen. However, in addition to it, aspirated/foreign material was also evident in virtually all the bronchi and bronchiolar lumen (Fig. 3). On the basis of etiology it was categorised as aspiration pneumonia. On bacteriological examination, *Klebsiella pneumoniae* subspecies *Pneumoniae* from the tracheal swab and *Staphylococcus chromogenes* from the lung tissue were isolated in this case.

Discussion

Bronchointerstitial pneumonia was diagnosed in cattle in the present study. Microscopic examination revealed distended interlobular septa with presence of lymphocytes and macrophages. In addition, sloughed epithelial cells and cellular debris were observed in bronchiolar lumen. In previous studies, similar histopathological findings were observed in calves and adult cattle[8] and sheep and goats [9, 10]. In cattle, along with aforementioned histopathological changes, the presence of aspirated or foreign material was observed in almost all bronchi and bronchiolar lumen. Earlier workers and also reported more or less similar findings under aspiration pneumonia [10, 11]. Aspiration pneumonia is often a devastating sequela to improper gastric tubing of animals or inflammation of pharynx, larynx and trachea which can also cause obstruction of the airflow [12]. The aspiration of rumen contents is the most common cause of the aspiration pneumonia in cattle [6]. Besides, inflammatory and necrotic properties of the aspirated fluid, bacteria from the nasopharynx are likely to be carried downward through the respiratory tract by gravitational drainage, leading to a spectrum of lung lesions ranging from bronchopneumonia to granulomatous [10].

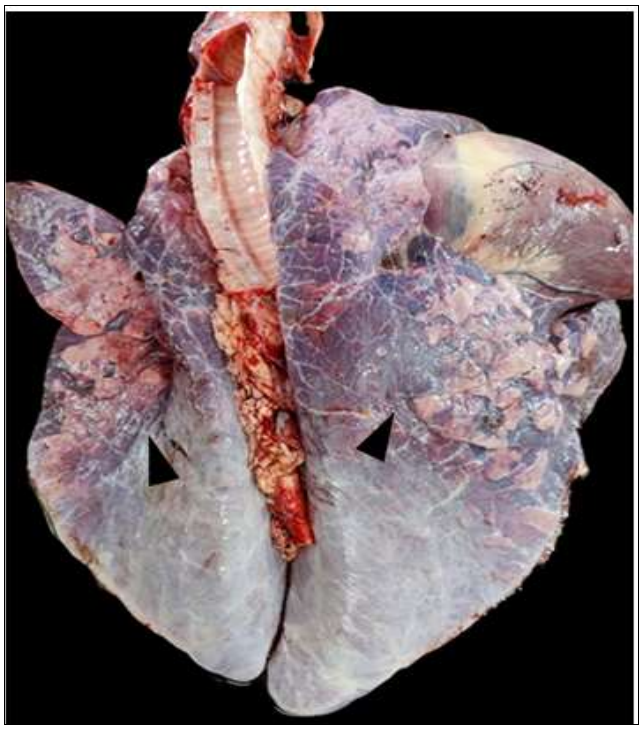

Fig 1: Photograph of lung showing congestion and consolidation (Arrowheads) mainly in the cranial region.

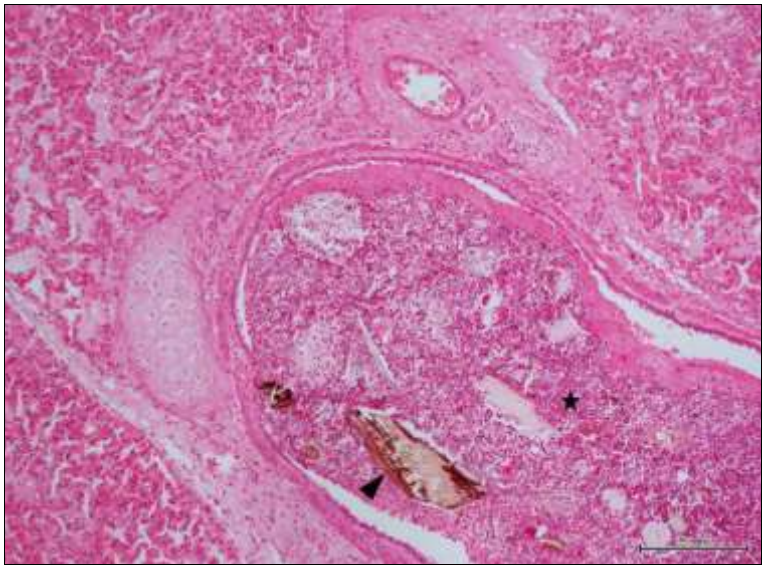

Fig 2: Aspiration pneumonia characterized by presence of aspirated/foreign material (arrow head) in the bronchiolar lumen admixed with necrotic debris and inflammatory cells (star). H&E×100

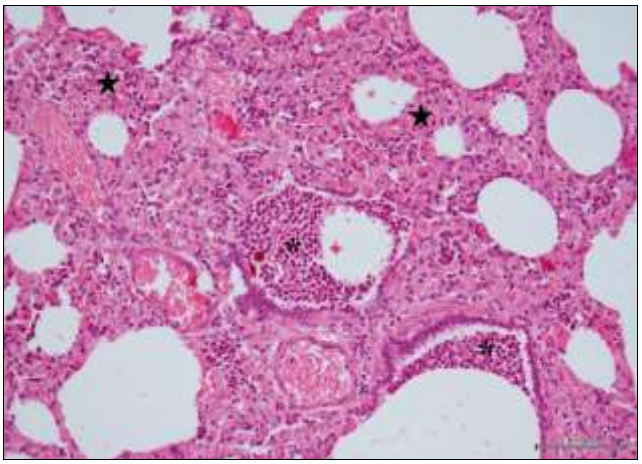

Fig 3: Aspiration pneumonia characterized by vascular changes, thickened alveolar interstitium (Stars) and infiltration of mixed inflammatory cells in bronchiolar lumen (asterisk) and alveolar interstitium. H&E×200

Conclusion

Based on the study conducted, it can be concluded that aspiration pneumonia in cattle results in significant pathological changes within the lung tissue. Histopathological examination revealed characteristic features including sloughed epithelial cells, necrotic cellular debris along with the presence of foreign material in the bronchiolar lumen. The isolation of *Klebsiella pneumoniae* and *Staphylococcus chromogenes* from the affected lung tissues underscores the bacterial involvement in the progression of lesions causing pneumonia. These findings highlight the multifactorial etiology leading to aspiration pneumonia, emphasizing the need for careful management practices to prevent inhalation of rumen contents/any foreign material which can lead to severe respiratory affections and substantial economic losses in bovine populations.

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