



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(1): 1371-1377

© 2021 JEZS

Received: 28-11-2020

Accepted: 30-12-2020

Renu

Department of Veterinary
Pathology, CVAS, Bikaner,
Rajasthan, India

PK Boyal

Help in Suffering, Maharani
Farm, Durgapura, Jaipur,
Rajasthan, India

S Rani

Department of Veterinary
Pathology, CVAS, Bikaner,
Rajasthan, India

H Dadhich

Department of Veterinary
Pathology, CVAS, Bikaner,
Rajasthan, India

Corresponding Author:

Renu

Department of Veterinary
Pathology, CVAS, Bikaner,
Rajasthan, India

Occurrence and pathomorphology of respiratory system incattle

Renu, PK Boyal, S Rani and H Dadhich

Abstract

The present study was conducted on 895 cattle of different age groups, sex and breeds to find out the occurrence of various pathological conditions of respiratory tract, and gross and histopathological changes with reference to the type, pattern and morphology. Out of these 895 specimens, 425 samples of respiratory system suspected for abnormalities were further processed for histopathological examination. An overall incidence of various pathological conditions was observed as 47.48%. The various forms of affections were identified as rhinitis (72.94%), laryngitis (21.17%), tracheitis (23.29%), pulmonary congestion and oedema (23.15%), atelectasis (3.42%), pulmonary emphysema (8.15%), pulmonary tuberculosis (2.89%), pulmonary hydatidosis (13.68%), anthracosis (0.78%), and pulmonary hemosiderosis (0.52%). While different forms of pneumonia were also observed as broncho-pneumonia (8.68%), fibrinous pneumonia (5.00%), catarrhal pneumonia (1.57%), interstitial pneumonia (27.63%), aspiration pneumonia (2.10%), and hemorrhagic pneumonia (2.36%).

Keywords: cattle, respiratory system, histopathology

Introduction

Cow and bullocks are the backbone of agriculture and play a major role in rural economy. Respiratory system is very important system in all living individuals because it delivers oxygen to the cardiovascular system for distribution to the body and removes carbon dioxide. Respiratory system of ruminants includes nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles and lungs. Although a vast majority of pathological conditions that are immediate concerned with impaired production are common in cattle. Certain pathological conditions are common in respiratory system of cattle such as allergic rhinitis, enzootic nasal granuloma, laryngitis, atelectasis, emphysema, bronchopneumonia, mycotic pneumonia, contagious bovine pleuropneumonia, interstitial pneumonia, pulmonary tuberculosis, and pulmonary neoplasm. Cattle are also constantly subjected to a wide variety of viral, bacterial, mycotic, parasitic and metabolic disorders but the conditions of respiratory tract are of paramount importance in that they are often associated with losses due to reduced production and mortality.

Materials and Methods

The specimens of respiratory system of cattle (*Bos indicus*) for the proposed investigation were collected from the carcasses of cattle irrespective of age, sex and breeds. The samples were collected from the municipal corporation of various districts of Rajasthan, mainly Bikaner, Jaipur and Sikar. The tissue samples were also collected from the carcasses of cattle, submitted to the Department of Veterinary Pathology, College of Veterinary and Animal Science, Bikaner, for the routine post-mortem examinations. The samples received from the field veterinarians were also included in this study. A total number of 895 specimens of respiratory system of cattle were examined and out of these, 425 (47.48%) specimens of respiratory system suspected for abnormalities were further processed for histopathological examination. Following collection, all the samples were properly preserved in 10% formal saline. Representative fixed tissue samples measuring 2-5 mm thickness containing normal and affected portion were further processed by paraffin embedding using acetone and benzene technique (Lillie, 1965) [15]. The tissue sections of 4-6 micron thickness were cut and stained with haematoxylin and eosin staining method. Gross and microscopic changes were recorded and interpreted.

Results**Nasal Cavity****Rhinitis**

This condition was observed in 310 cases (72.94%). Grossly, mucous membrane was swollen and congested.

Microscopically, hyperemia, edema, leukocytosis of the mucosa, excessive formation of mucus by the goblet cells, and infiltrating cells were observed (Fig.1).

Larynx**Laryngitis**

This condition was observed in 90 cases (21.17%). Grossly, yellow-grey, thick, crusted, necrotic areas were seen on larynx.

Microscopically, large necrotic foci had hyperemic borders, and mucus membrane of larynx was coated with mucoid exudates. Congestion and inflammatory cells was observed in some cases.

Trachea**Tracheitis**

This condition was observed in 99 cases (23.29%). Grossly, congestion on the mucosa of trachea was noticed.

Microscopically, mild inflammatory cells and congestion were seen.

Lungs**Pulmonary congestion and oedema**

This condition was observed in 88 cases (23.15%).

Grossly, affected lungs were uniformly deep red to reddish black in color, enlarged, edematous, and heavier than normal. On cutting, blood stained frothy fluid oozed out and the cut surface was smooth and pinkish.

Microscopically, alveolar capillaries were highly engorged with blood, haemorrhages, oedema, and infiltration of mononuclear cells and polymorphonuclear cells were observed (Fig.2). They were dilated, tortuous and projected into the alveolar lumina in a bud like fashion. Peribronchial infiltrations were seen around the bronchioles.

Bronchopneumonia

This condition was found in 33 cases (8.68%). Grossly, affected lobe had mosaic appearance due to patchy to diffuse areas of consolidation with intermingling normal. The pleura over the affected portion were grey or grayish yellow.

Microscopically, bronchioles and bronchiolar lumens were partially or completely obliterated with exudates comprising of polymorphonuclear leukocytes, mononuclear cells, denuded bronchiolar cells and mucus (Fig.3). Some of cases showed bronchiectasis. In some areas, red hepatization was seen where alveolar capillaries were tortuous and engorged with blood. The alveolar lumen was filled with serous or serofibrinous exudates containing a few erythrocytes, polymorphonuclear leukocytes and mononuclear cells. Bronchiolitis was the central and basic lesions. (Fig.4). There was fibrous thickening of alveolar septa with cellular exudate in the alveolar wall as well as in the lumen of the alveoli in chronic bronchopneumonia.

Fibrinous Pneumonia

This condition was observed in 19 cases (5.00%). Grossly, the affected areas of lung were consolidated and reddish black or deep red to reddish brown of grey in color. There were prominent serofibrinous exudates and an irregular discrete

zone of necrosis with swollen pale border. The pleura over the affected areas were roughened due to fibrin deposition. The cut surface was either moist with oozing of bloody fluid or becomes dry and granular.

Microscopically, the most characteristic feature was the predominance of the fibrinous exudation in the alveolar spaces, which was visualized as accumulation of fibrinous strands intermingled with inflammatory cells comprising of mononuclear cells, polymorphonuclear cells and macrophages.

Most of the case showed all stages of pneumonia viz. congestion, red and grey hepatization, and organisation areas of necrosis. Alveoli showed engorged capillaries and alveolar lumen contained copious serous exudates with erythrocytes and polymorphonuclear leukocytes. The alveolar lumen contained strands of fibrin mixed with leukocytes, macrophages and erythrocytes. Fibrin was less copious in quantity compared to its serous and/or cellular components.

Catarrhal pneumonia

This condition was observed in 6 cases (1.57%). Grossly, the affected areas of lung were consolidated and reddish black or deep red to reddish brown in color. On cutting the lungs, fluid oozed out. Microscopically, the walls of the alveoli showed infiltrations of lymphocytes and large mononuclear cells. The cellular exudates in the alveoli consisted of large mononuclear cells and leucocytes occasionally mixed with red cells. In the consolidated portions of the lung tissue, most of the alveoli were filled with catarrhal exudates (Fig.5). In some cases, catarrhal exudates in the alveoli with emphysema were found.

Interstitial pneumonia

This condition was observed in 105 cases (27.63%). Grossly, lungs showed dark red areas of consolidation with discrete lobar distribution. In some cases, lung showed emphysematous swelling and failed to collapse.

Microscopically, severe chronic interstitial pneumonia was characterized by the presence of extensive fibrosis in bronchioles, and in interlobular septa, along with the mononuclear leukocytic infiltration. The arterial lesions were characterized by the presence of pulmonary hypertensive changes in which some of the larger muscular arteries due to increasing intimal thickening lead to severe occlusion along with presence of blood in the bronchioles. The peribronchiolar and perivascular areas were infiltrated by lymphocytes with or without macrophages and plasma cells. In few cases, severe lymphocytic infiltration was observed in interalveolar septa. Epithelial cells lining of the alveoli showed hyperplasia, resulting in focal epithelialization. Some sections showed the acute interstitial pneumonia. Some areas showed thickening of interlobular septa due to serous fluid with infiltration by mononuclear cells. (Fig.6). Alveoli revealed hyalinization which comprised of homogeneous, smooth or faintly granular, eosinophilic material with typical distribution, lying as a pseudomembrane over the epithelium of the alveolar ducts and also extending over many alveoli and bronchioles with varying thickness.

Some other sections revealed hyperplastic changes in bronchiolar epithelial lining, leading to partial or complete obliteration of bronchiolar lumen, while in others the lumen was seen to contain proliferated epithelial cells.

Aspiration pneumonia

This condition was found in 8 cases (2.10%). Grossly, the

affected portions of the lung showed patchy areas of congestion, consolidation and greenish discoloration.

Microscopically, the lung parenchyma showed presence of aspirated foreign material within the bronchi, bronchiolar, and in alveolar lumina leading to their obliteration. This aspirated material produced purulent necrotic bronchiolitis.

Hemorrhagic pneumonia

This condition was observed in 9 cases (2.36%). Grossly, the affected lungs showed intensely red to brownish black patchy areas involving apical and diaphragmatic lobes. On incision, variable amounts of blood oozed from the affected zone.

Microscopically, the alveoli were partly or completely studded with erythrocytes and some amount of serous fluid admixed with some leukocytes. Some of the alveoli and bronchioles revealed a homogenous eosinophilic mass which resulting from lysis of erythrocytes. The alveolar walls were found thickened due to congestion and infiltration by a few mononuclear leukocytes.

Atelectasis

This condition was observed in 13 cases (3.42%). Grossly, the affected areas of lung were collapsed, depressed and reddish blue in color. The pleura over them were thickened and wrinkled. The cut surface was dry and leathery in consistency and the affected portion was sunk in water. Microscopically, alveoli in the affected portion of lung had small, elongated, irregular, cleft like alveolar lumina and constriction of bronchiolar lumina appearing stellate in shape due to shrinking of mucosa. The alveolar capillaries were slightly dilated and engorged with blood.

Pulmonary emphysema

This condition was seen in 31 cases (8.15%). Grossly, the emphysematous lungs were voluminous, puffy in consistency and grayish pale in color with imprints of ribs on the surface. A crepitating sound was heard on pressing while on cutting the affected portion and did not sink in water.

Microscopically, the alveoli were irregularly distended and at places giant alveoli were seen which resulting from coalescing together of neighboring alveoli due to rupture of interalveolar septa. Intact alveolar septa were thin, stretched and bloodless while the ruptured ones were seen as stumps projecting into the lumina (Fig.7). Bronchial and bronchiolar lumina were distended. Emphysema with infiltrations and haemorrhages were seen in some cases.

Pulmonary tuberculosis

This condition was seen in the lungs of 11 cases (2.89%). Grossly, lungs were found consolidated and studded with grayish white nodules, mostly distributed in the diaphragmatic lobes. The size of nodules varied from a pin head to the pigeon egg. In most of the cases, the nodules were sessile while in two cases they were found to be pedunculated. In some cases, the nodules were soft whereas in others these were hard, giving a pearly appearance. The mediastinal lymph node was significantly enlarged, firm and difficult to cut. Some nodules were hard to cut and gritty sound on cutting indicated calcification and a few cases showed cavitation.

Microscopically, granulomatous lesion typical of tuberculosis was evident in all the cases. The granulomas depicted caseation occasionally with calcified center surrounded by epithelioid cells and langhans type of giant cells with a narrow zone of lymphocytes encased in fibrous tissue capsule.

Foreign body giant cells were also seen along with langhans type of giant cells. The old tuberculous nodules showed a central mass of caseous material with calcification. These were surrounded by a large number of epithelioid cells, lymphocytes and a few langhans type of giant cells at the periphery. The whole lesion was surrounded by a thick layer of fibrous tissue capsule.

Pulmonary hydatidosis

This condition was found in 52 cases (13.68%). Grossly, the lungs showed hydatid cysts of varying in size from a pea to a tennis ball, or even larger, located underneath the pleura. These cysts were fluctuating containing clear watery or serous fluid. In some cases, the hard cysts contained some viscous fluid or caesous mass.

Microscopically, the fluctuating cysts revealed from within outward a germinal layer, a thick concentrically laminated elastic hyaline layer blending with the surrounding connective tissue capsule infiltrated predominantly by lymphocytes along with macrophages and sometimes with neutrophils and eosinophils. Cellular infiltration was present on both the sides of connectives tissue capsule, and in between the concentric hyaline layers.

The lung parenchyma in the vicinity of cysts showed atelectasis and congestion. Some of the section from hard cysts showed collapsed cyst wherein the laminated elastic hyaline layer was seen in folds. Cysts were surrounded by a thick coat of granulation tissue having aggregates of mononuclear cells with giant cells.

Pulmonary anthracosis

This condition was found in 3 cases (0.78%). Grossly, the affected lungs showed focal deposition of carbon particles, black or bluish black in color. The individual foci were linked together in a zigzag fashion.

Microscopically, sections revealed neither significant changes nor inflammatory reaction at the site of deposition of carbon particles. Generally carbon particles were found accumulated in the interalveolar septa and peribronchial tissue (Fig.8). No inflammatory reaction was noticed at the site of the focal accumulation of carbon pigment.

Pulmonary hemosiderosis

This condition was observed in 2 cases (0.52%). Grossly, the lung surfaces were smooth, brownish-purple in color and petechial haemorrhage was seen beneath the pleural surfaces. Cut surfaces were dry and showed brick red color. The condition involved all the lobes.

Microscopically, numerous diffuse focal intralveolar and intrabronchiolar haemorrhages were seen. There were numerous hemosiderinophages filling the alveoli along with red blood cells.

Discussion

Nasal Cavity

Rhinitis

This condition was found in 72.94% cases. Grossly, mucous membrane was swollen and congested. Microscopically, observed hyperemia, edema, leukocytosis of the mucosa, and excessive formation of mucus by the goblet cells. These findings are in close approximation to the finding recorded by Runnels *et al.*, (1976)^[18] and Jubb *et al.*, (2007)^[14].

Larynx**Laryngitis**

This condition was found in 21.17% cases. Grossly, yellow-grey, thick, crusted, necrotic areas were seen on larynx. Microscopically, large necrotic foci had hyperemic borders, and mucus membrane of larynx was coated with a mucoid exudates. These findings are in close approximation to the finding recorded by Thomson *et al.*, (2001) [22].

Trachea**Trachietis**

This condition was found in 23.29% cases. Grossly, petechial haemorrhages were seen on the mucosa of trachea. Microscopically, trachea revealed congestion and mild infiltration of inflammatory cells. These conditions are in close approximation of Akbor *et al.*, (2007) [1].

Lungs**Incidence of pneumonia**

The incidence of pneumonia was found in 47.36% of the total affected lungs. A higher incidence is reported by Damodaran and Sundararaj (1974) [7] who reported 58.90% mortality due to pneumonia in cattle. However, comparatively low incidence of pneumonia is reported by Singh and Kumar (1987) [20] at 18.7%.

Pulmonary congestion and oedema

This condition was found in 23.15% cases. A higher incidence is reported by Joshi *et al.* (1994) [12] at 27.10%, while lower incidence is reported by Chanda and Nayak (1977) [4] at 17.10%. Grossly, the affected lungs were inflamed, bright red in color, edematous and heavier than normal. Microscopically, the blood capillaries were found engorged with blood, and tortuous projecting into the alveolar lumina in a bud like fashion. The alveoli and bronchioles contained homogenous serous fluid with a few sharp holes which represented the trapped bubbles of air. These observations are in agreement with Cohrs (1967) [6].

Bronchopneumonia

This condition was noticed in 8.68% cases. Slightly lower incidence is reported by Choudhary and Nayak (1980) [5] at 7.20%. However, a higher incidence is reported by Damodaran and Sundararaj (1974) [7] at 62.13%.

Grossly, the affected part of the lung showed patchy to diffuse area of consolidation. Microscopically, bronchiolitis was the basic lesion and bronchiolar lumina were filled with exudates composed of polymorphonuclear, mononuclear, denuded bronchiolar epithelial cells and mucous leading to their partial or complete obliteration. These findings concur well with those of Jubb and Kennedy (1970) [13], and Singh and Kumar (1987) [20].

Fibrinous pneumonia

This condition was found in 5.00% cases. A higher incidence is reported by Çeribası *et al.*, (2014) [3] 16.35%, while a lower incidence is reported by Akbor *et al.*, (2007) [1] at 3.75% in buffaloes.

Grossly, the lungs were swollen, grey to dark red in color, firm in consistency, and tended to sink on immersing in water. Microscopically, the characteristic features were the predominance of the fibrinous exudates, intermingling with inflammatory cells in the alveolar septa was remarkably thickened due to infiltration of such exudates with

inflammatory cells. This is in conformation with the findings of Singh and Kumar (1987) [20].

Catarrhal pneumonia

Incidence of catarrhal pneumonia was found to be 1.57%. A higher incidence is reported by Choudhary and Nayak (1980) [5] at 7.2%. Grossly, the lung showed dark red in color, and patchy to diffuse area of consolidation. Microscopically, Sero-mucus exudates in the alveoli and infiltrating cells were seen. This is in conformation with the findings of Singh and Kumar (1987) [20].

Interstitial pneumonia

Incidence of interstitial pneumonia was found to be 27.63% comparatively a lower incidence is recorded by Chanda and Nayak (1977) [4] at 5.7% and Akbor *et al.*, (2007) [1] at 3.75%. While, higher incidence is reported by Çeribası *et al.*, (2014) [3] at 45.25% in cattle.

Grossly, the lung showed dark red areas of consolidation and failed to collapse. Microscopically, thickening of inter-alveolar septa due to septal cells proliferation and infiltration of mononuclear cell was noticed. This is in conformation with the findings of Jubb and Kennedy (1970) [13] and Singh and Kumar (1987) [20].

In chronic interstitial pneumonia, deposition of fibrous tissue was observed in interlobular septa and in and around the bronchioles. These observation are in conformity with those of Cohrs (1967) [6], Jubb and Kennedy (1970) [13], and Chanda and Nayak (1977) [4].

Aspiration pneumonia

This condition was observed in 2.10% of total affected lungs. Grossly, the affected lungs showed patchy area of consolidation, congestion and greenish discoloration. Microscopically, the presence of aspirated foreign material was seen in bronchi or bronchiole and in alveolar lumina, leading to their obliteration. These are in conformity with the findings of Cohrs (1967) [6] and Jones and Hunt (1983) [10].

Hemorrhagic pneumonia

This condition was found in 2.36% cases. Comparatively a high incidence is recorded by Pawaiya (1994) [17] at 6.02% cases of hemorrhagic pneumonia.

Grossly, the lungs showed congestion and patchy hemorrhagic lesions. Cut surface revealed some amount of frothy blood oozing from the affected area. Microscopically, the lesions were characterized by engorgement of capillaries, alveoli filled with erythrocytes, and some amount of serous fluid admixture with some degree of leukocytes. These observations are in agreement with the earlier findings of Jubb and Kennedy (1970) [13] and Runnells *et al.*, (1976) [18].

Atelectasis

The condition was observed in 3.42% cases. Grossly, the lungs revealed collapsed focal areas and compressed alveoli were bluish red in color. Microscopically, the alveoli appeared as slit like residual lumina having sharp angular ends usually associated with a small amount of oedema fluid and alveolar macrophages in the alveolar lumina. The constricted bronchioles appeared stellate in shape. These findings are in conformity with the findings of Jubb and Kennedy (1970) [13], and Ishino *et al.*, (1979) [8].

Pulmonary emphysema

This condition was recorded in 8.15% cases. A higher incidence is reported by Belkhiri *et al.*, (2009) [2] at 14.35% in bovines, while a lower incidence is reported by Islam *et al.*, (2015) [9] at 2.15% in cattle and buffalo. Grossly, the emphysematous lungs were voluminous, puffy in consistency and grayish pale in color with imprints of ribs on the surface. A crepitating sound was heard on pressing while on cutting the affected portion and did not sink in water. Microscopically, the alveoli were irregularly distended and at places giant alveoli were seen which resulting from coalescing together of neighboring alveoli due to rupture of interalveolar septa. Intact alveolar septa were thin, stretched and bloodless while the ruptured ones were seen as stumps projecting into the lumina. The recorded gross and microscopic observations are similar to those described by Jubb and Kennedy (1970) [13], and Runnells *et al.*, (1976) [18].

Pulmonary tuberculosis

This condition was observed in 2.89% of the total affected lungs. This is very much in conformity with the findings of Choudhary and Nayak (1980) [5] who recorded comparatively low incidence of TB at the level of 2% in cattle population. However, a higher incidence of tuberculosis is reported by Mondal *et al.*, (2014) [16] at 5.9% in cattle.

Grossly, the lungs were found consolidated with grayish white nodule which varied from a pin head to pigeon egg in size were sessile or pedunculate and soft or hard. The cut surface revealed caseous marks in centre, and some nodules showed calcification while in a few cases cavitations was also observed. Microscopically, the present study revealed granulomatous lesions typical of tuberculosis in all cases. The lesions varied from early granulomas with or without caseation, to advanced fibrotic caseocalcareous granulomas. These findings corroborate with those of Jubb and Kennedy (1970) [13], and Joshi *et al.*, (1976) [11].

Pulmonary hydatidosis

This condition was recorded in 13.68% of the total lungs. This is very much in conformity with Sundaram and Natrajan (1960) [21] who have reported 13.5% incidence of hydatidosis in cattle in Madras.

Grossly, the fluctuating cysts were unilocular containing clear watery fluid varying from a pea grain to a tennis ball and even larger in size. Microscopically, the fluctuating cysts revealed from within outward a germinal layer, a thick concentrically laminated elastic hyaline layer blending with the surrounding connective tissue capsule infiltrated predominantly by lymphocytes along with macrophages and sometimes with neutrophils and eosinophils. These observations are in conformity with the findings of Sundaram and Natrajan (1960) [21], and Cohrs (1967) [6].

Pulmonary anthracosis

This condition was recorded in 0.78% of the total lungs. Grossly, the carbon particles appeared as very fine black or bluish black pigment in the lung tissue. Microscopically, focal accumulation of carbon particles was seen in the alveolar wall, interlobular septa and in peribronchial tissue. These findings are similar to those described by Runnells *et al.*, (1976) [18], and Jones and Hunt (1983) [10].

Pulmonary hemosiderosis

This condition was recorded in 0.52% of the total lungs. Grossly, the lung surfaces were smooth, brownish-purple in color and petechial haemorrhage was seen beneath the pleural surfaces. Microscopically, numerous diffuse focal intralveolar and intrabronchiolar haemorrhage were seen. There were numerous hemosiderinophages filling the alveoli along with red blood cells. These findings are similar to Sastry (1983) [19].

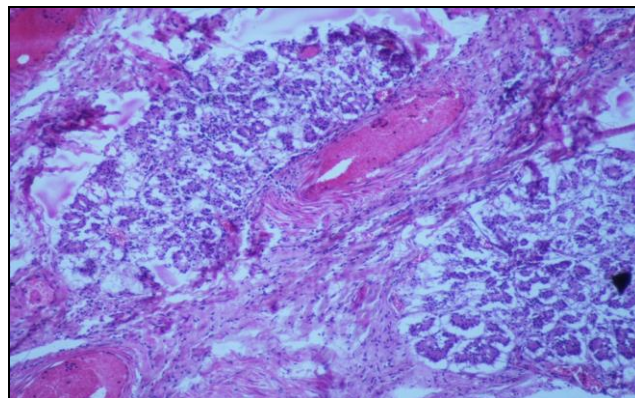


Fig 1: Microphotograph of nasal mucosa showing inflammatory exudates with infiltrating cells. H&E, 100X.

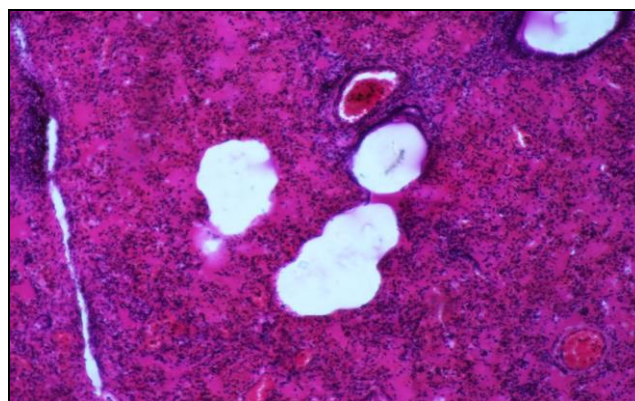


Fig 2: Microphotograph of lung showing congestion of alveolar capillaries, oedema and infiltration of mononuclear cells and polymorphonuclear cells. H&E, 100X.

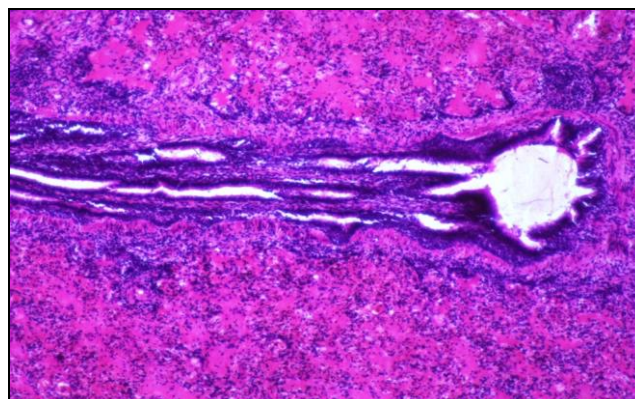


Fig 3: Microphotograph of lung showing bronchopneumonia in which bronchiolar lumen were filled with exudate, polymorphonuclear cells, mononuclear cells, denuded bronchiolar epithelial cells. H & E, 100X.

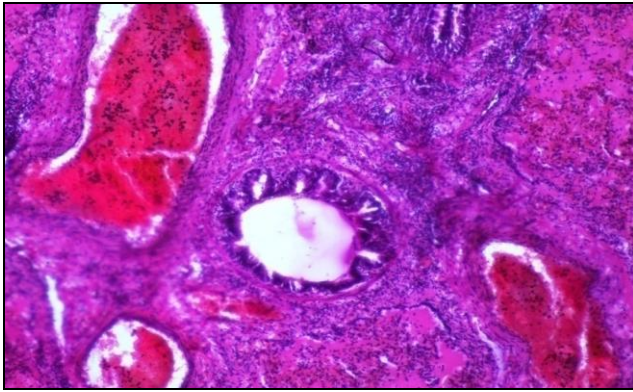


Fig 4: Microphotograph of lung showing bronchiolitis, congestion oedema and infiltration of mononuclear cells and polymorphonuclear cells. H&E, 100X.

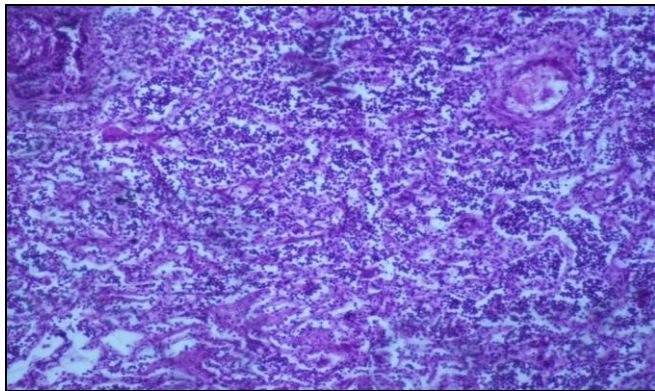


Fig 5: Microphotograph of lung showing catarrhal pneumonia in which catarrhal exudates in alveoli. H&E, 100X.

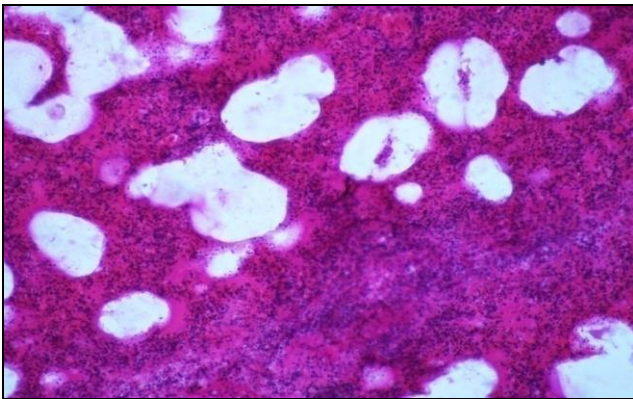


Fig 6: Microphotograph of lung showing thickening of interlobular septa with lymphocytic infiltration. H & E, 100X.

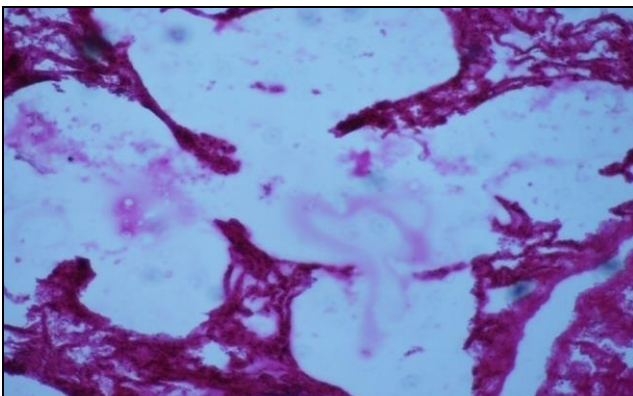


Fig 7: Microphotograph of lung showing Emphysema in which lung showing thin interalveolar septa and bullae formed by ruptured alveolar septa which appeared as stumps. H&E, 100X.

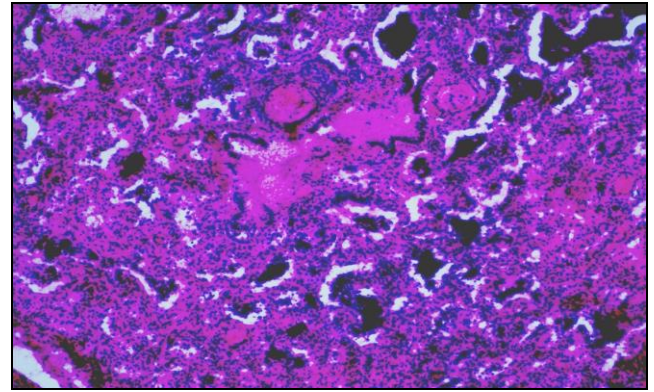


Fig 8: Microphotograph of lung showing anthracosis in which deposition of carbon particles in the interalveolar septa and peribronchial tissue. H&E, 100X.

Conclusion

There are some factors which responsible for causing respiratory disorders in cattle such as poor housing conditions, allotments and abrupt feeding transitions are particularly disturbing for dairy or suckling cows. The more they are stressed and weakened, the more these animals are vulnerable to bacteria and viruses which lead to development of several kinds of pneumonia and other respiratory disorders. Therefore, proper management practices and balanced feed diets in cattle can help to control these disorders.

Acknowledgement

The authors are highly grateful to the Vice Chancellor, Rajasthan University of Veterinary and Animal Sciences and Dean, College of Veterinary and Animal Science, Bikaner (Rajasthan) for providing essential facilities for completing the study.

References

1. Akbor M, Haider MG, Ahmedullah F, Khan MAHNA, Hossain MI, Hossain MM. Pathology of trachea and lungs of buffaloes. *Bangladesh Journal of Veterinary Medicine* 2007;5:87-91.
2. Belkhiri M, Tlidjane M, Benhathat Y, Meziane T. Histopathological study and pulmonary classification of bovine lesions. *African Journal of Agricultural Research*. 2009;4(7):584-591.
3. Çeribasi AO, Çeribasi S, Ozkaraca M. Immunohistochemical detection of bovine herpesvirus type 1 and bovine adenovirus type 3 antigens in frozen and paraffinized lung sections of pneumonic sheep and goats. *Veterinarski arhiv* 2016;86:9-21.
4. Chanda SK, Nayak BC. Pathological studies on the mortality in young calves. *Indian Journal of Animal Health* 1977;16:145-149.
5. Choudhary CH, Nayak BC. Incidence and histopathology of lung lesions in bovine. *Indian Journal Anim. Health* 1980;19:11-14.
6. Cohrs P. Special pathological anatomy of domestic animals. Pergamon Press, Oxford 1967.
7. Damodaran S, Sundararaj A. A survey of calf mortality in Madras State. *Indian Veterinary Journal* 1974;51:359-364.
8. Ishino S, Oka M, Terui S, Ikeda S. Pathological and microbiological studies on calf pneumonia occurring in mass rearing facilities. *National institute of Animal*

- Health. Japan 1979;19:91-103
9. Islam MS, Das S, Islam MA, Talukdar MMI, Hashem MA, Chowdhury S *et al.* Pathological affections of lungs in slaughtered cattle and buffaloes at Chittagong Metropolitan Area, Bangladesh. *Advances in Animal and Veterinary Sciences* 2015;3(1):27-33.
 10. Jones TC, Hunt RD. *Veterinary Pathology*. Vth Edn. Lea and Febiger Philadelphia 1983.
 11. Joshi DV, Sharma DR, Dhillon SS, Sodhi SS. Prevalence of tuberculosis in Animals of organized Farms in Punjab. *Indian Journal of Dairy Science* 1976;29(3):217-219.
 12. Joshi MD, Degloorkar NM, Moregaonkar SD, Kulkani GB, Deshpande BB, Digraskar SU. Age and sex wise incidence of pathological conditions of lung in cattle and buffalo. *Indian Veterinary Journal* 1994;71(8):768-770.
 13. Jubb KVF, Kennedy PC. *Pathology of domestic animals*. Second Edn. Academic Press, New York and London 1970.
 14. Jubb, Kennedy. *Palmer's. Pathology of domestic animals*. 5th Edn. Elsevier. London Newyork and Oxford 2007.
 15. Lillie RD. *Histopathological technique and practical histochemistry*, McGraw Hill Book co.; New York and London 1965.
 16. Mondal MAH, Parvin MS, Sarker SC, Rahman AKMA, Islam MT. Prevalence and risk factors of bovine tuberculosis in cattle in Mymensingh sadar. *Bangladesh Journal of Veterinary Medicine* 2014;12(2):179- 183.
 17. Pawaiya RS. Pathology of bovine pneumonia with Special reference to experimental pulmonary aspergillosis (*A. fumigatus*) in calves. *Indian Journal of Veterinary Pathology* 1994;18(1):70-71.
 18. Runnells RA, Monlux WS, Monlux AW. *Principles of Veterinary pathology*. 7th Edn. Scientific Book Agency, Calcutta 1976.
 19. Sastry GA. *Veterinary Pathology*, Vth ed. CBS Publishers and Distributors, 485, Delhi-32 1983.
 20. Singh CK, Kumar N. Prevalence and pathology of pneumonia in Cow and buffalo calves. *Indian Journal of Veterinary Pathology* 1987;11:67-68.
 21. Sundaram RH, Natarajan R. A study of the incidence of hydatid disease in cattle in the city of Madras. *Indian Veterinary Journal* 1960;37:19-24.
 22. Thomson RG, McGavin MD, Carlton WW, Zachary JF. *Special Veterinary pathology*. Library of Congress Cataloging-in-Publication. Edn. 3rd 2001.