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Histopathologicaland Bacteriological Examination of Pneumonic Lungs of Small Ruminants Slaughtered at Gondar, Ethiopia

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Abstract: The study was conducted from October, 2009 to January, 2010 to identify the bacteria involved and histopathological changes in pneumonic lungs of small ruminants slaughtered in Gondar town and Elforaabattoir. A total of 72 pneumonic lungs and 24 tracheal swabs of small ruminants were examinedfor histopathologicalchanges and bacteriological isolations. Bacteria isolated from trachea were *Pastuerella species* (48.28%), *Staphylococcus species* (17.24%), *Streptococcus s*pecies (13.79%) and others bacteria (20.69%). *Pasturela* species was the predominant organism isolated from swab of pneumonic lung followed by *Staphylococcus* and *Streptococcus*. Histopathologicalexamination the respective prevalence of *bronchopneumonia, interstitial pneumonia* and combination of two were 56.93%, 23.61% and 16.67% respectively. This study showed that *past. Species, Staphylococcus and Streptococcus* species were the most important bacteria involving in inducing pneumonia in small ruminants. In addition the study observed here suggests that other etiology also have a considerable effect on the occurrence of pneumonia in small ruminants.

Key words: Gondar · *ELFORA* · Histopathology · Pneumonic Lungs · Small Ruminants

INTRODUCTION

Livestock is very important both for the subsistence and economic development in Africa [1]. Small ruminants assume a uniquely important position in live stock production. Unlike cattle, small ruminants are capable of remarkable adaptability to diverse environmental conditions and are amenable ease of management. They are thus, a reliable source of income and cash security. Furthermore, they provide meat, skin, wool and manure that maintain soil fertility [2].

In Ethiopia small ruminants play a significant role in the national economy. The estimated 2.4 million TLU (Tropical Livestock Unit) for sheep and 1.7 million TLU for goats in Ethiopia place the country second in Africa and six in the world [3]. They supply more than 30 % of all domestic meat consumption and generate cash income from exports of meat, mainly as live animals and skin. Hence an increase in small ruminant production is needed both to maintain self sufficiency and to increase export earnings [4].

Small ruminant production in the country however is still constrained by various factors. The major constraints facing sheep and goats production include disease, inadequate nutrition, poor genetic potentials of the local stock, marketing, social factors, structural constraints and shortage of high level of trained man power [5]. Of these, multifactorial infectious diseases of small ruminants cause substantial loss through morbidity and mortality [6]. Thomson [7] stated that all diseases, those affecting the respiratory system are generally the most important in every species of domestic animals.

Bacterial infection of the respiratory tract may be primary, occurring in healthy individuals or secondary to a large number of conditions which depress resistance. Secondary bacterial infection occur especially when the local resistance of the respiratory mucosa is lowered and bacterial growing in the nose and throat extends down wards, usually giving a mixed infection [8].

No studies have been done on bacteriological and histopathological examination of pneumonic lung of small ruminants in this country with the exception of

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characterization of pasteurella organisms. Tesfaye [9] and Aschalew [10] made characterization of *Pasteurella*from pneumonic sheep. The present study was therefore, conducted with the objective of identifying bacteria involved in pneumonia of small ruminants and studying the histopathological changes of the affected lungs.

MATERIALS AND METHODS

Study Area: The study was conducted in Gondar, the capita of North Gondar Administrative zone of Amhara National Regional state, which is located 710km North West of Addis Ababa. The Gondar town is located at latitude of 12.4°N, longitude of 27.2°E and stands at an altitude range between 1800-2200 m.a.s.l.The average maximum and minimum daily temperature of the area varies between 22-30.7°C and 12.3-17.1°C; respectively. The region receives a bimodal rainfall with the average annual precipitation rate being 1000ml. The short rains occur during the months of March, April and May while the long rain extends from June to September. The production system observed in the area combines cereal-based agriculture and livestock farming. North Gondar zone has a livestock population of 2.03million cattle, 0.6 million sheep, 0.54 million goat, 0.25 million equine species of which (62.5% donkeys, 5% mules, 32.5% horses) and 1.9 million poultry [11].

Study Animals: Gondar Elforameat plant gives a slaughter service about 380 small ruminants per annum and the selected hotels found in the town slaughter 5-6 small ruminants per day. A total of 72 small ruminants slaughtered at Gondar Elfora Meat Plant and Gondar town having pneumonic lung were sampled. The sheep taken from the meat plant were transported by track and kept in open quarter for about 12-24 hours before slaughtered. But the small ruminants from hotels of Gondar town were shipped to the market by the owner. They were entirely male with an estimated age ranging from 1-2 years.

Specimen Collection: The lungs were examined for colure changes, consistency, adhesion, hemorrhages and emphysema. The type of lesion and distribution were recorded. Lung Tissuespecimens were collected from slaughtered of small ruminants. A total of 72 and 24 samples were taken for histopathologicaland bacteriological investigation respectively. Immediately after slaughter pieces of pneumonic lung and tracheal swabs were aseptically collected from the animals in sterile sampling bottle and sterile swab respectively. The specimens for histopathology were fixedin 10% buffered formalin and transported to pathology department for processing, The sample then dehydrated in alcohol, cleared in xylene, impregnated and embedded in paraffin, sectioned at 5-7 µm thickness and finally stained with H&E to examine under microscope. The tracheal swab taken from the same pneumonic lung kept in ice box and went immediately to the microbiological laboratory for bacterial isolation. The tracheal mucosa was adequately rubbed by rotating the cotton tipped stick which was then returned immediately to its capped tubes.

Data Analysis: Descriptive statistics was used for data analysis.

RESULTS

Bacteriological Findings: Of the total of 24 pneumonic lungs examined bacteriologically, 29 isolatesof bacteria were detected. The isolates were Past. Species (47.85%), Staphylococcus species (17.68%), Streptococcus species (13.44%) and others (21.03%) (Table 1).

Histopathological Examination: Different types of pneumonia were observed in histopathology examination of lung tissues of small ruminants. These were bronchopneumonia 41 (56.94%), Interstitial pneumonia 17 (23.61%), complication of broncho-interstitial pneumonia 12(16.67%) and granulomatous pneumonia 2 (2.78%).

Microscopic lesions with exudates in the alveoli, bronchioles and bronchi; congestion of blood vessels, hemorrhage and sometimes hyperplasia of associated bronchial lymphoid tissues were described as bronchopneumonia. Bronchopneumonia was subdivided into three types depending up on the predominant exudates. Bronchopneumonia with abundant neutrophils and few macrophages within the lumen of bronchi, bronchioles and alveoli were grouped as purulent bronchopneumonia. When the predominant exudates were fibrin with few neutrophils and macrophages, it was categorized as fibrinous bronchopneumonia. In cases where neutrophils and fibrins were seen almost in equal amount in the exudates, the lesion was named as fibrinoprulent bronchopneumonia. They were occurred at a rate of 21 (51.22%), 16 (39.02%) and 4 (9.76%) respectively.

Table 1: Comparison of bacterial isolation in lung and tracheal swab of pneumonic lungs

No	Bacterial Species	Isolation in %
1	Pasteurella species	14 (48.28%)
2	Staphylococcus species	5 (17.24%)
3	Streptococcus species	4 (13.79%)
4	Others	6 (20.69%)

Table 2: Different types of pneumonia observed in pneumonic lung of small ruminants

No	Types of pneumonia	Occurrence in %
1	Bronchopneumonia	41 (56.94%)
2	Interstitial pneumonia	17 (23.61%)
3	BP and IP complication	12 (16.67%)
4	Granulomatous pneumonia	2 (2.78%)

Table 3: Association of bacterial species and types of pneumonia

		Frequency of isolated bacteria				
		Bronchopneumonia				
No	Species of bacteria	Purulentbroncho-pneumonia	Fibrinousbroncho-pneumonia	Fibrinous and purulentbronchopneumonia	Interstitial Pneumonia	Broncho and Interstitial Pneumonia
1	Pasteurella species	-	5	3	2	4
2	Staphylococcus species	2	-	1	-	2
3	Streptococcus species	2	-	-	-	2
4	Other bacterial species	1	2	-	1	2

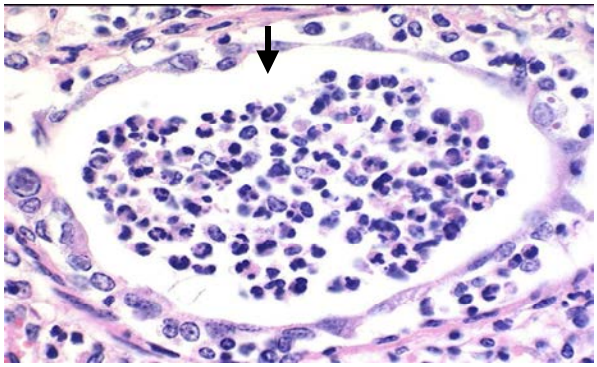

Fig. 1: Microscopic appearance of Bronchopneumonia (H & E Stain: 1000x)

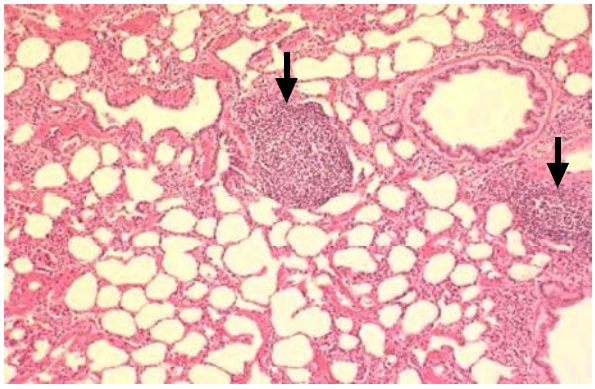

Fig. 2: Microscopic appearance of interstitial pneumonia (H & E Stain: 100x)

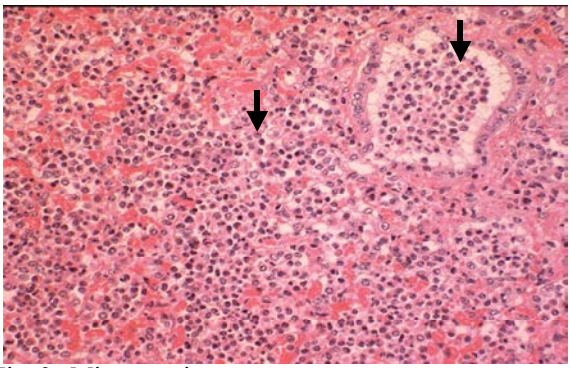

Fig. 3: Microscopic appearance of bronchointerstitialpneumonia (H & E Stain: 400x)

Microscopic lesion with thickening of alveolar wall due to mononuclear cells and/or fibroblast was categorized as interstitial pneumonia. Lesion surrounded by mononuclear cells and multinucleated giant cell was referred as granulomatous pneumonia.

DISCUSSION

The present study has shown a number of bacteria isolated from tracheal swab of pneumonic lung in small ruminants (Table 1). The finding is in agreement with Al-sultan [12], Otlus [13], Barbour *et al.* [14] and Richard *et al.* [15] who had successfully recovered

pathogenic organism like *staphylococcus, Streptococcus, Pasteurella* and *Corynebacterium* from pneumonic lung of sheep. *Passteurella* species was isolated at a rate of 14 (48.28%) which in line with the result of Bekele report [16] and lower than Tesfaye reported [9] (66.67%). This may due to some differences in managing stress that exposed to the disease before slaughtering.

In sheep 5 cases (17.24%) of pneumonic lung were infected with *Staphylococcus* species. This result agrees with Barbour *et al*. [14]. The rate observed in present study is higher than the rate reported by Almeida *et al.* [17] (2.96%) and lower than Ugochukwu [18] (33.33%). *Streptococcal* species was isolated at a rate of 4 (13.79%) which is higher than the rate reported by Otlus [13] (6.17%). This difference may occur due to genetic variation of the breed which influences their immune response and host receptor interaction with colonizing bacteria of the selected species for examination.

Animals were transported a long distance to reach the market. They were crowded and mixed at market places, transportation and lairage. They were also stressed by hot and cold weather, feeding shortage and others. All these predisposing factors could lower the resistance of the respiratory mucosa that allow the bacteria to extend down from the upper respiratory which leads to the development of pneumonia with multiple infection.

The dominant organisms isolated from tracheal swab of pneumonic lung were *Pasteurella* species followed by *Staphylococcus* and *Streptococcus* species. This observation is in agreement with Al-sultan [12] and Otlus [13] but inconsistent with Ugochukwu [18] that reported *Staphylococcus* and *Streptococcus*are the main dominant organism for the development of pneumonia in small ruminants. *Pasteurella*species constitutes 14 (48.28%) indicates that *Pastuerella*is the major causative agent involved in small ruminant pneumonia. This is consistent with the literature of Radostitis *et al*. [19].

The overall prevalence of different isolated bacteria in pneumonic lung is higher in some species of bacteria and lower in others. In the present work *Pasteurella* species was isolated at a rate of 14 (48.28%) is consistent with Ashraf *et al.* [20] and lower than that of Tesfaye reported [9] (66.67%). *Staphylococcus* and *Streptococcus* species were isolated at a rate of 5 (17.24%) and 4 (13.79%) respectively. These results are much higher than the rate reported by Almeida *et al.* [17] (2.96%) and by Otlus (1997) (6.17%) respectively.

Different types of pneumonia were observed during histopathological examination. These were *Bronchopneumonia* 41 (56.94%), *Interstitial pneumonia* 17 (23.61%), combination of two 12 (16.67%) and *Granulomatous pneumonia* 2 (2.78%). Those types of pneumonia are the most common types of pneumonia encountered in most studies. Kiram *et al.* [21] and Ashraf *et al.* [20] reported such result in sheep and Oros (1997) and Upandyaya *et al*. [22] reported in goats.

Purulent bronchopneumonia in present study 21 (51.22%) was lower than the result reported by Ashraf *et al*. [20] (58%). However fibrinous bronchopneumonia observed in this study 16 (39.02%) is higher than the one reported by Ashraf *et al*. [20] (9%). Multiple factors influence the development of pneumonia. Various micro-organisms found in the respiratory tract as a normal flora in different areas. Therefore, it seems plausible that the variation in types and extent of pneumonia could be attributed due to these and other differences.

In this study among the entire lung examined histopathologically, 17 (23.61%) pneumonic lung showed the characteristics of interstitial pneumonia. The prevalence rate in this study is comparable to the result recorded by Upandayaya *et al.* [22] (19%) but lower than that of Ashraf *et al.* [20] (41%). The presence of interstitial pneumonia indicates other causes such as allergen and viruses are involved in the development of pneumonia. Interstitial pneumonia and bronchopneumonia were also found together on the same pneumonic lung. This is due to interstitial pneumonia is the most important predisposing factors for the establishment of bronchopneumonia.

For about 41 (56.94%) bronchopneumonia cases, *Pasteurella* species were the most dominant organism isolated for fibrinous types of bronchopneumonia. Jubb *et al.* [23] and Upandyaya *et al.* [22] also reported *Pasteurella s*pecies were the most common pathogenic bacteria from cases of fibrinous bronchopneumonia in small ruminants. Most *Staphylococcus* and *Streptococcus* species were isolated from purulent bronchopneumonia. This is consistent with the result reported by Abubeker *et al.* [24] who were able to produce purulent bronchopneumonia by infecting small ruminants with *Staphylococcus and Streptococcus* species.

The variation in the prevalence rates of different types of pneumonia in small ruminants in different areas may attributed to the variation in nutritional status, breed, the effect of stressors involved (transportation, crowding and heat). In this observation transport stress, overcrowding and nutritional shortage could possibly play a constructive role in predisposing factors for the development of different types of pneumonia.

CONCLUSION

A number of pathogenic organisms associated directly or indirectly with pneumonia were isolated in bacteriological examination of the sample. The histopathologicalchanges in affected areas indicated the types and extent of pathological change occurred and the agent involved and responsible for the development of different pneumonia. Of which the bacteria involved to cause pneumonia, *Pasteurella* organisms are the most frequently isolated bacteria discovered from pneumonic lung. Predisposing factors were found to have a very big contribution in the development of pneumonia caused by pasteurella organisms.Hence, the type and extent of pathological changes, the type of pneumonia (Bronchopneumonia, Interstitial pneumonia, Granulomatous pneumoniaor others) and which organisms are responsible for each types of pneumonia should be given due attention.

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