Gross and Histopathological Findings on Lung Abscesses in Slaughtered Sheep in Libya

Ahmad Salem Omar-Ali and Zahra M. A. Mohammed

ABSTRACT

A Lung abscess is a type of necrosis characterized by a pus-filled cavity in the lung parenchyma. This study was conducted to identify gross and histopathological lesions in the lungs of slaughtered sheep during the period from October 2022 to February 2023. Out of 641 slaughtered sheep, 307 (47.9%) slaughtered sheep showed lung gross lesions, and 60 (19.5%) were affected by lung abscesses. Grossly, lung lesions including emphysema, congestion, and abscesses were observed in one or both lobes. Abscess size varied from small (0.3 cm) to large (5 cm), circle to irregular in shape, and was 0.2 to 0.3 cm in depth. Microscopically, abscesses were characterized by a caseo-necrotic core surrounded by extensive leukocytic infiltration and all encapsulated by a fibrinous membrane. Air spaces were dilated and ruptured in the affected area with emphysema. This study concluded that lung abscess is a serious health issue highly prevalent in Libya and responsible for huge economic losses to the sheep industry.

Keywords: Lung abscess, Lung lesion, Pulmonary diseases, Sheep.

I. INTRODUCTION

Respiratory diseases are considered a serious sheep problem in all major sheep-producing countries. Lung abscesses as one of the respiratory diseases that occur in most domestic animals. It is responsible for huge economic losses in the sheep industry due to; weight loss, reduction of growth, reduction of productivity, treatment costs, and mortality [1], [2]. Pathogenesis and disease appearance depend on; host immunity, type of infectious microbes, and environmental factors [3]-[6]. It occurs commonly in sheep and can not be diagnosed by clinical examination alone [6]. However, post-mortem assessment at slaughterhouses offers a useful tool for animal disease surveillance [7]-[9].

In many cases, it could be a complication of pneumonia, especially with certain types of bacterial agents [10]. Abscess is an area of pus or necrotic debris in lung parenchyma which leads to the formation of cavities that are surrounded by inflamed tissue [11].

Animals are in direct contact with different infectious and/or none infectious agents that are associated with lung diseases including; bacterial agents (*Mannheimia haemolytica, Staphylococcus aureus, Corynebacterium pseudotuberculosis, Klebsiella pneumoniae, and Pasteurella multocida*), viral agents (parainfluenza virus type 3 and adenoviruses), and parasitic agents (*Echinococcus granulosus* (Hydatid cyst), and *Dictyocaulus filaria*) [9], [10], [12]-[14]. However, this health issue is caused mostly by bacterial infection if enters the circulatory system [15].

Livestock plays an important role for farmers in Libya as a source of income. Also, small ruminants are considered the main source of red meat in the Libyan food chain, especially in the eastern province of the country. Al-Jabal Al-Khdar (the green mountain) region, is located in the eastern province of Libya, and it is an important part of the national economy for sheep production due to its green pastures, mild weather, and abundance of rain.

About 95% of sheep in Libya belong to the flat-tailed Barbary breed which is raised for meat and wool production, but wool production comes second to meat production in the farmer’s priority [16]. According to the local authority concerned of the city of El-Beida, the population of livestock is; sheep 580989, goats 55388, cows 144697, and camels 5873 [17].

The local authority has not offered any preventative educational program for farmers regarding this health issue or its impact. In addition, there is no published report indicating the prevalence rates of lung abscesses in sheep in Libya. Because of the economic impact on the sheep industry, lung abscesses should be extensively studied in the field of all Libyan regions for better understanding, and determining the causative agents; which will lead to design a better control strategy for it. So, the purpose of this study was to identify the gross and histopathological lung abscesses in slaughtered sheep in Libya, and to provide baseline data for future monitoring.

II. MATERIALS AND METHODS

A. Field Study Area

This study was carried out in El-Beida slaughterhouses, located in Al-Jabal Al-Akhder region, in the eastern province of Libya. El-Beida city is located between latitude 32°45’ N and longitude 21°44’ E with an elevation of altitude 623 m above the sea level. The climate of El-Beida is moderate with average temperature of 22 °C and 4 °C during the hottest and coldest seasons respectively. The average annual rainfall is about 540 mm.
B. Sample Collection
A total of 641 local sheep breeds of varying ages, weights, and sexes were slaughtered in El-Beida slaughterhouse over a period extended from October 2022 to February 2023 during wet and dry seasons. The average sex was males over 4 months old, and all sheep were submitted for routine slaughter process. During post-mortem examination, gross lesions of the affected lungs were recorded and then samples were collected for histopathological evaluation. All samples (4-5 mm in thickness) were fixed in 10% neutral-buffered formalin for histopathological examination, and transported to College of Veterinary Medicine, Omar Al-Mukhtar University for tissue processing. All samples were then dehydrated in graded ethanol and embedded in paraffin wax. The paraaffinized tissues were cut at 5 μm thickness and then stained with Harris Hematoxylin and Eosin (H&E). All sections were examined by an ordinary light microscope.

III. RESULTS
Lung lesions were detected in 47.9% (n= 307/641) of all examined sheep. 19.5% (n = 60/307) of the lung lesions diagnosed as abscesses.

A. Gross Lesions

Abscesses were found in one or both lung lobes and occurred as single or multiple. The size of the abscesses ranged from 0.3 to 5 cm in diameter and from 0.2 to 3 cm in depth. The shape of abscesses was circular in some cases and irregular in others. In 42 (70%) cases, the color of abscess content is white–yellow pus (Fig. 1, B), and in the other 18 (30%) cases thick greenish cheesy surrounded by necrotic tissue (Fig. 1, C) and all were odorless. In addition, pus consistency ranged from purulent to caseous. The grinding sound was noticed during the cut surface in 8 (13.3%) old large abscesses.

Lungs with abscesses were consolidated, congested, emphysematous, and others showed multifocal hemorrhagic spots on the surface of the lungs (Fig. 1, A, B). Lung emphysema that was combined with abscesses was characterized by the variable sizes of air bubbles due to the accumulation of air in the pulmonary parenchyma. In addition, these affected areas by emphysema appear pale, grayish to yellow, and feel puffy and crepitant (Fig. 1, A).

B. Histopathological Lesions

The focal area of pus formation in lung parenchyma varied from small to big in size. Abscesses appeared as focal eosinophilic homogenous structure-less of necrotized tissue, pus formation in the core and surrounded by a collar of mononuclear and multinucleated cells (Fig. 2, A, B, and C). Bronchiolar epithelium adjacent to large abscesses was necrotized and packed with erythrocytes with an aggregation of leukocytes including macrophages, mast cells, and lymphocytes (Fig. 2, D)

Blood vessels in the affected area were dilated and filled by a large number of erythrocytes because of the congestion. Also, hemorrhage and hemosiderophages were noticed in the air spaces and the air spaces septa adjacent to the pus formation (Fig. 3, A, B)

Fig. 1. Macroscopic pictures of lung lesions in sheep:
A. Area manifested by emphysema (thin arrow) and mild congestion (asterisk).
B. Large number of small abscesses appear as white areas and also few larger abscesses appear white-grayish in color (thick arrow), severe congestions appear all over the lung surface as dark red spots (arrow ahead).
C. Cut sections in large bumped abscesses contain yellow-greenish cheesy pus (thick arrows) and are surrounded by necrotic tissue (thin arrows).

Fig. 2. Microscopic pictures of lung abscesses in sheep:
A. Lung abscess shows an eosinophilic homogenous material in the center(asterisk), surrounded by a collar of leukocytic inflammatory cells(arrow), (H&E stain, 10x).
B. Figure A under higher magnification shows destruction in air spaces around the abscess (arrow), (H&E stain, 40x).
C. Caseo-necrotic area in the center of abscess (asterisk), a collar of mono-nuclear cells and also multi-nuclear cells and multinucleated giant cells (thick arrow) and fibroblast, (H&E stain, 60x).
D. Bronchiolar epithelium is necrotized (white arrow), with aggregation of inflammatory cells (black arrow), and congestion (packed with erythrocytes) (asterisk), (H&E stain, 60x).
Areas that manifest emphysema were noticed by the enlargement of air spaces combined with destruction in air spaces septa (Fig. 3, A, B).

Similar findings were observed as pus drained inside air spaces. Older abscesses are encapsulated by fibrous connective tissue (Fig. 3, C). Multinucleated giant cells (Langhan’s giant cells) which are characterized by the larger size and contain many nuclei that are peripherally oriented in a circle from the center were seen in some cases (Fig. 3, D).

IV. DISCUSSION

Respiratory diseases are common diseases in various species of domestic animals including sheep. One local study showed that pneumonia is an important sheep disease in Libya and confirmed the types and frequency of gross and microscopic lesions of pneumonia observed in sheep slaughtered in Libya [18]. Another local study recorded the prevalence as well as morphopathological characteristics of Ovine Pulmonary Adenocarcinoma forms in local sheep of Libya [19].

Lung abscesses could develop if the causative agents enter through the circulation system [15]. In General, neutrophils are generated and continue to develop until it is recruited into the site of infection or affected tissue. When acute inflammatory response fails to rapidly eliminate the inciting stimulus. Neutrophils and macrophages release enzymes and mediators in exudate that liquefy the affected tissue and form cavities and pus[20].

The present study to our knowledge, shows for the first time the frequency and nature of gross and microscopic lesion of lung abscesses observed in sheep slaughtered in Libya. As we mentioned earlier, sheep with lung abscesses show no clinical symptoms especially if they were not developed from pneumonia. In this case, abscesses will persist to become chronic and the outcome will be a reduction of animal productivity due to toxemia. In this study, lung abscesses were detected in 60 out of 307 (19.6%) affected lungs. Other researchers detected lung abscesses in 42 out of 86 (48.8%) examined slaughtered sheep [14] and in 160 out of 1500 (0.007%) examined slaughtered cattle [21].

The majority of the examined lungs manifest lung emphysema and ruptured air spaces septa, congestion, and these findings are in agreement with other earlier published studies [13], [21], [22]. However, according to Herenda et al. 2000, all animal species are affected by interstitial emphysema because of the absence of collateral ventilation bypass for air which leads to the rupture of air spaces and diffusional of air in the lung interstitium [23]. Other studies reported lung abscesses combined with emphysema similar to our findings [24], [25]. Moreover, we reported in this study thickening in air spaces septa in different lung regions, and it is due to Broncho-interstitial pneumonia in lung tissue [10], [18], [19], [24].

The present study reported large abscesses and a large number of small abscesses which indicate hematogenous spread of the causative agent. This finding was in agreement with other earlier studies [6], [26]. The histopathological findings of abscesses in this study are characterized by a central core of caseo-necrotic tissue, surrounded by a collar of leukocytic infiltration, and enclosed by fibrous connective tissue in old abscesses. Similar observations were described by other studies [13], [21], [22]. Most areas surrounding these abscesses demonstrated proliferation of fibrinous connective tissue in an attempt to contain the spread of the causative agent and the abscess. We reported the presence of Langhans giant cells in the collar zone which are formed by the adhesion and fusion of macrophages together. They are usually found in response to chronic inflammation such as granulomatous conditions or tuberculosis [27], [28]. The grinding sound reported here during the cut section of old large abscesses is due to the deposition of dystrophic calcification. This type of local abnormal deposition of calcium salts occurs in dying or dead cells that can no longer regulate the influx of calcium salts such as in abscesses and infections [20], [21].

V. CONCLUSION

This study showed the prevalence rate and the nature of lung abscesses within Libyan sheep flocks. However, further studies are required to investigate the prevalence of lung abscesses in the entire country during the year additionally to identify the causes. This may help to design preventative control measures that minimize this health problem. In addition, many factors could be attributed to this health issue, and should be monitored; such as climate changes and husbandry practices, mixed herding, and sharing of water and pasture with other animals.
CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

REFERENCES


