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Detection of Bovine Pulmonary Lesions Using Ultrasonography

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Abstract Bovine respiratory disease is regarded as a serious veterinary problem because it can be costly to identify, treat, and monitor, resulting in significant financial losses in the herd. The study was carried out to identify the most important clinical signs and determine the type and severity of lung lesions using ultrasonography. Twenty local cow breeds, aged 3 to 8 years, were used in the current study. A case history was obtained, clinical signs were recorded on a clinical card, and the lungs were examined firstly by auscultation using a stethoscope, and then ultrasound evaluation was carried out using a portable KX5100 vet ultrasound machine with a 3.5 MHz curved probe. Clinical examination indicated that all cows had coughed, while 85%, 80%, and 70% of the cows had lacrimation, nasal discharge, and fever, respectively. According to an ultrasound of the lungs, 60% of the lesions were acute and 40% were chronic. The most common lesions in acute cases were irregular pleural surface (89%), comet tail artifact (71%), and abnormal alveologram (65%). In 40% of cases, chronic lung consolidation lesions were also observed. Ultrasound is very effective at detecting lung lesions. By using ultrasound imaging, it is possible to distinguish between acute and chronic lung lesions in cows..

Keywords: Cows, Ultrasound, Lung lesions

Introduction Bovine respiratory disease consider one of the most important bovine diseases because the economic losses of diagnosis, treatments, and control (1). The lungs of cows have unique physiological and anatomical characteristics that make them more sensitive to inflammatory processes and lung lesions, which make them more susceptible to respiratory illnesses (2). Additionally, they have a number of risk factors, such as low physiological gas exchange, high basal ventilator activity, increased lung anatomical division, low amounts of bovine lysozymes, and low quantities of phagocytes in the pulmonary alveolar cavity (3). Cows respiratory diseases are characterized by the development of clinical signs that vary depending on the stage of infection. These signs include nasal discharge, lacrimation, high body temperature, and coughing, which is the most prevalent signs of the disease (1,4). Numerous studies have been done currently to use ultrasound to detect respiratory diseases in cows and calves (5,6), despite the fact that auscultation using a stethoscope is a fast and reliable clinical diagnostic technique (7), this made it possible for researchers to recognize lung disease, assess the degree of tissue damage, and assess the severity of the disease through ultrasound evaluation(8). Furthermore, ultrasound devices are widely available and serve as an essential tool for diagnosis due to their ability to take a look at particular regions of the chest, more sensitive than auscultation in detecting pulmonary consolidation in cows, and more sensitive and specific than radiography in detecting pulmonary abscess, pleurisy and pleural fluids in calves (9). The ultrasound is regarded as the third eye in the field of modern examination because it is radiation-free and doesn't harm the pulmonary tissue, especially when compared to other imaging techniques as radiography, because the latter can seriously harm tissue if used frequently (10,11).

The researchers indicated that ultrasound examination gives an early and accurate diagnosis, particularly when cows are infecting with respiratory diseases. It also provides a rapid assessment of the condition of the affected lung and provides an accurate classification of cases suffering from respiratory diseases (12,7). In Iraq, numerous studies have investigated the lung diseases in cows by using postmortem examinations (13), or molecular

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detection (14,15) and in previous research they used ultrasound to detect lung lesions in buffalo calves (16), but none use ultrasound to detect respiratory diseases in cows. The study was carried out to identify the most important clinical signs and determine the type and severity of lung lesions in cows using ultrasonography.

Material and methods

Ethical approval

The project was approved (UM.VET2023.139 in 2/1/2023) by the Committee for Research Ethics at the College of Veterinary Medicine, University of Al-Mosul, Iraq.

Twenty cows of local breeds, aged 3 to 8 years, were used in the current study. A case history was obtained, clinical signs were recorded on a clinical card, the lungs were auscultated using a stethoscope on both sides of the chest wall, and then an ultrasound evaluation was carried out using a portable KX5100 vet ultrasound machine with a 3.5 Mhz curved probe (KeeboMed, USA). Scanning was performed in the intercostal spaces 5 to 9 on both sides of the chest wall without clipping, only alcohol application on the scanning site, and normal lobs or lesions detection was followed by image saving and analysis, Acute and chronic cases were considered according to (16). Examination was ethical approved according to Institutional Animal Care and Use Committee of the College of Veterinary Medicine at University of Mosul (UM.VET.2023.139, 2/1/2023). Descriptive analysis was perform to show the percentages of different parameters.

Results

Based on the findings of the clinical examination, it was found that 100% of the cows had different types of cough, 85% have lacrimation, 80% showed serous to mucopurulent nasal discharge and 70% have fever (a body temperature more than 39.5°c) (Table 1).

Table 1. Clinical signs associated with respiratory disease in cows

Number of cows	Sings	%
20	Cough	100
17	Lacrimation	85
16	Nasal discharge	80
14	Fever	70

An ultrasound examination of the lungs of animals with signs of respiratory diseases revealed that 60% of them had acute cases, while 40% had chronic cases. The most prevalent lesions in acute cases were irregular plural surface (89%), comet tail artifact (71%) and alvelogram (65%). Consolidation lesions with a percentage of 40% were present in all chronic cases (Table 2).

Table 2. Case types and lesion types based on ultrasound examination

Cases type	Number of cows	Lesion	%
Acute	12	Irregular pleural surface	89
		Comet tail artifact	71
		Alvelogram	65
Chronic	8	Lung consolidation	40
Total	20		

Ultrasound examination of normal lungs or lobes appears with a clear regular white echogenic line moving semitenuosly with respiration which represents a plural surface; then, to the deep area, there are multi-echogenic parallel lines represent lung tissues called reverberation artifacts (Figure 1), while in acute cases ultrasound revealed a thicker irregular echogenic pleural surface with or without many commit tail artifacts appear at lung surface nearest to the chest wall towards the deeper lung layer, and directed vertically on the lung with many areas of hypoechogenicity diffuse in lung area called alveologram (Figure 2,3). While in chronic cases, there was pleural surface appeared irregular and thicker than normal with disappear of reverberation artifacts, and there were many hypoechoic dots and thread-like areas in the lung (Figure 4)

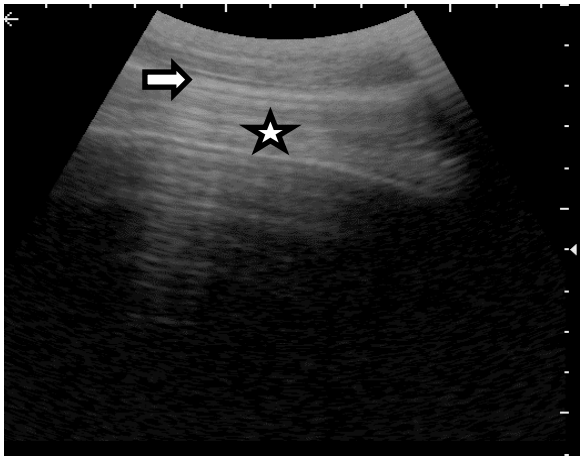

Figure 1. Sonogram of normal cows lung using (3.5 MHz) probe. Echogenic line (arrow) represent plural surface, echogenic lines running parallel to lung surface (star) reverberation

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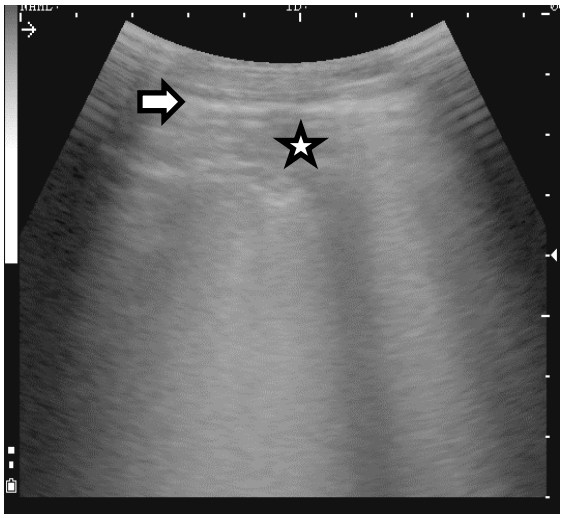

Figure 2. Sonogram of cows lung with acute respiratory disease using (3.5 MHz) probe. Echogenic irregular thick line represent plural surface (arrow), alvelogram appear as hypoechogenic areas (star).

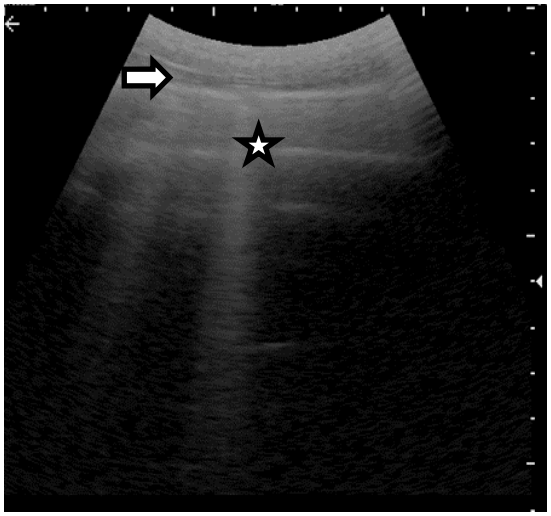

Figure 3. Sonogram of cows lung with acute respiratory disease using (3.5 MHz) probe. Echogenic thick line (arrow) of plural surface, comet tail artifact (star).

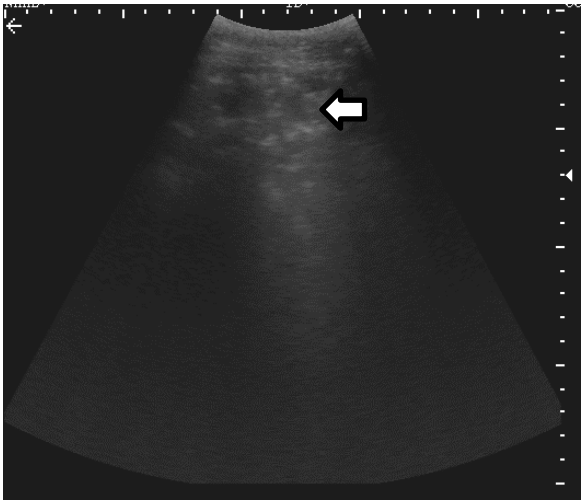

Figure 4. Sonogram of cows lung with chronic respiratory disease using (3.5 MHz)probe. Hypoechoic dot and thread like areas (arrow) represent consolidation.

Discussion

The results showed that most of the cows infected with respiratory diseases suffer from coughing by 100%. This result agrees with the researchers (1, 17) they indicated that self-motivated coughing has a significant association with respiratory diseases and with pulmonary consolidation. Cause of coughing is due to irritation of the larynx and bronchi, as a result of irritation during inhalation of caustic substances or bacteria, as the respiratory system works to remove excess mucus and inflammatory secretions as a defensive means (3).

The results also showed that cows with respiratory diseases suffer from lacrimation and nasal discharge by (85%) and (80%), respectively. These results were identical to previous study (2), the cause is attributed to inflammatory diseases of the upper respiratory tract as well as sinus filling with mucus and tear duct blockage with inflammatory substances (16). The results indicated that some infected cows suffered from a high body temperature by (70%), which represented the lowest percentage among the clinical signs, as this result agreed with (1,8), and that the reason behind the high temperature is the infection by pathogens (bacterial and viral) that cause inflammatory processes within the lung tissue (3), while the others cows did not showed a rise in temperature because they were in the stage of chronic infection, these results agree with (6,18), in contrast to chronic infections, which temperature return to

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normal range, acute pneumonia causes an increase in temperature (3).

The ultrasound examination of healthy cows lungs showed reverberation artifact, and this result agrees with (19), The reason for the formation of these reverberation is the air-filled lung tissue, as the ultrasound waves are reflected back and forth at the border between the parenchyma of the lung and its texture and form hyperechoic pulmonary structures in the form of reverberation artifact (12). Results of ultrasound examination of the lungs of cows with acute form showed irregularity of the pleura (89%), comet tail artifact (71%), and alvelogram (65%), these results of ultrasound abnormality agree with (5). The irregularity of the pleura occurs as a result of the imbalance of the contents between the visceral and parietal part of the pleura as a result of acute respiratory infection, while comet tail artifact are echo bands generate at lung surface and direct vertically to the deeper areas in acute cases, represent the presence of inflammatory fluids in the vesicles or bronchioles. (17). The results of the ultrasound examination of the lungs of affected cows showed the appearance of pulmonary consolidation in 40% of them. This result agrees with the researcher (19), as chronic infection leads to the loss of the normal appearance of the lung tissue and turn into liver-like tissue upon ultrasound examination (13).

Conclusion:

Concluded that ultrasound provide an easy, rapid and effective practical examination method for detection lung lesions and determined severity of the disease.

Conflict of interest

There is no conflict of interest in this study as stated by the authors.

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Article highlights

1. Ultrasound provides excellent detection of lung lesions in cows.
2. Acute and chronic lung lesions can be differentiated by ultrasound examination.