

Original Research Article

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Evaluation of Pulmonary Function in Goats Affected with Bacterial Pneumonia

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A B S T R A C T

In the present prospective study from August 2016 to July 2017 a total of 117 pneumonic goats were screened, of which naturally infected twenty-four cases of bacterial pneumonia were evaluated for pulmonary function in detail based on the different diagnostic methods such as clinical examination, isolation and identification of bacteria, hematology, blood gas analysis and radiographic study. Predominant clinical signs such as pyrexia, coughing, sneezing, congested mucous membrane, tachypnoea and bilateral nasal discharge noticed which are considered to be major indicator of bacterial pneumonia. Isolation and identification of bacteria confirmed that *Pasteurella spp.* (20.83%) as predominant bacterial isolate followed by *Mannheimia spp.*, *Pseudomonas spp.*, *Escherichia spp.*, *Staphylococcus spp.* and *Bacillus spp.*. The hematology and blood gas analysis revealed significant leucocytosis with neutrophilia indicating acute bacterial infection whereas increased $VpCO_2$, $VtCO_2$, H^+ ions and decreased VpO_2 , VO_2 sat values were suggestive of respiratory acidosis leading to severe respiratory distress. Further radiography of thoracic region in pneumonic goats helped in assessing its severity of pulmonary function as score-1, 2 and 3. The results concluded that above diagnostic methods aids in knowing the severity and prognosis of bacterial pneumonia in goats.

Keywords

Goats, Bacterial pneumonia and pulmonary function

Article Info

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Introduction

In India, goat rearing is one of socio economic status to low and moderate farmers. The goats are low cost with highly profitable, adoptable, small in size and easy to handle so in traditional goats are referred as “poor man’s cow”. In the present situation intensive goat farming system affect the health of goats due to overcrowding, transport stress, immunity and sudden change in the environmental condition that precipitates

respiratory problems in goats causing severe economic loss to the farmer. Among this pneumonia is a major problem and pose threat in goat farming. So the current study was envisaged to know the incidence of bacterial pneumonia and any changes in pulmonary function by different diagnostic methods such as hematology, blood gas analysis and radiographic study and also aids in assessing the severity and prognosis of bacterial pneumonia in goats.

Materials and Methods

Incidence of bacterial pneumonia

The incidence of bacterial pneumonia in goats was studied from August 2016 to July 2017. During this period, naturally infected clinical cases of bacterial pneumonia in goats presented to Veterinary Clinical Complex (VCC), Veterinary College Bidar was undertaken for detailed clinical, physical and physiological examination with supportive diagnostic aids such as pulmonary function score, isolation and identification, haematology, blood gas analysis and radiographic study.

Clinical examination

To assess the pulmonary function of bacterial pneumonia in goats, the detailed examination of suspected cases was performed as per the pulmonary function score card by clinical assessment and physical examination (table-1)

Isolation and identification of bacteria

Isolation and identification of the bacterial origin is followed as per standard protocol.

Hematological examination

The two ml of whole blood was collected in K2 EDTA- 2ml, J. K. diagnostics vials from jugular vein for haematological investigations. Total erythrocyte count (TEC), Total leukocyte count (TLC), Packed cell volume (PCV), Haemoglobin content (Hb), Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentrations (MCHC) in automatic blood cell counter (ERMA INC) and Differential leucocytic count (DLC) was done with Giemsa staining technique as per standard methods (Sadeghiana *et al.*, 2011 and Ghanem *et al.*,

2015) to know any alterations in hematological value implicating bacterial pneumonia in comparison with the normal healthy goats.

Blood gas analysis

Similarly two ml venous blood was collected, on the day of case presentation and immediately run into the blood gas analyzer. The blood gases were analyzed to assess the pulmonary function by recording the changes in venous partial pressure of carbon dioxide (V_pCO_2), venous partial pressure of oxygen (V_pO_2), venous Actual bicarbonate ion ($VHCO_3A$), venous total carbon dioxide content ($VtCO_2$) venous base excess (VBE), venous hydrogen ion concentration (VH^+) and venous oxygen saturation ($VO_2 \text{ sat}$) and compared with the normal healthy goats.

Radiography

To assess the different pulmonary function scores in pneumonic goats, the radiography was taken to confirm the pneumonia (Smith and Sherman, 2009). On the day of case presentation the X-ray of thoracic region was taken out during inspiratory pause with kVp 55 and mAs 6. On radiographic examination infiltration, density and contrast of chest X-ray were recorded to assess the pneumonic condition. The severity of pneumonia was scored as mild (score 1), moderate (score 2) and severe (score 3) cases, which was compared with the normal chest radiography of healthy goats.

Statistical analysis

The haematological and blood gas values obtained were analyzed by ANOVA using SPSS (statistical package for social sciences) version20. The results were demonstrated as means \pm SE. The results were considered statistical significant when $p < 0.05$.

Results and Discussion

In this prospective study a total of 117 pneumonic goats were screened, of which 24 goats suffering from bacterial pneumonia were evaluated in detail to assess the pulmonary function as follows.

Clinical signs

The clinical signs in goats affected with bacterial pneumonia were recorded (FIG.1) as pyrexia, sneezing and coughing were found to be 100 per cent followed by congestion of mucous membrane (95.83%), bilateral nasal discharge (91.66%), tachypnoea (91.67%), dyspnoea (87.50 %), tachycardia (79.17%), ocular discharge (75.00%), anorexia (75%), mucopurulent nasal discharge (66.67%) and crackles sound on lung auscultation (58.33%) were considered as major indicator markers in identification of bacterial pneumonia in goats. The results were in agreement with , Ghanem *et al.*, (2015) and Chung *et al.*, (2015) in pneumonic goats.

The goats were examined in detail for assessing the pulmonary function scoring. Among twenty-four cases of bacterial pneumonia in goats, 15 goats were scored as score 3 i.e. severely infected followed by 8 goats were scored as score 2 i.e. moderately infected and 1 goat scored as score 1 which was mildly infected (plate 1). The similar scoring was done by Christodoulopoulos *et al.*, (2002) in lambs. In pneumonic goats to assess the pulmonary function along with that prognosis of disease condition can be elucidated.

Isolation and identification of bacterial origin in pneumonic goats

From the infected goats the bacteria isolated from the nasal swabs were *Pasteurella spp.* (20.83%) followed by *Mannheimia spp.*

(16.67%) cent, *Pseudomonas spp.* (12.50%), *Escherichia spp.* (12.50%), *Staphylococcus spp.* (12.50%), *Bacillus spp.* (8.33%) and mixed infection (16.67%). (FIG 2, Plates 2, 3, 4, 5, 6, 7) The results revealed that *Pasteurella spp.* and *Mannheimia spp.* were found to be most predominant and pathogenic. The comparable results were observed by earlier workers, Hussein *et al.*, (2006) Momin *et al.*, (2011)

Haematological parameters

The detailed hematological changes in bacterial pneumonia of goats showed in table.2. The results revealed that significant changes ($P<0.05$) in Leucocytic count with neutrophilia and lymphopenia when compared to healthy goats in the present study may be attributed to acute inflammatory changes in lower respiratory tract particularly due to bacterial infection in pneumonic goats. The present results agreed with Nahed and Tamer (2014) in ewes, Ghanem *et al.*, (2015) in Boer goats, The stress induced during respiratory illness that result in endogenous release of corticosteroids, which have a major role in regulating the concentration of leucocytes in mild to severe pneumonia in goats. However other parameters such as monocytic count, MCHC and PCV found to be significantly altered but they are all within normal physiological range and rest of the parameters were found to be non significant.

Blood gas analysis

The blood gas values of goats shown in table-2 revealed that there was significant elevation ($P<0.05$) in the $VpCO_2$, $VtCO_2$ and H^+ ions, while significant decrease ($P<0.05$) in VpO_2 and VO_2 sat values may be due to respiratory acidosis leading to pulmonary hypoventilation and hypoxic condition in bacterial pneumonia. The results were in accordance with Ghanem *et al.*, (2015)

Table.1 Pulmonary function score card for pneumonic goats

Sl. No	Score Parameters	Score 0	Score 1	Score 2	Score 3
1	Rectal temperature	Normal	Elevated	High	Very High
2	Conjunctival mucous membrane	Pink	Congested	Congested	Severe Congested
3	Respiratory rates	Normal	Tachypnoea	Dyspnoea	High dyspnoea
4	Heart rates	Normal	High	Tachycardia	Tachycardia
5	Lung auscultation	No abnormal sound	Moist rales on anterior lung	Moist rales on whole lung	Crepitant sound on whole lung
6	Nasal discharge	No	Present	Present	severe
	a) Unilateral/ bilateral nares	No	Unilateral	Bilateral	Bilateral
	b) serous/mucous/mucopurulent	No	Serous	Mucous	Mucopurulent
7	Ocular discharge	No	Scanty, serous	Serous to mucous	Mucous to purulent
8	Sneezing	No	Slightly	Present	Severe
9	Coughing	No	Slightly	Present	Severe
10	Feed intake	Normal	Reduced	Inappetence	Anorexia

Table.2 Comparative evaluation hematological and blood gas parameters of bacterial pneumonia in goats

PARAMETERS (Units)	Healthy goats (N=6)	Diseased goats (N=24)
WBC ($10^3/\mu\text{l}$)	10.92 \pm 1.08	18.74 \pm 1.09*
RBC($10^6/\mu\text{l}$)	14.92 \pm 0.15	13.34 \pm 0.70
HB(g/dl)	9.13 \pm 0.34	8.65 \pm 0.51
PCV(%)	23.43 \pm 0.75	28.41 \pm 0.20*
MCV(fL)	15.62 \pm 0.36	19.06 \pm 1.46
MCH(pg)	6.05 \pm 0.19	5.80 \pm 0.46
MCHC(g/dl)	38.83 \pm 0.48	32.95 \pm 2.05*
NEUTROPHIL(%)	40.83 \pm 1.30	54.00 \pm 1.10*
ESIOPHILS(%)	1.50 \pm 0.51	0.96 \pm 0.32
LYMPHOCYTE(%)	56.67 \pm 1.36	42.04 \pm 1.17*
MONOCYTE(%)	0.67 \pm 0.37	2.63 \pm 0.14*
BASOPHILS(%)	0.33 \pm 0.24	0.33 \pm 0.07
VpCO ₂ (mmHg)	36.70 \pm 6.59	54.71 \pm 3.10*
VpO ₂ (mmHg)	95.13 \pm 11.62	68.23 \pm 4.67*
VHCO ₃ A(mmol/l)	17.87 \pm 0.95	20.67 \pm 0.12
VtCO ₂ (mmol/l)	18.02 \pm 1.86	23.48 \pm 1.19*
VH ⁺ (nmol/l)	53.28 \pm 6.47	76.37 \pm 7.03*
VBE(mmol/l)	-4.06 \pm 0.36	-4.66 \pm 0.69
VO ₂ SAT(%)	88.58 \pm 2.50	68.84 \pm 3.46*

Mean \pm SE across a column with (*) superscripts differ significantly ($P<0.05$)

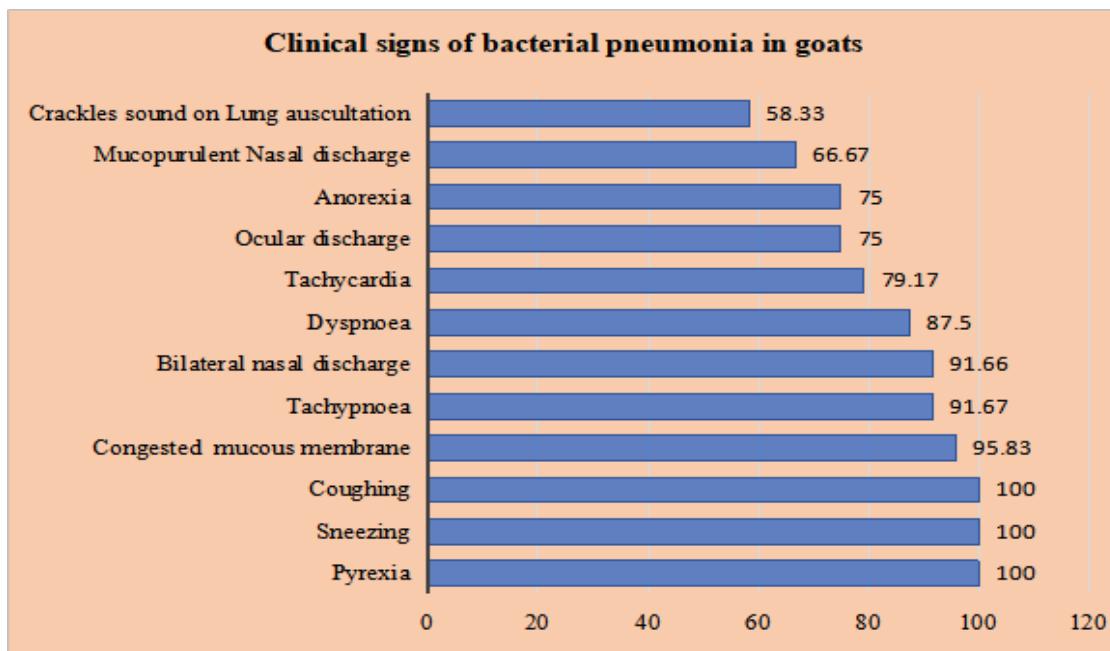


Fig.1 Predominant clinical signs observed in bacterial pneumonia in goats

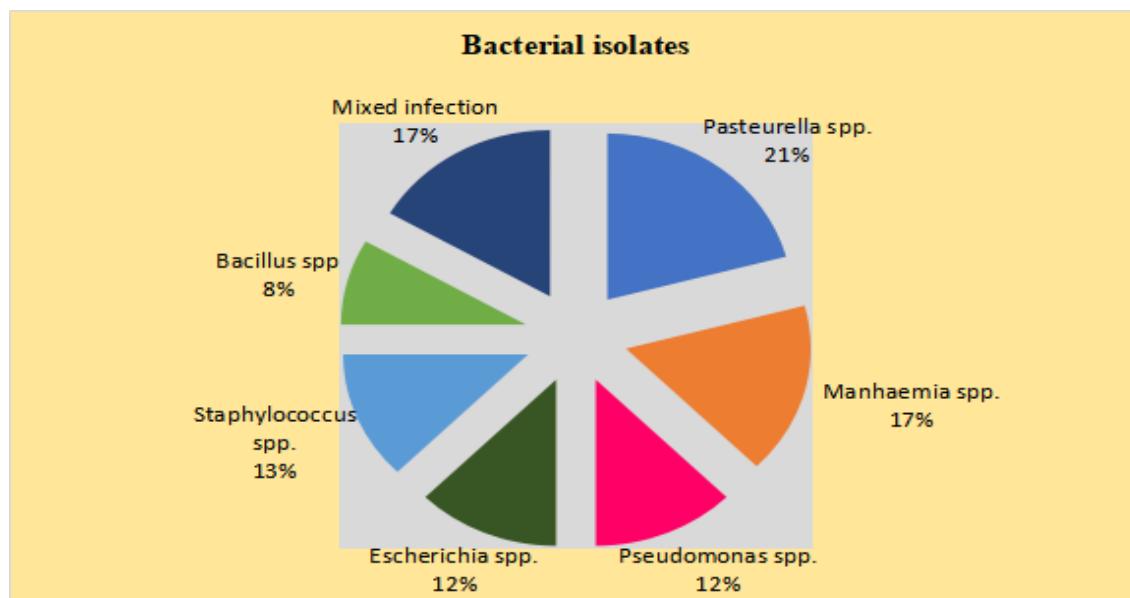


Fig.2 Bacterial isolate of pneumonic goats



Plate.1 The pneumonic goats showing serous to mucopurulent nasal and ocular discharge

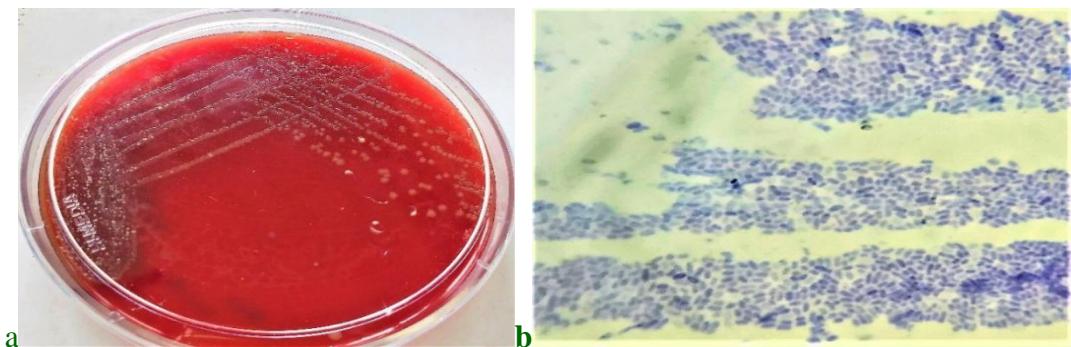


Plate.2 a: *Pasteurella spp.* showed the gray dew drop colony with fruity odour, non-haemolytic colony in sheep blood agar; b: *Pasteurella spp.* showed the bipolar organism in Methylene blue stain

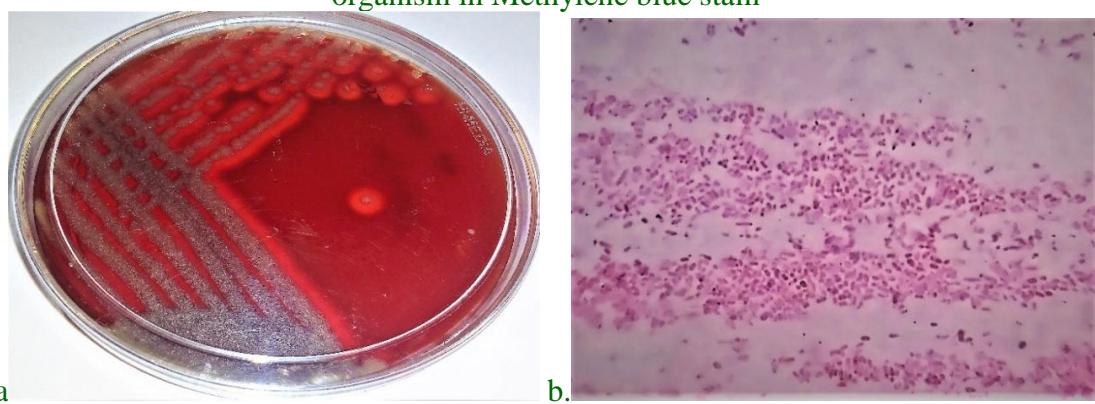


Plate.3 a: *Mannheimia spp.* showed small, dew drop greyish, complete haemolysis in sheep blood agar; B:*Mannheimia spp.* bacteria showed the gram-negative coccobacilli in Gram's stain

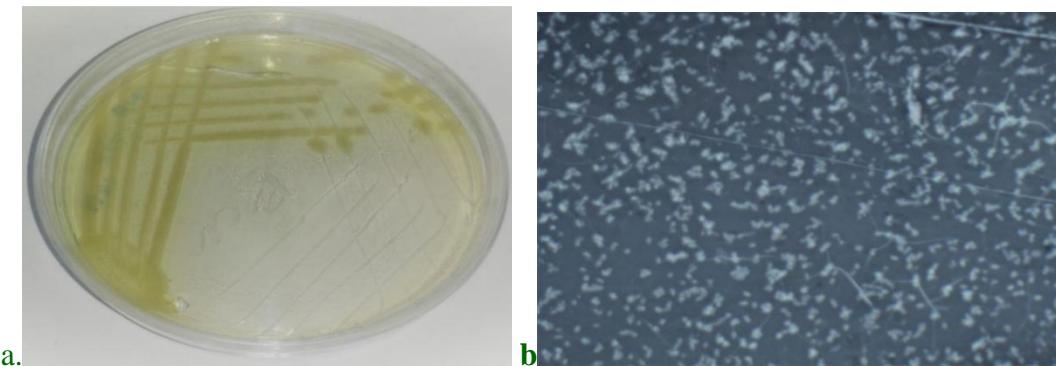


Plate.4 a: *Pseudomonas spp.* showing the greenish pigmentation with fried egg appearance colonies in nutrient agar.
b:*Pseudomonas spp.* in negative staining ,observed hollow organism white capsule in black background

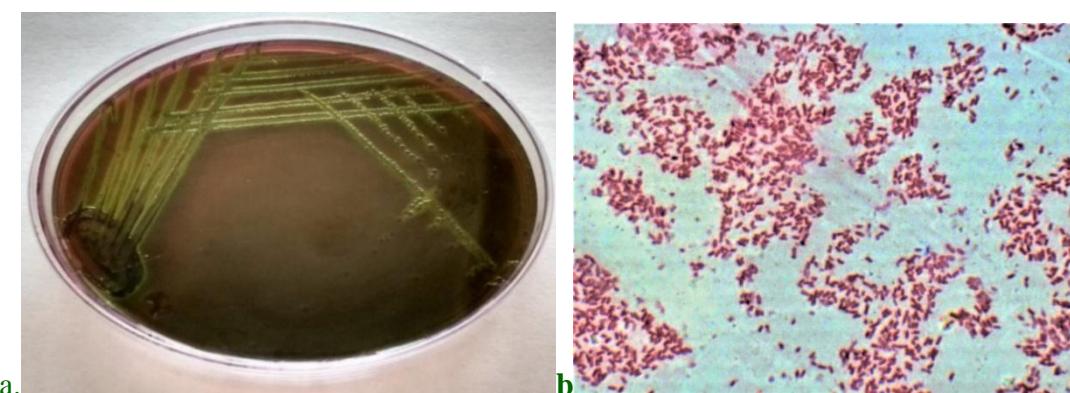


Plate.5 a: *Escherichia spp.* showing metallic sheen growth in Eosin methylene blue agar.
b: *Escherichia spp.* showing in Gram's staining, gram-negative, non-spore forming rods, single or paired observed

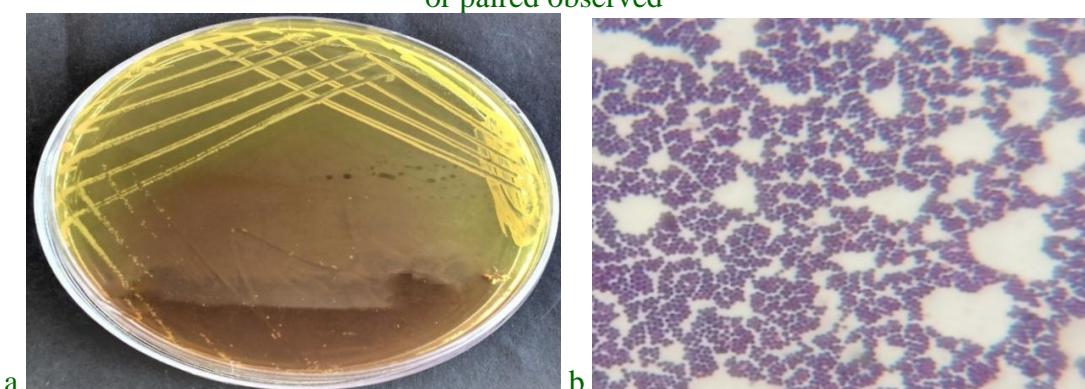


Plate.6 a: *Staphylococcus spp.* showed golden yellow colour colony in Mannitol salt agar.
b: *Staphylococcus spp.* showing gram-positive cocci arranged in grape like clusters in Gram's stain

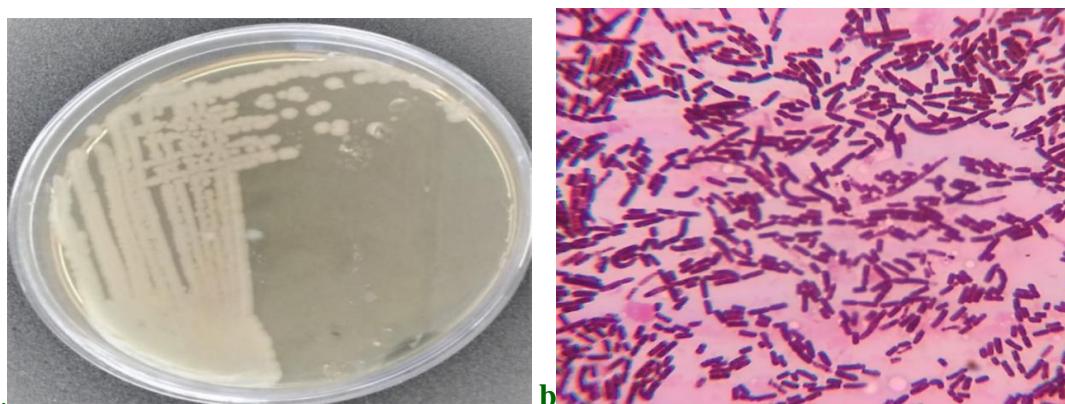


Plate.7 a: *Bacillus spp.* showing irregular, round, opaque, dull, grayish white colony in nutrient agar; b: *Bacillus spp.* showing in gram positive, single or pair in chain of bacilli seen in the Gram's stain

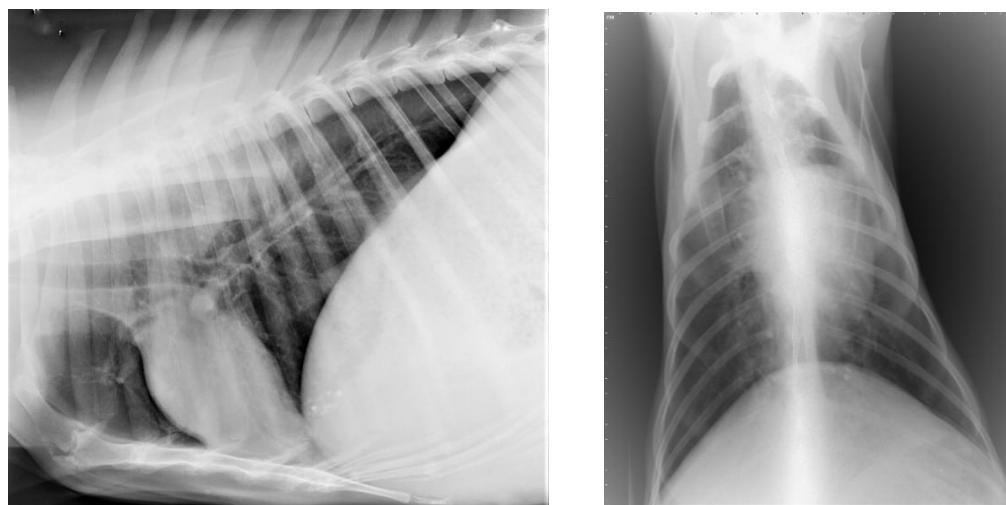


Plate.8 Thoracic radiography of goat showing normal lung (score 0)

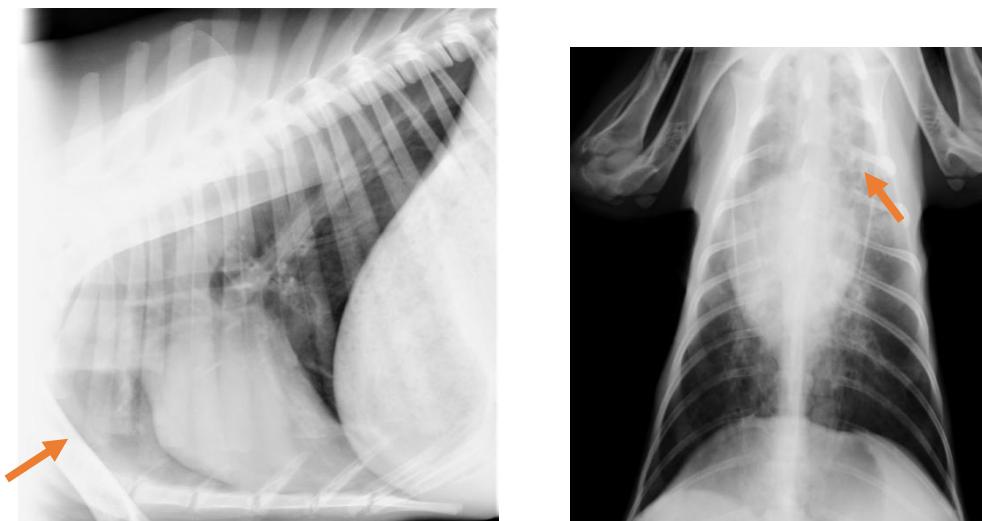


Plate.9 Thoracic radiography of lung showing mild pneumonic changes in goat (score 1)

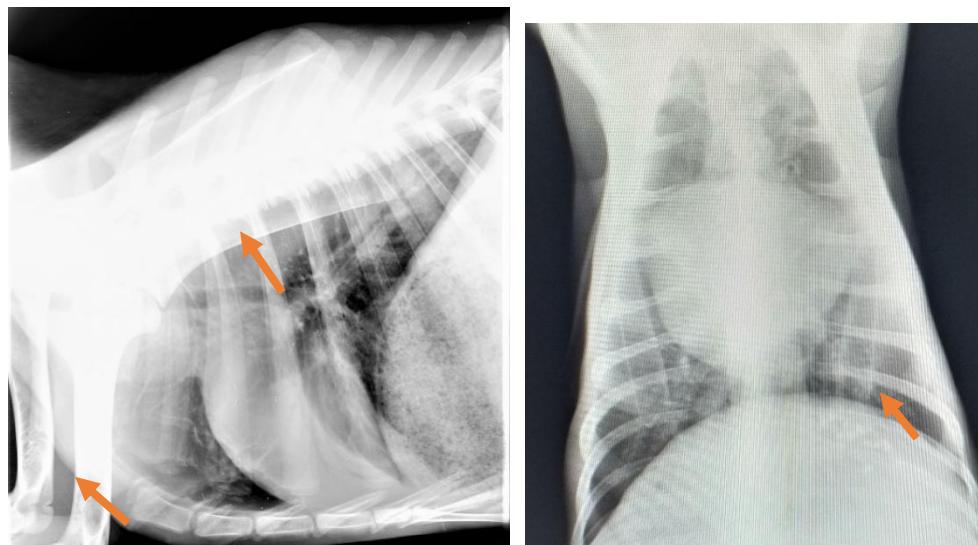


Plate.10 Thoracic radiography of lung showing moderate pneumonic changes in goat (score 2)

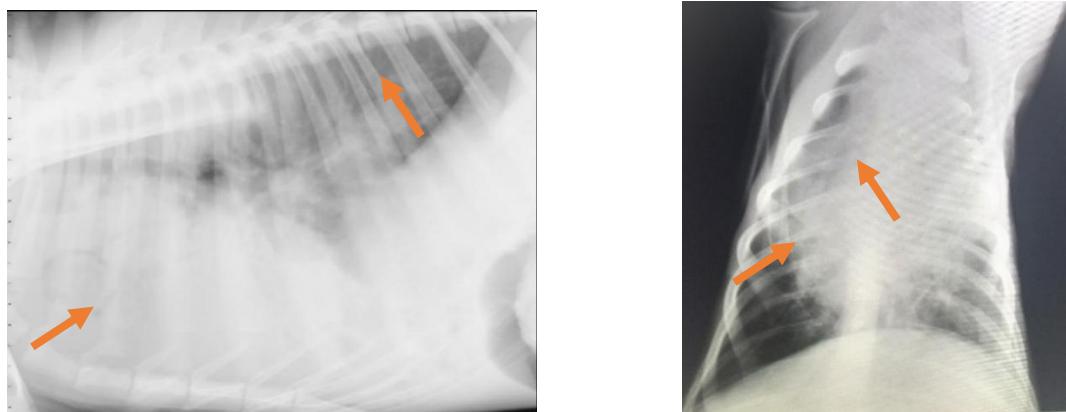


Plate.11 Thoracic radiography of lung showing severe pneumonic changes in goat (score 3)

Radiographical study

Radiography is thought to be one of the ‘gold standard test’ for confirmation of pneumonia in goats (Bossuyt *et al.*, 2007). Masseau *et al.*, (2008) opined that radiography study was 94 per cent sensitive for detecting the lower respiratory tract infection in cattle. Therefore in the present study both infected and healthy goats were subjected to radiographic examination. Based on the radiographic examination severity of bacterial pneumonia in goats were confirmed and scored as score-1, 2 and 3 by observing infiltration density, contrast and areas of lung affected when compared to healthy goats (Plate 8,9,10,11).

The results were in agreement with Falcon *et al.*, (1985). Extensive changes observed in the lungs on radiographic examination may help in assessing the severity and also prognosis of the condition (Smith and Sherman, 2009).

Hence concluded that the present study suggested the Pulmonary function in goats affected with bacterial pneumonia may be effectively diagnosed by employing different diagnostic methods such as hematology, blood gas analysis and radiographic study in supportive with detailed clinical examination aids in assessing the severity and prognosis of bacterial pneumonia in goats.

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