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Full Length Research Paper

Studies on the bacterial flora and pathologic lesions of caprine pneumonic lungs in Maiduguri North-Eastern Nigeria

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The study was conducted in Maiduguri, North - Eastern Nigeria to assess the bacterial flora, gross and histopathological lesions of caprine pneumonic lungs. A total of 500 caprine pneumonic lung samples from goats slaughtered at the Maiduguri municipal abattoir were collected and examined. The results of the bacterial isolates show *Escherichia coli* (86.6%), *Mannheinmia haemolytica* (54.4%), *Klebsiella pneumoniae* (52.8%), *Streptococcus pyogenes* (19.6%) and *Staphylococcus aureus* (17.6%). Mixed infection of *S. aureus* and *S. pyogenes* was seen in 41(8.2%), *E. coli* and *S. aureus* in 36 (7.2%) and *K. pneumoniae*, *S. aureus* and *S. pyogenes* in 29 (5.8%). The gross lesions of pneumonic lungs identified were congestion, consolidation and exudation. Three types of pneumonia were identified based on the histopatholological examinations of 25 pneumonic lungs randomly selected from the 500 lungs samples collected which included: bronchopneumonia 12 (48%), interstitial pneumonia 8 (32%) and Cuffing pneumonia 5 (20%). *E. coli* and *M. haemolytica* were the bacteria most frequently isolated from lungs with lesions of bronchopneumonia while *S. pyogenes* and *S. aureus* were more frequently isolated from lungs with lesions of interstitial pneumonia. There was no statistical association (P>0.05) between the lung lesions observed and the associated bacterial isolates.

Key words: Caprine, pneumonia, bacterial flora, pathology, Nigeria.

INTRODUCTION

The ability of the goat to thrive in harsh conditions, its relatively small size and its low cost brings it within the reach of the low income households in Nigeria (Fajeminsin, 1991). In Nigeria, apart from poor management which includes inadequate and unbalanced feeding, high disease prevalence associated with high neonatal mortality constitutes a major obstacle to the promotion of large scale holding of livestock (Majiyagbe and Lamorde, 1997). Diarrhoea and respiratory diseases (pneumonia) were reported as the major causes of mortality in goats (Ameh et al., 2000; Ackermann and Brodgon, 2000). In Nigeria it has been estimated that sheep and goats provide 35% of the total meat needs (Obi, 1997). In spite of their large number and enormous contribution to the national economy, goat production is not well developed due to inadequate nutrition, poor management and prevailing diseases (Bekele et al.,

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1992). Pneumonia can cause heavy economic losses to farmers including mortality, emaciation, poor weight gain, poor meat quality and condemnation of the affected lungs during meat inspection (Al – Rawashdeh and Al – Qudah, 2000). The aetiology of pneumonia is complex and multifactorial which are either non-infectious or microbial determinants including bacteria, viruses and fungi (Garoia et al., 1998). Concurrent infection of the respiratory tract by viruses, bacteria and lung worms have been described and such disease conditions are commonly known as Respiratory Disease Complex (RDC), indicating the difficulty to attribute to only one aetiology (Tibbo et al., 2001; Woldemeski et al., 2004).

The objectives of this study were therefore to isolate and characterise the various bacterial microbiota associated with caprine pneumonic lungs and identify some gross and histopathological lesions in the affected lungs of goats in Maiduguri, North – Eastern Nigeria.

MATERIALS AND METHODS

Study area

Maiduguri is situated between latitudes 12° 30”N and 14° 30”N and longitudes 10° 30”E and 14° 45”E (MLS, 2011). Maiduguri comprises of 15 wards and shares boundaries with Konduga, Jere and Mafa Local Government Areas with estimated population of 2,733,696 in 2008 based on 3.8% growth rate (NPC, 2006). The study area lies within the Sudan savanna of the country’s vegetation with amount of rainfall ranging from 300-700mm/annum, with minimum and maximum temperature of 19 and 48°C, respectively. The predominant ethnic groups in the study area are the Kanuri, Shuwa, Hausa and sprinkles of Fulani. Crop production and livestock farming are the predominant occupation of the people while other economic activities include trading and craftsmanship. Major crops grown in the region include maize, millet, guinea corn, rice, cowpea, fruits and vegetables.

Source and collection of pneumonic lung samples

The study was carried out on 500 pneumonic lung samples from goats slaughtered at the Maiduguri municipal abattoir. Five hundred (500) caprine pneumonic lung samples were collected from the Maiduguri municipal abattoir. Sample for microbiology was put into sterile polythene bag and transported in ice pack to the laboratory. Samples for histopathology were fixed in 10% buffered formalin.

Laboratory examination of bacteria

Samples for bacteriologic examinations were collected and the surface of the lung seared with hot spatula. The lungs were incised using sterilized scalpel and the exudates was then taken using swab and inoculated onto blood and MacConkey agar and incubated aerobically and anaerobically in duplicates at 37°C for 24 h to obtain the discrete bacteria colonies. After 24 h of incubation, the plates were brought out and the colonies were studied. The size, shape, colour and character of colonies were observed and recorded. Subsequently, the colonies were stained with Gram’s staining techniques and examined for staining properties and cellular morphology under x100 objective of light microscope. Single colony type from both blood and MacConkey agar, were sub cultured onto selective/differential media and nutrient broth to obtain pure culture. The pure cultures were transferred on to nutrient agar slants for biochemical test using standard procedures (Cowan and Steel, 1974).

Gross and histopathology

Lungs were examined for gross lesions of pneumonia by placing emphasis on the location, colour, size, palpation, as well as examination of the cut surface of lesions and major airways as described by (Thompson, 1983). Samples for histopathology were fixed in 10% buffered formalin. Blocks of the fixed tissues were embedded in paraffin wax and 5 µm thick sections was cut from them and stained with haematoxylin and eosin (H&E) for histopathologic examination as described by Drury and Wallington (1980).

Statistical analysis

Descriptive statistics involving frequency and percentage was used to determine bacterial isolates from the caprine pneumonic lungs. Chi-square was also used to determine the level of association between the bacterial isolates and the histopathological lesions observed.

RESULTS AND DISCUSSION

Five hundred (500) caprine pneumonic lungs were examined. Table 1 shows the species of bacteria isolated from the caprine pneumonic lungs out of which *Escherichia coli* had the highest isolation rate of 433 (86.6%), followed by *Pasteurella haemolytica* in 272(54.4%), *Klebsiella pneumoniae* in 264 (52.8%), *Streptococcus pyogenes* in 98(19.6%) and *Staphylococcus aureus* in 88(17.6%). Most of the bacteria occurred as multiple infections. The *S. aureus* were commonly isolated together with the *Streptococcus pyogenes* in 41(8.2%) of the pneumonic lungs. *E. coli* have been isolated with *Staphylococcus aureus* in 36 (7.2%) of the pneumonic lungs. The least bacteria isolated were *K. pneumoniae* which *have* been isolated with *S. aureus and Streptococcus pyogenes* in 29 (5.8%) of the samples examined. The duplicate anaerobic incubation in both blood and Mac Conkey agar did not yield any growth.

The gross lesions of pneumonia observed were those of suppurative bronchopneumonia, granulomatous pneumonia, exudative pneumonia and consolidation. Histopatholological examinations of 25 caprine pneumonic lungs randomly picked from the 500 caprine pneumonic lungs collected revealed three types of pneumonia: bronchpneumonia 12 (48%), interstitial pneumonia 8(32%) and Cuffing pneumonia 5 (20%) (Figure 1). The lungs with purulent bronchopneumonia were characterised by heavy and severe neutrophilic infiltrations into the bronchus and the alveoli (Plate 1) while the lungs with interstitial pneumonia were characterized by severe lymphocytic infiltration into the interalveolar

Table 1. Frequency of isolation from caprine pneumonic lungs in Maiduguri, Borno State.

Bacterial isolate	Frequency	Percentage
Escherichia coli	433	88.6
Manheinmia haemolytica	272	54.4
Klebsiella pneumonia	264	52.8
Streptococcus pyogenes	98	19.6
Staphylococcus aureus	88	17.6
S. aureus and S.pyogenes	41	8.2
E.coli and S.aureus	36	7.2
K.pneumoniae, S.aureus and S.pyogenes	29	5.8

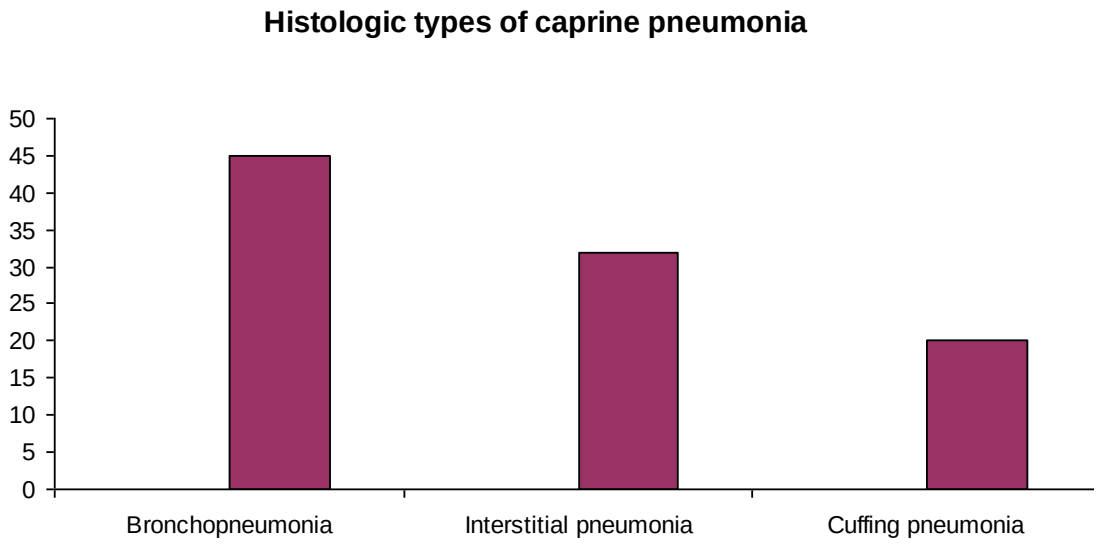

Figure 1. Chart showing dissipation of different types of pneumonia.

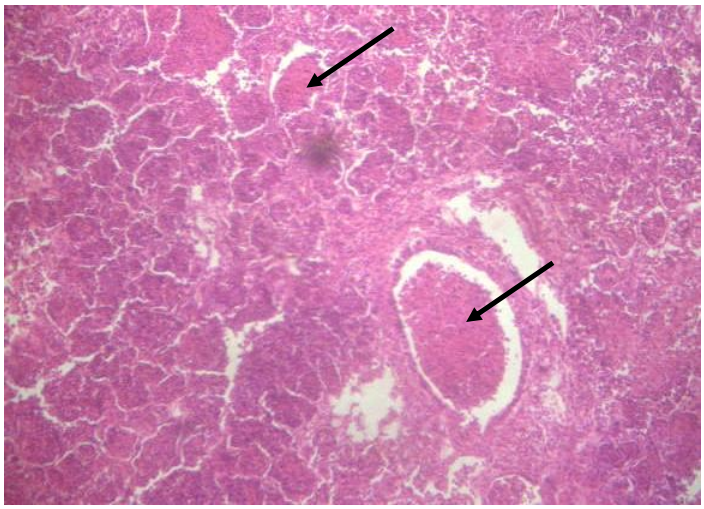

Plate 1. Lungs showing purulent bronchopneumonia characterised by heavy infiltration of neutrophils into the alveoli and bronchi (arrows). H&E x1600.

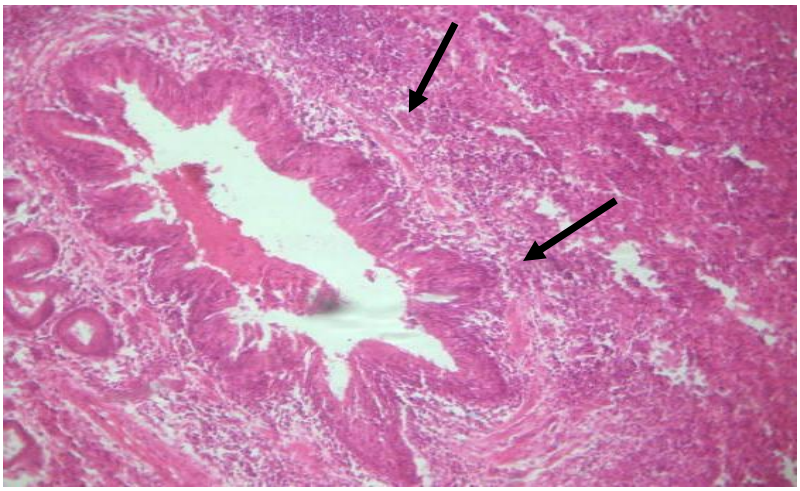

Plate 2. Lungs showing interstitial pneumonia characterized by severe lymphocytic infiltration into the interalveolar spaces and peribronchiolar area (arrows). H&E, x1600.

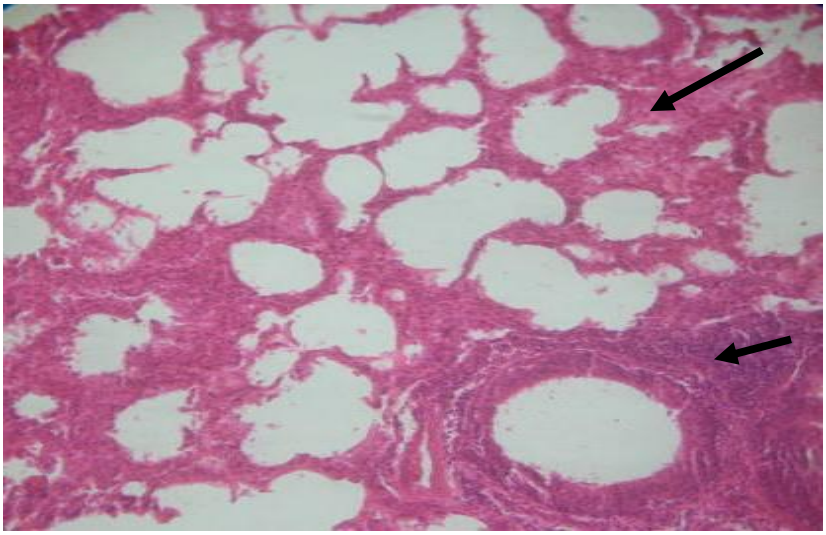

Plate 3. Lungs with cuffing pneumonia characterized by severe lymphocytic peribronchiolar reaction and interstitial distension with collapsed alveoli (arrows). H&E x1600.

spaces and peribronchiolar area. Alveolar walls were distended and some of their lining cells were destroyed (Plate 2). In those lungs showing Cuffing pneumonia, the lungs were characterized by lymphocytic peribronchiolar reactions and interstitial distension with collapsed alveoli (Plate 3).

Table 2 shows the associated bacterial etiologic agents of the three types of pneumonia identified. Mixed infections were observed in almost all the pneumonic lungs examined. *P. haemolytica and E. coli* were more frequently isolated in lungs with bronchopneumonia while *S. pyogenes* and *S. aureus* were frequently isolated from lungs with interstitial pneumonia. There were no significant association (P>0.05) between the lung lesions and the associated bacterial isolates from the three histological pneumonic lesions described.

DISCUSSION

This study has shown that a variety of bacteria have been isolated from caprine pneumonic lungs. These include *Mannheinmia (Pasteurella) haemolytica* (54.4%), *Klesiella pneumonae* (52.8%), *Streptococcus pyogenes*

Table 2. Frequency of isolation of *M. haemolytica, K. pneumoniae, E. coli, S. aureus and S. pyogenes* obtained from Interstitial pneumonia, Bronchopneumonia and Cufffing pneumonia (P > 0.05).

Bacterial isolate	Interstitial pneumonia	Bronchopneumonia	Cuffing pneumonia
M. haemolytica	3(12%)	6(25%)	2(16%)
K. pneumoniae	5(20%)	4(16.7%)	3(25%)
E. coli	3(12%)	5(20.8%)	2(16.7%)
S. aureus	7(28%)	5(20.8%)	3(25%)
S. pyogenes	7(28%)	4(16.7%)	2(16.7%)
Total	25	24	12

(19.6%), *Staphylococcus aureus* (17.6%), and *Escherichia coli* (88.4%). The isolation of the aforementioned bacteria in this study has confirmed earlier reports that they were the most common pneumonic bacteria isolated from lung tissues as widely documented by several authors (Zaki et al., 2002 and Mona, 2005; Yimer and Asseged, 2007; Emikpe, et al., 2009). It is common to detect pulmonary mixed infections since the respiratory air pathways act as a reservoir for potentially pathogenic micro-organisms which develop into pneumonia following stress, decline of hygiene measures or climatic conditions (Moustafa, 2004), with obvious pneumonic lesions than when a single bacteria was incriminated (Novert, 2002).

The isolation of mixed pneumonic pathogens in this study agrees with the findings of (Sedeek and Thabet, 2001; Khaled *et al*., 2008) who reported that pneumonic mixed pathogens are mainly caused by *S. aureus, E. coli, Pasteurella multocida* and other organisms. This demonstrates the complexity of the disease where *S. aureus* may predispose the animals to infection by *Coliform* organisms or other pathogens.

Despite the fact that *Pasteurella species* are being nasopharyngeal commmensals (Dabo et al., 2007), when they invade the lungs tissues under stress, its virulence is exaggerated and pathogenicity differs (Christensen et al., 2004). The isolation of *pasteurella species* especially *Mannheinmia haemolytica* as one of the common isolates of caprine pneumonic lungs confirms the assertion that both in terms of infection intensity and pathogenicity, *Mannheinmia haemolytica* assume greater prominence in caprine pasteurellosis (Sisay and Zerihun, 2003).

Isolation of *E. coli* in 433 (80.6%) of the caprine pneumonic lungs observed in this study is higher than the reports of Obasi et al. (2001) and Megra et al. (2006) which affirms the pathogenic role of *E. coli* in caprine pneumonia. *E. coli* can act as secondary invaders in pneumonic lungs already weakened by some stress factors such as adverse environmental conditions due to poor management practices (Maria, 2008). The high rate of *E. coli* isolated in this study may not be unconnected with the stress condition under which the goats are slaughtered at the abattoir.

Both *S. aureus* 88 (17.6%) and *S. pyogenes* 98 (19.6%) have been isolated in caprine pneumonic lungs in this study. Our finding is consistent with the findings of (Obasi et al., 2001; Megra et al., 2006) who have isolated *S. aureus* and *S. pyogenes* in varying percentages from caprine pneumonic lungs. In line with this, Ajuwape and Aragbesola (2002) isolated *S. aureus* from the nasal swab of normal rabbits.

The isolation of *K. pneumoniae* in 246 (52.8%) of the caprine pneumonic lungs examined in this study is higher but corroborates well with the findings of Ajuwape and Aregbesola (2002) who recorded 6% incidence of *K. pneumoniae* in the respiratory tract of healthy rabbits. The bacteria have been reported as common saprophytes in soil and the respiratory tract of healthy animals.

The gross lesions of caprine pneumonia reported in this study included suppurative bronchopneumonia, granulomatous pneumonia, exudative pneumonia and consolidation have been reported by Raji et al. (2000) in both ovine and caprine species. The histopathological lesions of caprine pneumonia observed in this study in Maiduguri have been reported by (Akpavie et al., 1991) in bovine. The observation in this study shows that 48% of the histopathological lesions of pneumonia observed in caprine were those of bronchopneumonia which is lower than the findings of Obudu et al. (1995) who reported that bronchopneumonia accounted for 81.8% of all cases of pneumonia in goats. The findings in this study state that interstitial pneumonia and bronchopneumonia accounted for 8 and 48% of caprine pneumonic lungs, respectively which contradicts the report of Ferdausi et al., 2008 who reported 15 and 3.3% prevalence of interstitial pneumonia and bronchopneumonia, respectively in 60 lungs of slaughtered goats.

CONCLUSION AND RECOMMENDATIONS

The results of this study show a variety of bacterial agents in caprine pneumonic lungs: *E. coli* (88.6%), *M.* haemolytica (54.4%), *K. pneumonae* (52.8%), *S. pyogenes* (19.6%) *and S. aureus* (17.6%). Three types of pneumonia have been identified from the histopathological study of the caprine pneumonic lungs and these include interstitial pneumonia (32%), bronchopneumonia (48%) and Cuffing pneumonia (20%). There was no significant association (P>0.05) between

the histopathological lesions observed and the bacterial isolates. There is the need for the characterization of the individual bacterial isolates from caprine pneumonic lungs and ascertain the pathogenic role of each of the isolates in caprine pneumonia. Since the etiologic agents of caprine pneumonia are varied and complex, further investigation in other parts of the country is imperative to institute effective control measures. Proper resting of goats prior to slaughter at the lairage and minimal stress during transportation is therefore recommended to minimise the incidence of caprine pneumonia in goats.

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