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CASE REPORT

A Case Report of Respiratory Mannheimiosis in Sheep and Goat Complicated by *Bordetella parapertussis*

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SUMMARY

In January 2007, an outbreak of acute respiratory disease in a flock of sheep and goats in Vom, Plateau State, Nigeria, was reported to the Central Diagnostic Laboratory of the National Veterinary Research Institute, Vom, Nigeria, for investigation. The investigation comprised the disease history, clinical and post-mortem examination, and microbiological analysis of lung lesions. Clinically, one sheep and one goat were found dead without any previous signs of illness. Necropsy of the two animals demonstrated lung consolidation and fibrinous pneumonia. Mannheimia haemolytica serotype A2 was isolated from the lung lesions of the two animals. In addition Bordetella parapertussis was isolated from the lung lesions of the necropsied goat. In vitro antimicrobial susceptibility test results indicated the M. haemolytica isolates and the B. parapertussis isolate were susceptible to Conflox, Neocloxin, Oxytetracyclin, Gentaprim and Streptomycin. The confirmation of Mannheimiosis outbreak in this investigation adds to the growing list of the prevalence and incidence rates of the disease in and across Nigeria as highlighted in the review of literature. The need to embrace the vaccination of sheep and goats as the hub of control programme against pneumonic pasteurellosis in the country is also emphasized.

KEYWORDS: Mannheimia haemolytica, Sheep and Goat, Super-infection, Bordetella parapertussis, Outbreak, Small Ruminant, Nigeria

INTRODUCTION

Nigeria is one of the four leading livestock producers in sub-Saharan Africa. Livestock play a significant role in the nation's economy contributing over 20% of the total agricultural gross domestic product (GDP). In 2011, the sheep and goats population in Nigeria was estimated to be 38 million and 57.3 million (FAOSTAT, 2011) respectively. Traditionally managed stock is over 85% for all species of ruminants (Aziz et al., 2010). Sheep and goats are of considerable importance especially to the poor and landless peasants. Two of the greatest problems facing developing countries and indeed the world are hunger and poverty; domestic livestock are inextricably linked to both. One-quarter of the world's poor depend on small ruminants, not just as a source of food protein but as a source of income. For farmers in developing countries, animal ownership is the route to prosperity and wellbeing. Outbreak of livestock diseases is capable of destroying

the wellbeing of the rural poor. It can devastate whole families, local communities and affect a nation's economy. Of all the diseases of small ruminants, those affecting the respiratory tract (Peste des petits ruminants (PPR), caprine contagious pleuropneumonia (CCPP) and pasteurellosis) cause substantial loss through high morbidity and mortality (Diallo, 2006; Emikpe and Akpavie, 2010a; Emikpe and Akpavie, 2010b).

Most of the respiratory infections often result from adverse physical and physiological stress combined with viral and bacterial infections. Inevitably Mannheimia haemolytica, and sometimes Pasteurella multocida pneumonia occur as a result of theses interactions. In lambs and kids, pneumonic pasteurellosis can be acute with sudden death. The losses result not only from the death of animals, but treatment costs, weight loss, extra labour, condemnations and a smaller supply of meat. The "lungers" or respiratory cripples that result from this disease may represent a greater financial loss than do those animals that die acutely. The lungers also help to disseminate the infection among susceptible animals (Gilmour and Gilmour, 1989).

The presence of this disease, as with many enzootic ones, is in many cases not reported to the veterinary authorities in Nigeria. Only when the disease reaches serious proportions are reports made and investigations possible. In spite of these difficulties much information has been collected from government stock farms and veterinary clinics.

This communication describes an outbreak of pneumonic pasteurellosis caused by a specific serotype of M. haemolytica in a flock of sheep and goat in north central Nigeria. We also describe a retrospective review of Mannheimiosis in sheep and goats especially within Nigeria.

CASE REPORT

An adult male sheep carcass of the African (Yankasa) breed was submitted to the Central Diagnostic Laboratory of the National Veterinary Research Institute, Vom from a sheep and goat flock situated in Vom, Plateau State, Nigeria for diagnostic evaluation on January 25, 2007. The animal was found dead in the morning without any previous signs of illness observed. On January 26, 2007, a four and half month female goat was also submitted with a history of sudden death. During this period the farm housed about 721 animals including 167 sheep and 94 goats, others include cattle and horses. Thirteen sheep and 6 goats died in total. More than a third of the sheep and goat flock is greater than 3 year old. The entire flock is left on open field almost all day and night in the near temperate climatic weather of the Jos Plateau, where harmattan winds cause the coldest weather between December and February.

Pathology

In the goat, there was unilateral cranioventral pulmonary consolidation (lobular pneumonia), and diffuse fibrinous pleuritis (Figure 1), and the trachea contained frothy exudate. The sheep had severe bilateral cranioventral pulmonary consolidation, fibrinous pleuritis, frothy trachea and severe serosanguinous hydrothorax of about 500ml. Microscopically, there was a bronchoalveolar pneumonic pattern with filling of the alveoli septi and expansion of pulmonary interstitial mainly by aggregates of neutrophil, moderate macrophages some lymphocytes and edema fluid. Bronchial and bronchiolar airways contained moderate amount of these cellular infiltrates, while medium and low calibre pulmonary vessels show

moderate congestion. (Figure 2).

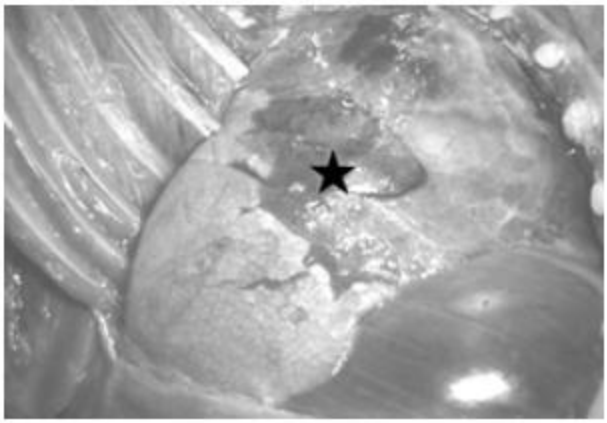

Figure 1: Lung showing pneumonic mannheimiasis in goat. Note fibrinous pleuritis and cranioventral pulmonary consolidation (black star).

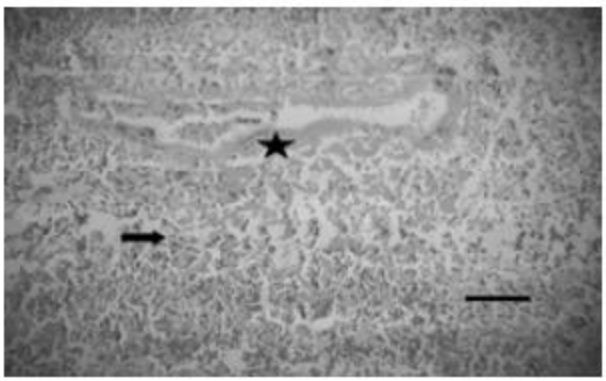

Figure 2: Lung showing pneumonic mannheimiasis in goat. Note the edema filled parallel to the blood vessel (black star) and inflammatory cellular infiltrates (arrow), mainly neutrophils, some macrophages and lymphocytes. Bar= 200µm

Lung samples were collected from the sheep and goat during necropsy and were processed for bacterial isolation. Swabs from the incised lung lesion edge were streaked onto sheep blood agar and MacConkey agar and the plates incubated for 24 to 72 hours in aerobic incubator at 37oC. Presumptive Pasteurella / Mannheimia-like colonies were oxidase tested and positives tested further biochemically for subsequent genus and species verification as described by Bailey and Scott (Bailey and Scott, 2002). Isolates identified as Mannheimia haemolytica were biotyped and capsule serotyped as described by Gilmour and Gilmour (1989).

Culture of lung tissue from the goat yielded a heavy growth of M. haemolytica, and Bordetella parapertussis was also identified (Bailey and Scott, 2002); the sheep lung yielded a heavy growth of M. haemolytica only. The M. haemolytica isolates from the sheep and the goat were identified as biotype A serotype 2 (A2). Both M. haemolytica and Bordetella parapertussis isolates were susceptible to Conflox, Neocloxin, Oxytetracyclin, Gentaprim, Streptomycin.

DISCUSSION

In recent years, research on respiratory tract diseases in small ruminants has progressed in Nigeria. Both documented and anecdotal evidence are mounting to indicate that the country is home to many ruminant respiratory tract infections. The aetiologies of respiratory infections in ruminants in Nigeria are being identified, albeit mostly from government farms (Ikede, 1977; Ikede, 1978; Ojo and Obi, 1996; Ugochukwu, 2008). The M. haemolytica serotype implicated in sheep and goat pneumonia in this report was of serotype A2. A similar outbreak documented earlier in north central Nigeria had implicated serotype A7 (Odugbo et al., 2004). The ability to identify M. haemolytica by serotype is crucial in the understanding of the epidemiology of the disease and in the development of effective control strategies. In 2000, Sabri et al., found that the outer membrane protein extracted from M. haemolytica A7 was effective in protecting animals against homologous and heterologous infection by live M. haemolytica A2, A7 and A9, thereby

highlighting possibly effective serotype for vaccine preparation. The route of administration of this vaccine for the control of pneumonic mannheimiasis might also be important as demonstrated for caprine Peste des petits ruminant vaccination (Emikpe et al., 2013).

Some management and husbandry circumstances in operation in the farm which may have predisposed to the outbreaks include, the intensive management and high number of goats and sheep confined together; sheep and goats from different sources being housed together; new sheep/goats entering the flock; weaned lambs mixed together, even temporarily. The outbreak occurred in an area of sub-tropical climate with a temperature averaging 20oC.

A review of literature on respiratory infections which commonly occur in sheep and goats shows that adverse physical and physiological stress combined with viral and certain bacterial infections are the initiating factors (Brogden et al., 1998; Gilmour and Gilmour, 1989). Inevitably, M. haemolytica pneumonia occurs as a result of these interactions. Although no attempt was made to assess the respiratory viruses involve in this reported outbreak, we speculate that the primary infection of the lower respiratory tract with B. parapertussis bacterium, increased the susceptibility of the sheep/goat to secondary M. haemoltyica action. Both field and experimental work have shown that most of the initiating agents are viruses which act as primary agents in respiratory infections in sheep and goats. The viruses include parainfluenza-3 (PI-3) virus whose presence in Nigeria is well documented (Ibu et al., 1993; Obi, 1997), respiratory syncytial virus, adenovirus, sheep and goat pox virus, herpesvirus, and reovirus. B. parapertussis and Mycoplasma ovipneumoniae are also organisms that have the ability to colonize the sheep or goat lower respiratory tract in large numbers, attach to cilia and reduce clearance of other microorganisms such as M. haemolytica (Alley, 1991; Brogden et al., 1998). However in sheep and goats dying during the second week of an outbreak, bacteria such as Neisseria spp., Corynebacterium pyogenes, (currently Arcanobacterium pyogenes) Streptococcus spp., and Escherichia coli were frequent isolates from lung lesions in addition to M. haemolytica (Alley, 1991; Brogden et al., 1998).

A review of the literature on pneumonic pasteurellosis in small ruminants indicates that all research workers agree that M. haemolytica and Pasteurella multocida are the organisms mainly responsible for causing the lung damage seen in caprine and ovine pneumonia. The role of these pathogens in sheep and goats has been fully reviewed by several authors (Alley, 1991; Brogden et al., 1998; Gilmour and Gilmour, 1989). The multiplicity of serotypes capable of causing pneumonia and the high rate of nasal carriage in apparently healthy sheep and goats are two major factors which make pasteurellosis in small ruminants different from that in other ruminants. In a cross-sectional survey, Odugbo (Odugbo et al., 2003) documented the presence of six serotypes (A1, A2, A6, A7, A8 and A9) of M. haemolytica from sheep in Nigeria. All six serotypes induced various degrees of experimental mannheimiosis in small ruminants (Emikpe and Akpavie, 2010a; Odugbo et al., 2004). Two of these serotypes (A2 and A7) have reportedly been implicated in field outbreaks of mannheimiosis in Nigeria (Antiabong et al., 2005; Odugbo et al., 2004). In this current outbreak, Bordetella parapertussis was in addition isolated from the lung tissue of goat. Although its pathogenic potential was not determined in this investigation,

researchers (Alley, 1991; Brogden et al., 1998; Mohamed and Abdelsalam, 2008) have reported the recent recognition of B. parapertussis as a potential pathogen in sheep and goats and it may well have a wider distribution. We speculate that the apparent paucity of information on B. parapertussis may stem from the difficulty of its isolation from pneumonic tissue as it is best cultured from bronchial washings since it has a preference for ciliated epithelium (Alley, 1991). Also established in a survey in sheep pneumonic lungs in Nigeria is P. multocida, which presented a less fulminating form of experimental pneumonic pasteurellosis (Odugbo et al., 2006).

Although there is a paucity of reliable information on actual incidence of pneumonic pasteurellosis among smallholders who operate at poor management level in Nigeria, unpublished records and figures being obtained from government stock farms demonstrate that the disease is becoming widespread with enormous cost in terms of death, treatment, labour and unthriftiness of the disease. Mortalities from outbreaks of acute pneumonia may reach 20% (Alley, 1991). While the majority of losses usually occur in the first week of the outbreaks, sporadic deaths in apparently healthy animals may continue for several months afterward. The short clinical course of acute pneumonia makes treatment unlikely to be successful although metaphylactic treatment of in-contact animals may still be economic in small flocks. It has become necessary to carry out antibiotic susceptibility test on strains of M. haemolytica as plasmid-based resistance to sulphonamides and some commonly used antibiotics has been widely encountered (Bailey and Scott, 2002). However for the farmer in the developing country like Nigeria, vaccination may prove to be the most cost-effective control programme. Both documented and unpublished evidence abound on the considerable losses that frequently occur as a result of outbreaks of pneumonic pasteurellosis in small ruminants in Nigeria to warrant mounting a vaccination control programme.

In Europe, vaccines are available to aid farmers in the control of pneumonic pasteurellosis (Donachie, 2002). In Nigeria there is currently no vaccine licensed for use against M. haemolytica. The livestock keepers' main pre-occupation is to maintain the health of their livestock through control programs that are affordable and applicable. The cost-effective control of pneumonic pasteurellosis in Nigeria is underpinned by the identification of the specific M. haemoltyica serotypes commonly isolated in these animals. With the increasing incidences of pneumonic pasteurellosis in Nigeria, its control through vaccination programme should provide practical and achievable ways of alleviating poverty and furthering social and economic development.

The co-occurrence of M. haemolytica with B. parapertussis pathogens is becoming a frequently reported syndemic. Further work will include investigating how the contemporaneous presence of M. haemolytica and B. parapertussis may relate to disease, which will add to the current knowledge of disease pathogenesis and transmission.

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