

# Pasteurella Multocida - Induced Cerebral Lesions in Experimentally Infected Nubian Goat Kids: A Brief Communication

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## Abstract:

A group of nine young Nubian goat kids (3 to 4 month old) were intratracheally inoculated with a virulent strain of *Pasteurella multocida* for experimental induction of pneumonia. Another group of goat kids of the same age (n = 5) were kept as uninfected controls. After inoculation, infected animals showed clinical signs of moderate to severe respiratory distress, fever, intermittent cough weakness, dullness, reduced appetite and recumbency. Death occurred in five animals within different time intervals ranging from 24 to 72 hours post infection. The main gross and histopathological lesions in dead animals were indicative acute fibrinous or fibrinopurulent bronchopneumonia with fibrinous adhesions and severe vascular changes in visceral organs. However, unrelated types of cerebral lesions were microscopically detected in four of the infected goat kids. These included focal encephalomalacia and diffuse gliosis in one kid, perivascular and perineural oedema of the cerebral cortex in another kid and acute fibrinous meningitis in other two goat kids. The remaining kids which survived infection did not show significant pulmonary or cerebral lesions when sacrificed 28 days post inoculation.

**Keywords:** bronchopneumonia; cerebral lesions; pasteurellosis; pasteurella multocida; nubian goat kids

## Introduction

*Pasteurella multocida* (*P. multocid*) is one of the major causes pneumonia and septicemia in various species of farm animals [15,17,21]. The organism is commensally present in the upper respiratory tract of healthy animals as a normal constituent of the nasal and pharyngeal microflora. However, it will become extremely virulent and capable of causing the disease when the immune status of the animal is compromised [7,9,19]. In addition to the veterinary importance of the *P. multocida*, the organism is also considered a serious public health hazard for humans due to its frequent involvement in wound infections, septicemia, respiratory tract infection and suppurative meningitis in infants, children and adult patients [5, 8,10,12, 13,18, 20]. The association of *P. multocida* infection with the central nervous system of farm animals, however, received very little attention and only individual cases of acute meningitis and haemorrhagic encephalitis have been reported in cattle and buffalo [3,14]. The present communication hence provides a histopathological evidence of the occurrence of cerebral lesions in young Nubian goat kids experimentally infected with a virulent culture of *P. multocida*.

## Materials and Methods

A group of nine 3 to 4 month old male Nubian goat kids were each inoculated with 2ml of a pure viable culture of *P. multocida* containing  $1 \times 10^9$  CFU/ml via the intra-tracheal route for experimental induction of pneumonia. The infective material (lyophilized culture of *P. multocida*)

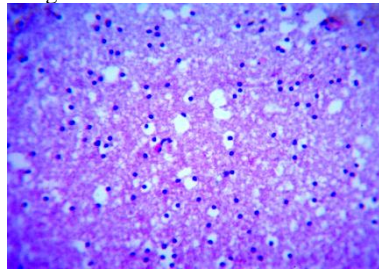
was obtained from the Department of Vaccine Production, Central Veterinary Research Laboratories, Khartoum, Sudan. Another group of five kids of the same age were kept as uninfected controls. The animals were kept in separate pens and given free access to sorghum hay, lucerne (alfalfa) grass and water. All animals were thoroughly observed for clinical changes before and after inoculation with the infective bacteria. Detailed postmortem examination was carried out immediately after death of infected animals and at day 28 post infection on surviving animals. Representative tissue specimens were immediately collected at necropsy from the nasal tissue, trachea, lung, liver, kidney, heart, brain or any other organ with grossly detectable pathological lesions. The tissue specimens were fixed in 10% buffered formalin solution for routine histopathological processing, sectioning and staining with haematoxylin and eosin (H&E) as described by Bancroft and Gamble (2007).

## Results and discussion

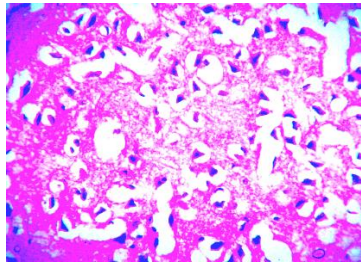
All *P. multocida* - infected goat kids developed moderate to severe clinical signs of respiratory distress and laboured breathing a few hours after inoculation with the virulent culture. Infected animals then developed high fever, intermittent cough and profuse catarrhal nasal discharges. They became dull, depressed and had reduced appetite. Five of the infected animals became very weak, recumbent, off food and died within 24 to 72 hours post infection. The remaining four kids showed

gradual recovery and appeared healthy within a period of 3 to 4 weeks post inoculation. Post mortem examination of the dead animals revealed remarkable gross lesions of acute fibrinous and fibrinopurulent bronchopneumonia with wide spread vascular changes including haemorrhages, congestion and oedema in most visceral organs and serous membranes. Histopathologic examination of the pneumonic portions of the lungs revealed microscopic evidence of acute fibrinous and fibrinopurulent bronchopneumonia in the lung tissue as indicated by deposition of fibrinous and cellular exudate inside the lumen alveoli, bronchi and bronchioles together with diffuse and massive infiltration of inflammatory cells mainly polymorphonuclear leukocytes in the lung tissue. In addition to the above described pneumonic changes, abnormal histopathological alterations were further detected in the brain tissue (cerebrum) of four of the *P. multocida* infected goat kids. These comprised focal encephalomalacia and diffuse gliosis in one animal (Figure 1), Perivascular and perineural oedema on the cerebral cortex in another animal (Figure 2) and acute fibrinous meningitis as evident by deposition of fibrinous exudate and focal infiltration of lymphocytes in another two animals (Figure 3). However, the remaining kids which

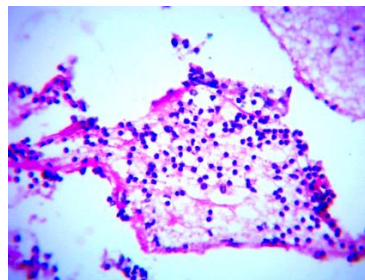
survived infection did not show significant pulmonary or cerebral lesions when sacrificed 28 days post inoculation. Limited information is currently available on the involvement of the central nervous system on the pathogenesis of *P. multocida* infection. The lack of adequate reports on *P. multocida* – induced lesions in the central nervous system of farm animals is probably due to the fact that the brain is always excluded from being examined in routine necropsies because of the absence of neurological signs in experimental cases and naturally occurring outbreaks (Marza et al. 2015). It is worth mentioning that *P. multocida* has previously been isolated from the brain of experimentally infected buffalo calves showing histological evidence of acute encephalitis (Abubakar and Zamri - Saad, 2011; Abubakar et al. 2013). The recovery of *P. multocida* from the brain of infected animals may well constitute a positive indicator of the involvement of the nervous system on the pathogenesis of the disease (Abdullah et al. 2014; Khaleel et al. 2014). Further studies are therefore required to determine the pathophysiological response of the nervous system to the natural and experimental infection with *P. multocida* in laboratory and farm animals.



**Figure 1:** Brain (cerebrum) of *Pasteurella multocida* – infected goat kid showing encephalomalacia and diffuse gliosis (H&E X100)



**Figure 2:** Brain of *Pasteurella multocida* – infected goat kid showing perivascular and perineural oedema. (H&E X 100)



**Figure 3:** Brain of *Pasteurella haemolytica* Goat kid showing acute fibrinous meningitis.

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## Compliance with ethical standards:

All procedures performed in the present investigation were in accordance with the ethical standards of the international and national guidelines for the care and use of animals.

## Conflict of interest

The authors declare that they have no conflict of interest.

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