

Morganella morganii* associated bronchointerstitial pneumonia in a guinea pigMorganella morganii*-geassocieerde broncho-interstitiële pneumonie bij een cavia¹V. Vandenberghe, ²V. Jasson, ¹S. Van der Heyden, ²P. Wattiau, ¹S. Roels¹Unit Surveillance, Orientation and Veterinary support, Subunit Prionology and Pathology,²Unit Bacterial Diseases, Subunit Foodborne and Highly Pathogenic Zoonoses,

Veterinary and Agrochemical Research Centre (CODA - CERVA), Groeselenberg, 99, 1180, Brussels, Belgium

Stefan.Roels@coda-cerva.be

A BSTRACT

Morganella morganii was isolated from the lung of a guinea pig. Necropsy revealed hemorrhagic consolidation of the lungs, and histological examination revealed bronchointerstitial pneumonia. *M. morganii* is a commensal gram-negative bacillus of the intestinal tract of humans, mammals and reptiles. Only few reports of *M. morganii* associated disease in animals are available in the literature. To the authors' knowledge, this is the first report of *M. morganii* associated disease in a guinea pig.

SAMENVATTING

Morganella morganii werd geïsoleerd uit de long van een cavia. Op autopsie werden vast aanvoelende zones met een bloederig aspect in de long vastgesteld. Histologisch onderzoek van de long duidde op de aanwezigheid van broncho-interstitiële pneumonie. *M. morganii* is een commensale gramnegatieve bacil van de darmtractus bij de mens, zoogdieren en reptielen. Over *M. morganii*-geassocieerde ziekten bij dieren is slechts weinig gerapporteerd. Dit is volgens de auteurs het eerste geval beschreven bij een cavia.

INTRODUCTION

Morganella morganii, previously classified as *Proteus morganii*, belongs to the tribe *Proteae* of the family *Enterobacteriaceae* (Choi et al., 2002; Falagas et al., 2006; Roels et al., 2007). This organism was isolated by Morgan in 1906 as the predominant species in the feces of infants with diarrhea (Senior, 1987), and was identified as a rare cause of lower respiratory tract infection (Roels et al., 2007). Two subspecies have been described: *M. morganii morganii* and *M. morganii sibonii* (Choi et al., 2002; Falagas et al., 2006; Roels et al., 2007). *M. morganii* is a gram-negative bacillus, which is despite its wide distribution, an uncommon cause of infections in humans (Falagas et al., 2006). Since *M. morganii* was the cause of septicemia in patients in a cardiac surgery unit in 1981, it has been identified as a significant cause of nosocomial infection (Ono et al., 2001). It is found in the environment and in the intestinal tracts of humans, mammals and reptiles as part of the normal flora (Falagas et al., 2006). Although the reports of *M. morganii* associated disease in veterinary medicine are limited, it has been

reported in various animal species: piglet (Ono et al., 2001), rabbit (Roels et al., 2007), chickens (Zhao et al., 2011), jaguar (Choi et al., 2002) and alligators (Novak et al., 1986). To the authors' knowledge, this case report describes the first isolation of *M. morganii* associated with pneumonia in a guinea pig.

CASE REPORT**Case history, necropsy and histology**

An adult four-year-old female laboratory guinea pig with a history of not doing well and sudden death was presented for necropsy. The guinea pig was bred at the Veterinary and Agrochemical Research Centre (Brussels) and the breeding parents were bought at Harlan laboratories (Horst - the Netherlands). The guinea pig was used for breeding during a period of three years. Afterwards, the animal was used for the control of vaccines, and was injected with an inactivated IBR vaccine, a few weeks before death. Gross examination revealed the presence of serohemorrhagic fluid in the thoracic (5-10 cc) and abdominal (few cc)

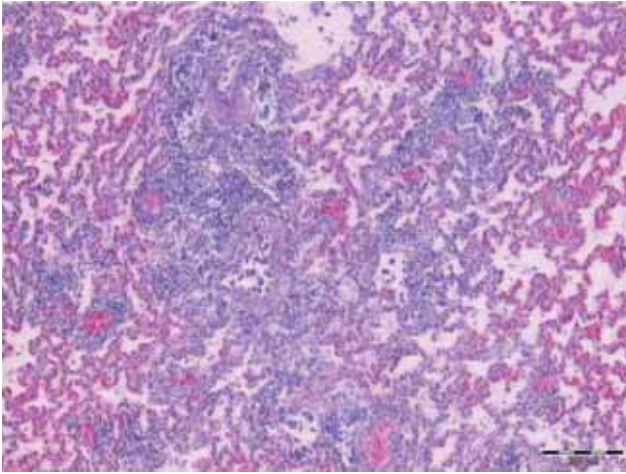


Figure 1. HE of the lung. Interstitial pneumonia with peribronchial and perivascular aggregates of inflammatory cells.

cavities. The cranial lungs and the cranioventral part of the caudal lungs showed hemorrhagic consolidation. The spleen was enlarged, the gastrointestinal lymph nodes were enlarged and congested. The enlarged liver and the kidneys showed an irregular surface. Samples from the lung, spleen, liver, mesenteric lymph node and kidney were taken for histopathological examination. They were fixed in 10% neutral buffered formalin, and processed through routine methods for light microscopic examination.

Histologic examination of the lung tissue revealed hypercellularity of the interalveolar septa due to the infiltration of red blood cells and inflammatory cells, such as lymphocytes, macrophages and some neutrophils (Figure 1). Peribronchially and perivascularly, aggregations of inflammatory cells were present consisting of lymphocytes, plasma cells, macrophages, some neutrophils and some giant cells (Figure 2). The mesenteric lymph node revealed focal necrosis, congestion of the blood vessels and infiltration with neutrophils. The spleen showed depletion of germinal centers and mild infiltration with neutrophils. Histopathological examination of the liver indicated aggregates of inflammatory cells (lymphocytes, plasma cells and some neutrophils) centrilobularly as well as in the portal triads. Sinusoids were mildly infiltrated with mixed inflammatory cells. The kidney showed a multifocal interstitial nephritis, with the presence of lymphocytes, plasma cells, macrophages and neutrophils. Degenerated neutrophils were detected in some tubuli. Degenerative processes, such as multifocal membranoproliferative glomerulonephritis and fibrosis, were present.

Bacteriology

Based on the results of the autopsy, the lungs were examined for bacterial agents. The lung lesions were sampled with a Pasteur Pipet and plated onto an agar plate supplemented with 5% sheep blood (CSB; Bio-Rad), a colistine aztreonam agar plate supplemented

with 5% sheep blood (CAP; Oxoid) and onto a MacConkey 3 agar plate (MAC, Oxoid). A pure culture of semitransparent hemolytic colonies was detected on the CSB plate. Also the MacConkey agar showed a pure culture of small greyish colonies surrounded by a pink circle. No growth was detected on the CAP agar plates. The colonies isolated on MAC were further tested with the BBL Crystal Enteric/Non-Fermenter identification system (Becton Dickinson), according to the instructions of the manufacturer, and were shown to be *M. morganii*. Colonies of both CSB and MAC were also analyzed with MALDI-TOF (Bruker Daltonics Microflex II, Biotyper V2.0 software), according to the instructions of the manufacturer, and confirmed to be *M. Morganii* (Lo-Ten-Foe et al., 2007; Ford et al., 2013).

DISCUSSION

Pneumonia is the most frequent cause of death in guinea pigs, and is usually associated with bacterial infection (O'Rourke et al., 2003; Allen et al., 2005). Although *Bordetella bronchiseptica* is the most commonly diagnosed agent, other pathogens, such as *Streptococcus pneumoniae* or *Streptococcus zooepidemicus*, may be involved (O'Rourke et al., 2003; Allen et al., 2005). Less frequently implicated agents are *Klebsiella pneumoniae*, *Pasteurella pneumotropica*, *Pseudomonas aeruginosa*, *Citrobacter freundii*, *Staphylococcus aureus* (Allen et al., 2005) or adenovirus (O'Rourke et al., 2003; Allen et al., 2005). *M. morganii* has been associated with lung lesions in a piglet (Ono et al., 2001), a jaguar (Choi et al., 2002) and a rabbit (Roels et al., 2007). Histologically, the lung lesions in the rabbit and the jaguar were characterized by the presence of neutrophils, serofibrinous fluid, macrophages, and desquamated and necrotic epithelial cells. In both cases, alveolar septa were thickened due to congestion and mixed inflammatory cells. No significant histological changes were noted in the other

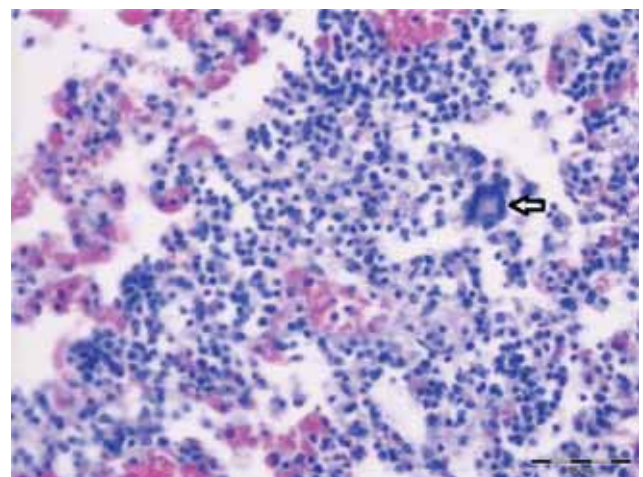


Figure 2. HE of the lung. Detail of Figure 1. Inflammatory cells in the interalveolar septa with the presence of giant cells.

examined organs (Choi et al., 2002; Roels et al., 2007). The histological examination of the lung of a piglet revealed severe serofibrinous pleuropneumonia composed of parenchymal coagulative necrosis, moderate macrophage and neutrophil exudation into alveoli, hemorrhage, vasculitis, thrombosis and interlobular edema. Hemosiderin accumulation was observed in liver, kidney and spleen (Ono et al., 2001). In contrast with the previously reported cases, the lung lesions in the present case were characterized by the thickening of the interalveolar septa by the infiltration of mostly lymphocytes and plasma cells, indicating a subacute to chronic infection. Lesions were also present in other organs, such as spleen, kidney and liver.

M. morganii is considered to be a rare pathogen in humans, which is most often encountered in postoperative patients, and is mainly associated with urinary tract infections, bacteremia/sepsis in children as well as in adults, skin and soft tissue infections, meningitis, ecthyma, chorioamnionitis, septic arthritis and endophthalmitis (Falagas et al., 2006). Generally, *M. morganii* causes disease in sites previously infected by other organisms, and may cause pyogenic infection when accidentally introduced into the body (Choi et al., 2001; Roels et al., 2007). In veterinary medicine, *M. morganii* has been associated with various diseases such as pneumonia and acute death in several animal species (Ono et al., 2001; Choi et al., 2002; Roels et al., 2007; Zhao et al., 2012). In general, *Morganella morganii* causes disease in sites previously infected by other organisms and may cause pyogenic infection when accidentally introduced into the body (Choi et al., 2002; Roels et al., 2007). As in the case of the jaguar and the rabbit, the exact source and mode of infection in the present case could not be determined. PRRSV infection has been demonstrated in a piglet, and the combination of this infection and change in environment might have increased the susceptibility of the pig to *Morganella morganii* infection (Ono et al., 2001). In the case of the chickens, the highest mortality occurred 24-48 hours after an injection/immunization of the neonatal chicks. The use of a continuous syringe to inoculate the vaccine must have resulted in cross contamination of the chicks with bacteria (Zhao et al., 2012). Necropsy of the alligator in which blood culture results reported *Proteus* sp. and *Morganella morganii* indicated a wide spread septicemia originating from skin wounds and subcutaneous abscesses that were apparently the results of fighting (Novak et al., 1986).

The presence of inflammatory cells in the liver and kidneys of the guinea pig in the present case may suggest septicemia; the lesions found in the spleen and kidneys may indicate an underlying primary disease. Unfortunately, none of these organs were taken for bacteriological or viral examination. Hence, it could not be proved that the histological lesions in the other organs were caused by *Morganella morganii*. Furthermore, the presence of a bacterial or virological primary disease could not be excluded.

Although *M. morganii* as a pneumonic pathogen in

animals needs to be further elucidated, the present case, together with the few reports in other animals, documents the potential pathogenic character of this organism. It may be suggested that this organism should be considered as a differential diagnostic agent in bacterial pneumonias in domestic as well as in wild animals.

ACKNOWLEDGEMENTS

The authors would like to thank Riet Geeroms, Gaël Landuyt and Matthieu Pakula (Unit Surveillance, Orientation and Veterinary Support, Subunit Prionology and Pathology) for their help with the preparation of the histology and Heidi Vander Veken (Unit Bacterial Diseases, Subunit Foodborne and Highly Pathogenic Zoonoses) for the help with the bacteriological analysis. The authors also thank Anne Simon and Alexia Verroken (Saint-Luc Hospital) for their assistance in the MALDI-TOF analysis.

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