CASE REPORT

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Pathology of leptospirosis and acute fatal foreign body macroaspiration in a one-year-old Nigerian indigenous breed of dog

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Abstract

Macroaspiration is a common cause of mortality in dogs. Majority of cases of acute macroaspiration in dogs that leads to death are iatrogenic. In this case, we present report of leptospirosis in a bitch that died of macroaspiration. A carcass of a one-year-old Nigerian indigenous breed of dog was presented to the University of Jos Veterinary Teaching Hospital, Polo, for postmortem examination. *Rhipicephalus sanguineus* was recovered from the skin. The carcass was moderately dehydrated, emaciated and the mucous membranes were yellowish. The colon was severely haemorrhagic with blood-stained fluid in the abdominal cavity. The entire liver parenchyma was markedly jaundiced. The trachea contained froth mixed with fine black granular substance (activated charcoal). The spleen was markedly enlarged (splenomegaly). The bladder contained yellowish urine with a urine specific gravity of 1.010, marked bilirubinuria, glucosuria, proteinuria and mild haematuria. Microscopic examination of the urine revealed fine granular casts, transitional epithelial cells, leucocytes and red blood cells. Histopathological examination of tissues showed centrilobular hepatic necrosis, necrosis and desquamation of tubular epithelial cells, glomerular degeneration and complete destruction of the Bowman's capsule, moderate lymphocyte depletion, marked infiltration of mononuclear cells into the mucosa and submucosa. It was concluded that even though the dog had leptospirosis, the immediate cause of death was foreign body macroaspiration.

Keywords: Glomerular degeneration, Macroaspiration, Jaundice, Leptospirosis, Yellowish urine

Introduction

The intake of liquid or solid materials into the pulmonary airways is usually known as aspiration (Hu *et al*., 2015). Contents or materials that can or may be aspirated by animals are many, including secretions, feed materials, haemorrhagic materials, liquids, or other foreign materials that may be accidentally inhaled (Raghavendran *et al*., 2011). In veterinary practice, the word "aspiration" which is a common condition in canine species is frequently used interchangeably with aspiration pneumonia (Kogan *et*

al., 2008). Even though there are numerous articles on aspiration pneumonia in the small animal practice (Kogan *et al*., 2008; Laura *et al*., 2018), other less common aspiration-related respiratory conditions such as macroaspiration which usually leads to sudden death are either poorly documented or are not recognized in the canine patients (Laura *et al*., 2018). The prognosis of aspiration varies based on the content and volume of the aspirated substance and the underlying conditions of the patient. In dogs with aspiration-related respiratory conditions, the location and severity of lesions usually vary based on the nature of the substance aspirated, the volume and pH of aspirated materials, the health status of the patient, and whether there are concurrent respiratory disorders (Knight *et al*., 1993; Laura *et al*., 2018).

Leptospira serovar on the other hand is an infectious zoonotic bacterial pathogen that infects a wide variety of animals with a global prevalence (Gurumyen *et al*., 2021; Stull *et al*., 2022; Sykes *et al*., 2023). Leptospirosis is considered an emerging disease of concern and there is currently over 300 serovars of the disease grossly reducing vaccine efficacy (Sykes *et al*., 2023). Clinically, leptospirosis may present wide clinical manifestations depending on the infecting serovar, size of the inoculum, the host species involved as well as the immune status of the host animal (Sykes *et al*., 2023). In Nigeria, the disease has been reported through serology in dogs and wildlife, with very high case fatality (Ajayi *et al*., 2017; Gurumyen *et al*., 2021).

Even though there are numerous articles on leptospirosis, the majority of the articles focus more on prevalence studies and only very few studies document pathological lesions associated with this disease (Ajayi *et al*., 2017; Gurumyen *et al*., 2021). While it is known that other underlying conditions could complicate the pathology of leptospirosis, no reported study or case documents leptospirosis complicated by other conditions. It is against this background that we present here a case of leptospirosis complicated by macroaspiration in a 1-year-old Nigerian Indigenous breed of dog.

Case Presentation

Case report

A carcass of 1-year-old bitch (Nigerian indigenous breed of dog) was presented to the University of Jos Veterinary Teaching Hospital Polo, Jos, Plateau State, Nigeria, for postmortem examination. The client reported that the bitch died suddenly few days following weakness, inappetence and yellowish urine. The bitch had neither history of vaccination nor of a recent visit to the Veterinary clinic.

Laboratory investigation

The client presented the carcass for postmortem examination immediately after the bitch died and the postmortem examination was done immediately (within one hour of presentation). There was a rough hair coat with moderate *Rhipicephalus sanguineus* infestation. The carcass was fresh and warm at the time of postmortem examination. The carcass was moderately dehydrated and emaciated, and the mucous membranes were yellowish with evidence of melena around the anal region. Both small and large intestines were severely haemorrhagic (with large intestine more severely affected) and congested, with congested mesenteric veins (Plate IA). The intestine contained blood-stained mucoid intestinal content while the washed mucosal surface was severely haemorrhagic (Plate IB). There was blood-stained fluid in the abdominal cavity (haemorrhagic ascites) measuring about 1.5 litres and the entire liver parenchyma was markedly jaundiced (Plate IIA). The trachea contained froth mixed with a fine black granular substance (activated charcoal) which extended and filled the bronchi (Plate IIB). The spleen was markedly enlarged (splenomegaly) and about two-thirds (2/3) of it was congested (Plate IIC). The bladder contained yellowish urine (Plate IID) which readily sediment without centrifugation. The urine was collected and immediately subjected to urinalysis. Tissues were collected, fixed and routinely processed for histopathology.

The entire intestine was markedly haemorrhagic with congested mesenteric veins (Plate IA). The intestine contained blood-stained mucoid intestinal content while the washed mucosal surface was severely haemorrhagic (Plate IB).

Urinalysis

The urine was yellowish, cloudy with unremarkable odour and a urine-specific gravity of 1.010 (Table 1). Chemical examination was done using Mission Expert Urinalysis Reagent test strips (San Diego, USA) and the results showed marked bilirubinuria (3+), glucosuria (1+), proteinuria (2+), mild haematuria (1+), presence of epithelial cells (2+), pH of 7 while ascorbic acid, urobilinogen, nitrite, and ketone bodies were negative. Microscopic examination of both unstained and Giemsa-stained urine collected at postmortem revealed fine granular casts (cylindruria) of varying sizes and shapes (Plate III 1A and 1B

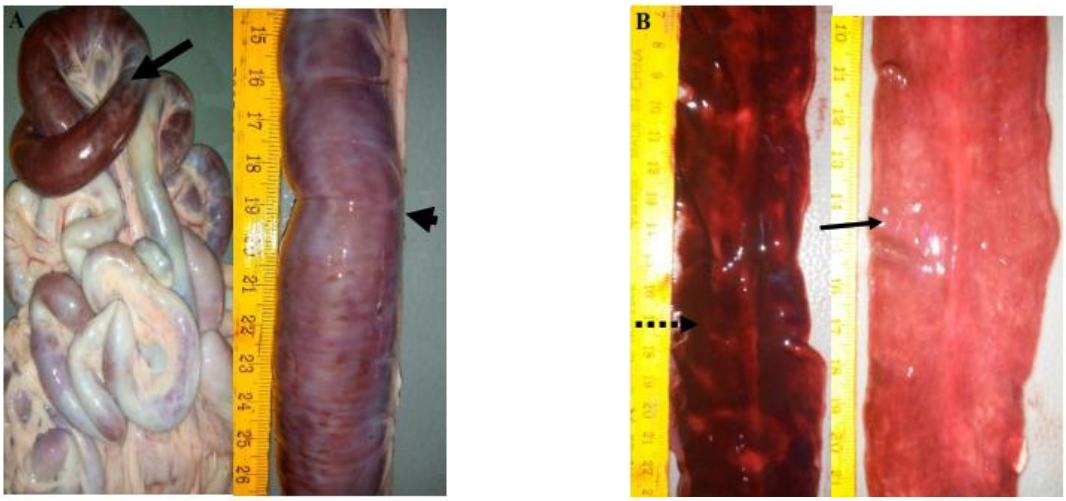

Plate I: Photographs of the intestine at postmortem showing **A**: haemorrhagic colon (arrow) and a segment of the colon (arrowhead); **B**: colon mucosa containing bloody mucoid intestinal content (dotted arrow) and the haemorrhagic mucosa without intestinal content (slim arrow)

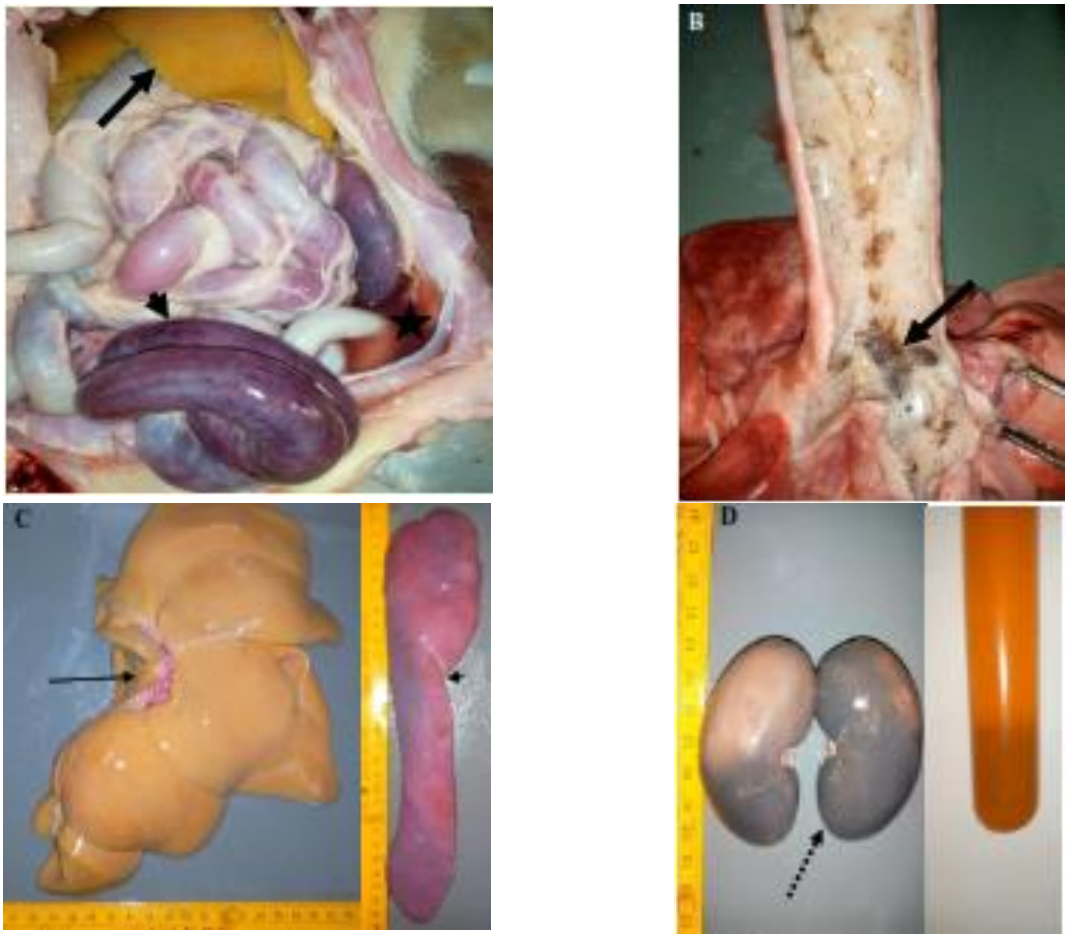

Plate II: Photographs of organs at postmortem showing **A**: jaundiced liver (arrow) and haemorrhagic large intestine in-situ (arrowhead) and blood-stained fluid in the peritoneal cavity (haemorrhagic ascites**)** (star); **B**: lungs with froth and activated charcoal in the trachea and bronchi, completely obstructing the bronchi (arrow); **C**: jaundiced liver (slim arrow), enlarged spleen with about two third of the parenchyma congested (slim arrowhead); **D**: severely necrotic and friable kidney (dotted arrow) and a yellowish urine in a test tube showing sedimentation without centrifugation

respectively). Other findings from the urine sediment include the presence of transitional epithelial cells (Plate III C and D), leucocytes and red blood cells. The urine was cultured on Standard albumin-Tween 80 medium (EMJH) and *Leptospira* species was isolated.

Histopathology

Histopathological examination of the tissues collected during postmortem examination showed marked infiltration of neutrophils in the bronchiole and interstitium (broncho-interstitial pneumonia) with mild haemorrhages (Plate IVA), bronchiole with granular materials deposited in the alveoli (Plate IV B). In the liver, there was diffused hepatic necrosis and complete obliteration of hepatocellular architecture of the liver, with mild infiltration of neutrophils around portal areas and severe generalised necrosis of hepatocytes (Plate V). Predominant lesions in the kidney were necrosis and desquamation of tubular epithelial cells, glomerular degeneration, complete disruption of the Bowman's capsule and moderate infiltration of neutrophils in the

Table 1: Urinalysis of the urine sample collected

Parameters	Inference/value
Physical properties	
Colour	Yellow
Transparency	Cloudy
Odour	Normal
Urine Specific gravity	1.010
Chemical Properties	
pH	7.0
Bilirubin	2+
Blood	1+
Glucose	1+
Ketone bodies	Negative
Protein	2+
Microscopic analysis of urine sediment	
Erythrocytes	1+
Leucocytes	1+
Epithelial cells	2+
Crystals	Negative
Casts	3+

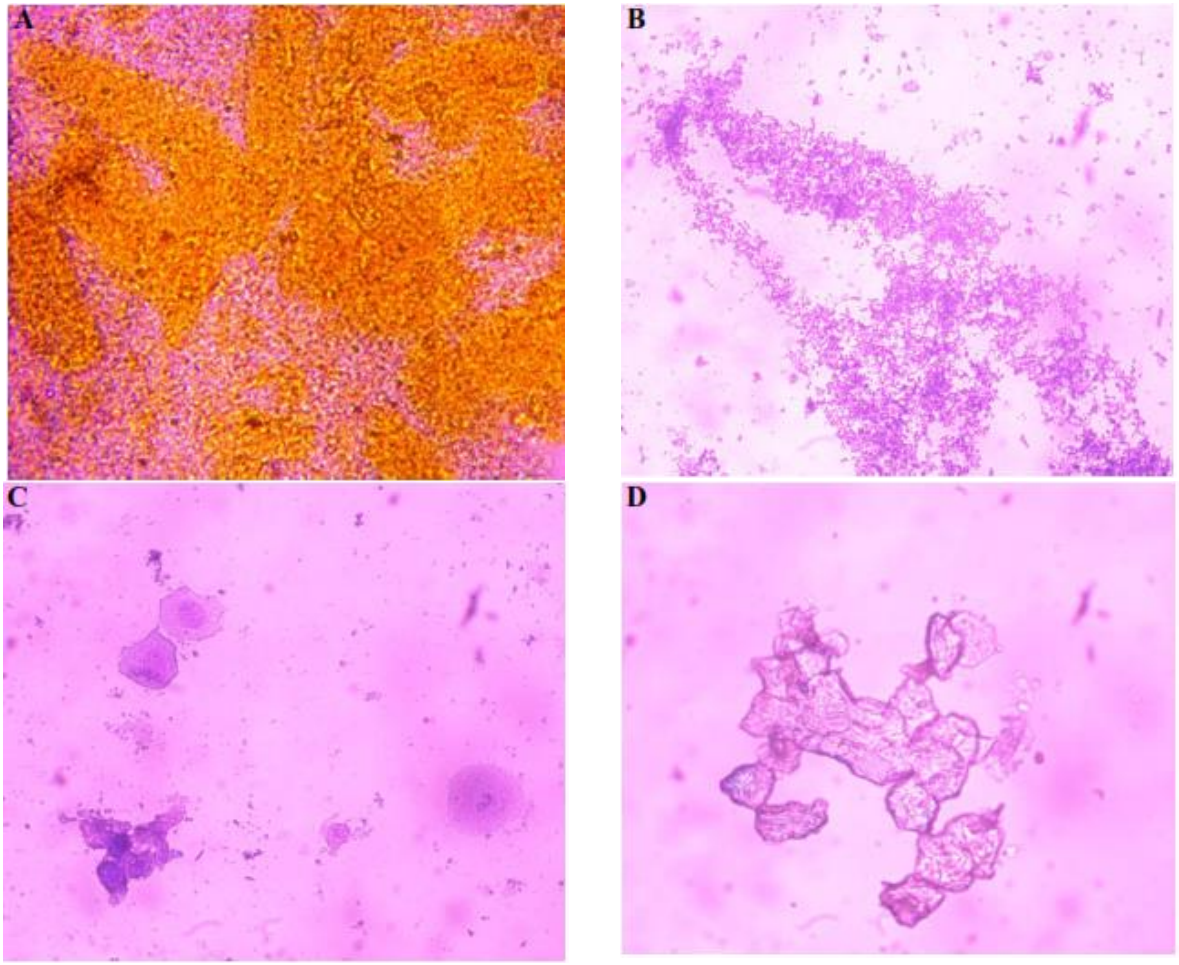

Plate III: Photomicrographs of urine obtained at postmortem from the dog showing **A**: granular casts from wet mount (unstained slide); **B**: granular casts of varying shapes from Giemsa-stained slide (Mag. X100). **C** and **D**: Transitional epithelial cells. X400

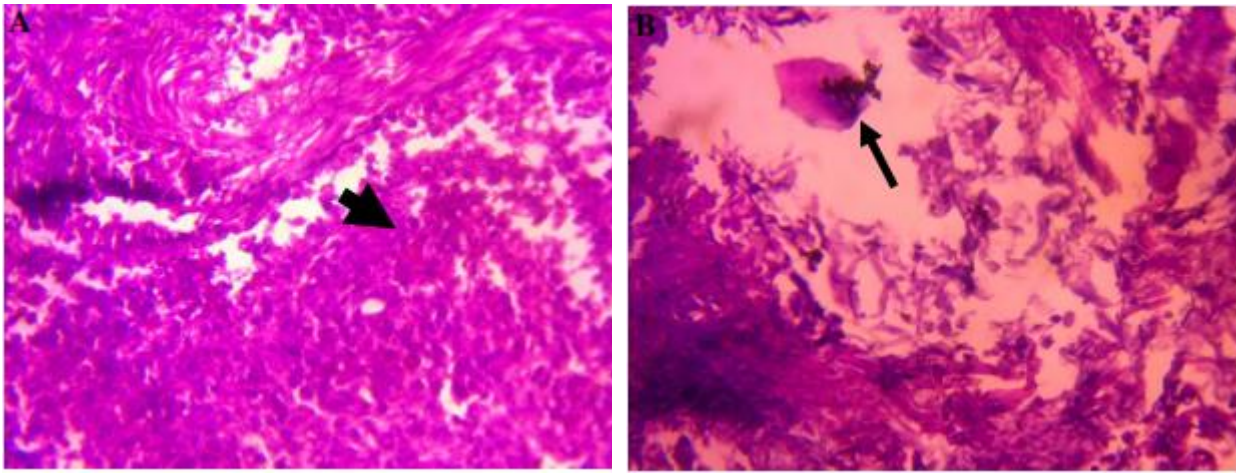

Plate IV: Photomicrographs of lung tissue sections from the leptospirosis-infected dog **A**: showing marked infiltration of neutrophils in the bronchiole (arrowhead), (bronchopneumonia) with mild haemorrhages (arrowhead), **B**: showing a bronchiole with granular materials and a macrophage (arrow). H & E. X400

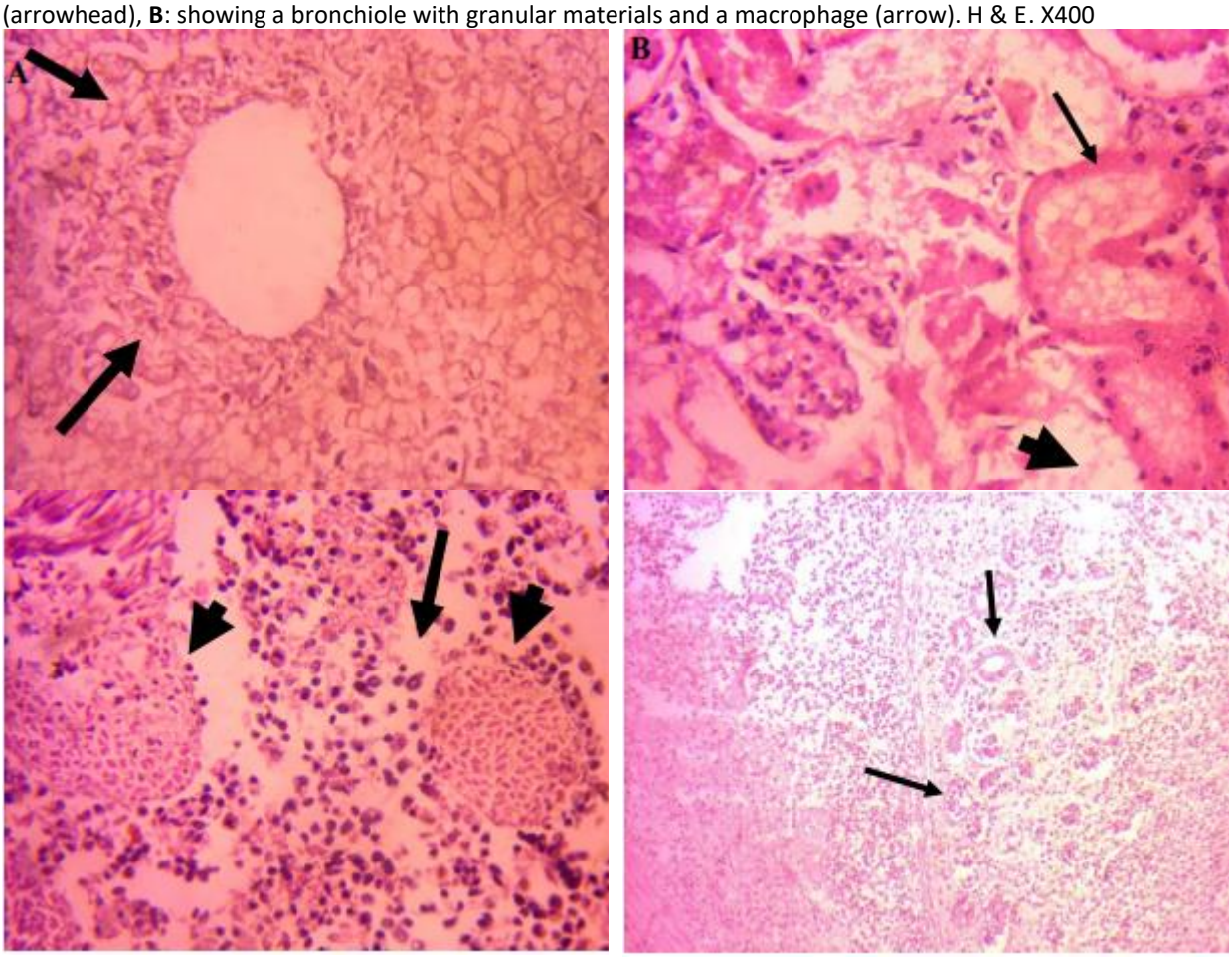

Plate V: Representative photomicrographs of tissue sections from the leptospirosis-infected dog **A**: the liver showing centrilobular hepatic necrosis (arrows) with complete obliteration of hepatocellular architecture. H & E stain, Mag. X400; **B**: the kidney showing necrosis and desquamation of tubular epithelial cells (slim arrow), glomerular degeneration and complete disruption of the Bowman's capsule (arrowhead). H & E stain, Mag. X400; **C**: the spleen showing moderate lymphocyte depletion (arrow) and atrophic germinal centres (arrowheads). H & E stain, Mag. X400; **D**: the intestine (colon) showing marked infiltration of mononuclear cells into the mucosa and submucosa with few intestinal glands (slim arrows). H & E. X100

renal cortex. In the spleen, there was moderate lymphocyte depletion and atrophic germinal centres while in the intestine (colon), there was marked infiltration of inflammatory cells in the mucosa with few intestinal glands and complete collapse of the intestinal crypts.

Discussion

Tracheobronchial obstructions resulting from foreign body inhalation is not a common occurrence in dogs, even though it is potentially life-threatening. These foreign bodies that may be inhaled by dogs include plant material, food or other foreign objects that may be chewed and inhaled accidentally (Laura *et al*., 2018). In dogs with aspiration-related respiratory conditions as similarly observed in this report, the location as well as the severity of lesions usually vary based on the nature of the substance aspirated, the volume of aspirated materials, health status of the patient, and whether there are other underlying respiratory disorders or conditions that have impacts on the respiratory system (Knight *et al*., 1993; Laura *et al*., 2018). In this report, we present a case of leptospirosis, a disease with respiratory compromise complicated by fatal acute macroaspiration. The aspirated material in this case was activated charcoal administered by the client, which led to aspiration into the trachea and bronchioles. The aspirated materials mixed with froth completely obstructed the bronchioles, further complicating the broncho-interstitial pneumonia induced by Leptospirosis and this led to the sudden collapse and death of the dog. Aspiration pneumonia has been documented as one of the secondary complications of leptospirosis (Sykes *et al*., 2023). This sudden death due to macroaspiration agrees with previous reports (Sherman and Karagiannis, 2017; Laura *et al*., 2008), who reported death as a consequence of aspiration.

The dog in this case had leptospirosis which was not under Veterinary intervention and while the disease was progressing to terminal stage, the client complicated the case by the administration of activated charcoal, which was accidentally aspirated massively into the trachea. The gross lesions seen in this case were consistently found in 12 confirmed cases of leptospirosis in Jos, Plateau State, Nigeria. While the said study (Gurumyen *et al*., 2021) did not evaluate the mechanisms through which leptospirosis induced the reported lesions, the consistency of the lesions reported in the study could perhaps be attributed to the serovars circulating in the Plateau State. This is supported by findings of Sykes *et al*. (2023) on canine leptospirosis, which states the different serovars are associated with diverse lesions.

The findings of isosthenuria, marked bilirubinuria, mild glucosuria, marked proteinuria and marked cylindruria from the urinalysis results are all consistent with previous reports (Sykes *et al*., 2023). According to Sykes *et al*. (2023), the observed isosthenuria is linked with acute renal injury/failure, the bilirubinuria is due to hepatic dysfunction resulting from disrupted hepatocyte intercellular junctions by the bacteria, leading to leakage of bile into the circulation, eventually leading to bilirubinuria (Sykes *et al*., 2023). The glucosuria in leptospirosis is a renal glucosuria and together with the cylindruria a specific indication of renal tubule damage while proteinuria is attributed to defects in tubular reabsorption of low molecular weight proteins in conjunction with glomerular loss of high molecular weight proteins due to glomerular dysfunction (Ajayi *et al*., 2017; Sykes *et al*., 2023). Other urinalysis findings in this case include mild pyuria, mild haematuria and the presence of transitional epithelial cells which are all indications of renal tubule damage as earlier stated.

Histopathologically, the pulmonary lesions in this case are consistent with previous reports (Gurumyen *et al*., 2021; Sykes *et al*., 2023). It was noted that the cases of leptospirosis in Plateau State, Nigeria revealed that pulmonary lesions are consistent findings (Gurumyen *et al*., 2021). In the liver, the differences observed in the magnitude of hepatic lesions in this case are relatively not the same as the lesions documented in previous reports (Sykes *et al*., 2023). The difference could be attributed to differences in circulating serovars of leptospirosis (Sykes *et al*., 2023). Most of these lesions observed in the spleen had been consistently reported earlier (Gurumyen *et al*., 2021).

In conclusion, the consistency of lesions reported in this study and those reported in our earlier case series shows the circulating serovars of leptospirosis in Plateau State, Nigeria are more multisystemic compared to those reported in other studies elsewhere. Dogs with leptospirosis may also be concurrently having other disease conditions and a holistic approach is advocated.

Conflict of Interest

The authors declare that there is no conflict of interest.

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