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Case Report

Fatal multiple intestinal intussusceptions and torsion secondary to a non-degradable foreign body gastrointestinal obstruction in a captive Lion *(Panthera leo)*

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Abstract

Intussusception is the invagination of one segment of the intestine into the part of the tract that either precedes or follows in the gastrointestinal tract of different species of animals. This report describes a case of fatal multiple intestinal intussusceptions and torsion associated with non-degradable foreign body gastrointestinal obstruction in a captive lion (*Panthera leo*) in a zoo in Nigeria. Parenchymatous tissues were aseptically collected during necropsy for bacteriological isolation and histopathology. Also, intestinal fecal material was collected and sent for parasitological examination. The main lesions were gastroduodenal, duodeduodenal, duodejejunal and jejunojenunal intussusceptions and duodenal torsion. A non-degradable towel-like fabric foreign body obstruction along the pyloric antrum/canal region of the stomach down to the jejunum was found. Microscopic lesion included ischemic necrosis of inner circular and outer longitudinal smooth muscles of the intestine with necrosis of other layers and vascular congestion. Parasitological examination revealed presence of *Babesia* spp. in blood smear examined before the death of the lion. While *Escherichia coli* was isolated from the liver on MacConkey agar. A diagnosis of intussusception and torsion associated with non-degradable foreign body (fabric) gastrointestinal obstruction was made. This first case of ingestion of a non-degradable fabric foreign body leading to gastrointestinal obstruction in captive lion in Nigeria has brought about the need for vigilance of zoo authority to prevent a recurrence during crowd influx to the garden.

Key words: foreign body, gastrointestinal obstruction, intussusception, lion.

Introduction

Intussusception is the invagination or prolapse of one portion of the intestine (intussusceptum) into the part of the tract that either precedes or follows it (intussuscepien) and may occur anywhere in the gastrointestinal tract (1). Intussusception occurs in different species of animals and humans (13). Foreign bodies, neoplasms, and some parasites are known to facilitate the intestine to telescope into itself. In wildlife, other causes of intussusception include obstruction by nylon cord, fishhook and wire as previously reported in a Florida Manatee (*Trichechus manatus latirostris)* (8). Some intussusception cases resolve spontaneously and, if treated early, almost all can be reduced by enema or surgery; if untreated, it may be fatal (9). Intestinal

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obstruction is the most common cause of digestive disease in all species (5). Intussusception is the most common cause of abdominal surgical emergencies in infants and children and is characterized by a palpable abdominal mass, colicky abdominal pain, vomiting and passage of bloody stool (16, 17). The cause is generally unknown, but it is thought to be associated with intestinal irritability and hypermotility both of which can occur secondary to enteritis, irritation caused by parasites and general debility. Obstruction can be induced by volvulus, torsion, hernias, strangulation, or intussusception (2). Intussusception in lion seems to be a rare condition and this appears to be the first report of intussusception in a lion in captivity in Nigeria. We therefore, describe the clinical and pathologic features of intussusception and torsion associated with non-degradable fabric foreign body gastrointestinal obstruction in a captive lion.

Case Report

In the summer of 2017, a 10-year-old lion in an enclosure with other two lionesses, that were 12 years at a Zoological garden in Nigeria. The animal presented a recent history of weakness, anorexia and debilitating illness, and died after a course of 8 days. Following illness, the case was reported to the Wildlife Clinic of the Veterinary Teaching Hospital (VTH) of the University of Ilorin. The lion was therefore immobilized using Ketamine (5 mg/kg) and Xylazine (1mg/kg) in a 5 ml dart (Dan-inject®) delivered in 2 shots using the Dan-inject® CO_2 JM standard riffle to enable thorough physical and clinical examination. Clinical parameters including heart rate, pulse and lung sound were within normal range, but a hard-variegated tick was found on the eyelid. The animal was dewormed using Ivermectin 0.2mg/kg subcutis and was given vitamin B and C intramuscularly. Ganasegur® (3 mg/kg) was administered by intramuscular route to treat babesiosis. Also, Yohimbine was given at 0.1 mg/kg to reverse the effect of Xylazine following blood, fecal and oral swabs collection. Prior to death, laboratory investigation revealed presence of *Babesia* spp, although results of a complete blood count and serum biochemical analysis were within reference intervals for the lion.

Laboratory investigation for parasites was carried out by suspending 1g of intestinal fecal material taken per rectum in salt solution and covering with glass slide before microscopic examination was carried out. For bacteriology, samples were aseptically collected from lungs, liver, kidney, spleen, duodenum, ileum and rectum. Samples were collected into buffered peptone water and incubated at 37ºC for 24 hours at the Veterinary Microbiology laboratory of the VTH. Samples were cultured on Xylose Lysine Deoxycholate agar (XLD) (Biotech, Ipswich, UK) Mannitol Salt agar (MSA) (Oxoid, Hampshire, UK) and Eosin Methylene Blue agar (EMB) (TM Media Rajasthan, India) and incubated at 37ºC for 24 hours. Growths on MSA were further inoculated in Blaird Parker agar (BPA) (Oxoid, Hampshire, UK) with egg yolk tellurite supplement and incubated at 37ºC for 48 hours, growths with hazy zones were inoculated on oxacillin resistant *Staphylococcus aureus* base (ORSAB) (Oxoid, Hampshire, UK) and supplemented. Growths on EMB were sub-cultured on sorbitol MacConkey (sMac) and incubated at 37ºC for 24 hours to screen for pathogenic *Escherichia coli* strains. Brain sample was taken and sent to the National Veterinary Research institute, Vom for Florescent Antibody Technic (FAT) to rule out Rabies which can result into pica behavior.

Laboratory investigation revealed presence of *Babesia* spp, and results of a complete blood count and serum biochemical analysis were within reference intervals in the lion (Table 1). There was no growth on all XLD plates; therefore, no further test was performed on the sample for *Salmonella* isolation. Samples from liver, kidney, spleen and feces showed positive growth on oxacillin resistance screening agar base (ORSAB), which is presumptive for the presence of methicillin resistant *Staphylococcus aureus* (MRSA), but further molecular characterization would be necessary to confirm the result; samples from small intestine and rectum were both positive for coagulase negative *Staphylococcus* species. Two samples, from lungs and liver showed growth on sorbitol MacConkey agar presumptively indicating the presence of pathogenic *Escherichia coli*, though further work needs to confirm this assumption. There was evidence of dehydration as postmortem examination revealed dried mucous membrane of the eyes and rough fur. The carcass was severely emaciated (Fig. 1) and sunken eyes with attached round tick in the adjacent skin (Fig. 1, inset). Lung was markedly collapsed secondary to abdominal distention as a result of intussusception and possibly septicemia. The lung also had peripheral lobar emphysema, while the stomach was distended with the foreign body (Fig. 2B) and had congested gastric vessels (Fig. 2B). Figure 2C shows the non-degradable towel-like foreign body found in the stomach and intestine of the lion. At the pyloric region of the stomach, the pylorus was invaginated into the duodenum (gastroduodenal); first intussusception (Fig. 2A). Eight centimeters away from this telescoping, there was a second telescoping within the duodenum (duodenoduodenal) and a third telescoping occurred within the duodenum again (duodenoduodenal), 10-12 cm apart (third). There was a 180 degrees rotation of the intestine along its axis to the right (torsion) before the third telescoping. Also, there was a telescoping at the duodenal/jejunal (duodenojejunal) end (fourth), while within the jejunum a fifth telescoping (jejunojejunal) occurred (Fig. 2B). The mesenteric vessels were markedly congested and the intestinal mucosa showed petechiae/ ecchymotic hemorrhages, throughout from duodenal to colon area. On cut surface within the lumen of the pylorus up to the jejunum was a twisted non-degradable towel-like

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fabric foreign body (Fig. 2C) which expanded the lumen of the small intestine. The mucosa of the intestine was infarcted at the obstructed area. Histopathologic findings included coagulative necrosis of the intussuscepted sections of the intestine as a result of blood vessel compromise leading to loss of blood supply (ischemia). The ischemia lead to the severe diffuse necrosis of the outermost layers of the circular and longitudinal muscles of the intestine (Fig. 3A). On higher magnification there was evidence of longitudinal and circular muscle myofiber cytoplasmic hyper eosinophilia (necrosis) admixed with myositis which was characterized by lymphohistiocytic cellular infiltration (Fig. 3B). Also, the coagulative necrosis extended to the villi with evidence of swollen and stacking of villi and loss of epithelia lining cells. There was intermuscular fiber edema evident by intermuscular fiber spaces with severe vascular congestion and perivascular edema. Other microscopic lesions included dissociation of cryptic epithelium from basal membrane, duodenum (intussuscepien), ischemic necrosis of circular muscles evident by hyper eosinophilic myofibers cytoplasm and necrotic muscularis mucosa, submucosa and villi. The Florescent Antibody Test performed on the smear of the brain sample was negative for rabies.

Table 1. Hematology result of the captive Lion.

Hematology	Case	*Reference
Hemoglobin (g/dl)	12.33	8.9 – 14.6
PCV (%)	37	26.8 – 44.1
RBC (x 10 ^{12}/L)	10.48	5.0 – 8.3
MCV (Fl)	35.40	46.6 – 55.9
MCH (Pg)	11.77	14.8 – 18.5
MCHC (g/dl)	33.3	29.6 – 35.5
WBC (x 10^9/L)	27.4	7.2 – 25.6
Neutrophils (Mature) (%)	79	-
Neutrophils (band cell) (%)	-	-
Lymphocytes (%)	19	-
Monocytes (%)	-	-
Eosinophils (%)	02	-
Basophils (%)	-	-
Platelets (%)	1658	-

*Reference values (14).

Discussion

The ingestion of this non-degradable towel-like fabric foreign body obstructed the small intestine of this captive lion leading to the multiple gastroduodenal, duodeduodenal, duodejejunal and jejunojenunal intussusceptions and duodenal torsion which eventually had a fatal outcome. The zoological garden is usually open to the public just like every other zoological garden in the world. Although, it has been observed that the influx of people to the garden during public holidays and festive periods are usually high, and the crowd could be difficult to manage. Bearing this in mind, clinical investigation and analysis suggest that the first sign of loss of appetite and weakness in this lion which was observed by the lion handlers coincides with the last experienced huge influx of people into the garden. In retrospect, the lion died on Saturday afternoon, the 16th September, 2017 this was after an eight-day course of illness invariably beginning on the 8/9th September, 2017. This period was just 4-5 days after the end of the public holiday weekend following the Islamic festival of *Eid el karbir* which was celebrated between 1st - 4th September, 2017. It is therefore, most probably that a visitor to the garden during this festive period must have mistakenly or intentionally thrown a large face towel into the lion's enclosure. Human–carnivore conflicts are known to arise from human attack or predation on livestock belonging to sedentary farmers in and around wildlife protected areas and not in captivity (4). In such cases, affected human communities usually respond by killing carnivores, thereby leading to high carnivore mortality (4, 10). It is therefore surprising that humans will intentionally want to harm or even indirectly kill a lion in captivity without provocation or attack. Another question to answer would be why a carnivorous feline like the lion would eat and swallow a non-degradable towel-like fabric. It is thought that meat may have been wrapped up in the towel. This seems to be the

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only logical reason, having tested the brain of this lion for rabies using fluorescent antibody technique (FAT) and which turned out negative. If the ingestion of this non-degradable towel-like foreign body was a pica behavior, this have only been attributed to hunger, physiological stress, nutritional deficiency and dyspepsia (20), although its occurrence in lions is of little knowledge. Furthermore, pica appetite leading to gastric problems and eventually death have been reported in zoo animals in Nigeria (7, 11) which has been linked to nutritional deficiencies, although not reported in carnivorous species devoid of rabies, which makes this case quite striking. It was unfortunate that, the incidence escaped the watchful eyes of the zoo keepers. This was probably a result of the huge crowd influx experienced during this period. Intussusception is known to be the most common cause of abdominal surgical emergencies in children, its clinical symptoms includes colicky abdominal pain, vomiting and passage of blood-stained feces (16, 17). In this case, although the lion was weak, there was no straining to suggest abdominal pain, or vomiting and/or passage of bloody feces. Intussusception can be fatal if untreated, although some cases may resolve on its own. The use of enema or surgery remains an effective treatment (9). The lion was scheduled to be transferred from the zoo to the Imaging unit of the University Veterinary Teaching Hospital for ultrasonography and x-ray examination which could have been useful in the diagnosis of the intussusception but the lion died before the transfer. Intussusception can be detected by palpation of the abdomen for the presence of mass(es) but because this condition is not common in lions and has not been reported before, the clinical examination done on this lion following sedation was targeted at screening for parasites and infectious diseases which seems to be more commonly reported in lions (3, 6, 12, 18). Other causes of intussusception in wildlife include obstruction by nylon cord fishhook and wire as seen in a Florida Manatee (8). Contrary to reports that obstruction can be induced by volvulus, torsion, hernias, strangulation or intussusception (2), in this lion, it is of the opinion that the obstruction caused by the large non-degradable towel-like fabric foreign body within the stomach and small intestine predisposed to the intussusception and the torsion. Intestinal obstruction is said to be by far the most common cause of digestive disease in all species (5), this is evident as the compromise of blood vessels leading to infarction at the point of in folding due to obstruction caused necrotizing duodenitis in this lion.

Figure 1. The cadaver of the lion severely emaciated with prominence of the rib cage and sunken eyes with attached round tick (inset).

Figure 2. Lion, gastrointestinal tract. **A.** First intussusception, at the pyloric antrum of the stomach. The pylorus was telescoped into the duodenum and 180 degrees rotation of the intestine along its axis to the right (torsion). **B.** Jejunal intussusception and mesenteric vascular congestion. **C.** Stomach-intestine on cut surface within the lumen of the pylorus up to the jejunum was twisted. Non-degradable towel-like fabric foreign body obstructed and expanded the lumen of the small intestine.

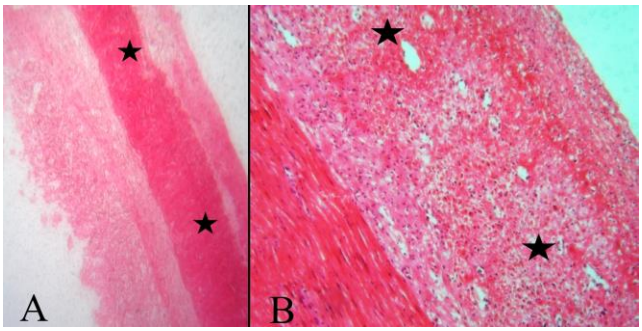

Figure 3. Lion, intestine: **A.** Intussuscepted duodenum, severe diffuse coagulative necrosis as a result of blood vessel compromise leading to loss of blood supply (ischemia), longitudinal (large stars) and circular muscle with marked myofiber cytoplasmic hyper eosinophilia, nuclear pyknosis and loss (necrosis) with severe cellular infiltration (HE, 40x). **B.** Higher powered field of A, longitudinal muscle (large stars), with severe myositis and myofiber necrosis (HE, 100x).

The pathogenesis of the events that led to the death of this lion is thought to be that the physical occlusion of the gastrointestinal lumen by the ingestion of this non-degradable towel-like fabric foreign body brought about luminal blockage and exertion of force and tension on the luminal wall and associated structures including villi, submucosa glands, blood vessels and the muscular wall. The gross lesion showed that the foreign body distended the intestinal wall anterior to a narrower distal segment and coupled with continuous increased intestinal peristaltic movement against luminal blockage allowed for several intussusceptions to occur. This may have led to the twisting (torsion) of the duodenum along its axis. The obstructed and intussuscepted intestinal segments become infarcted due to ischemia leaving a coagulated necrotic area of the intestine as evident from the histopathology. Also, the microbiota of the intestine at these affected segments multiply and may enter the blood circulation leading to bacteremia and possibly septicemia and shock which may have eventually led to the death of this lion. The shock which was evident by severe lung collapsed from cardiopulmonary depression secondary to abdominal distention as a result of intussusception and possibly septicemia which will lead to impaired tissue perfusion (evident by dehydration) and cellular hypoxia. The congestion, oedema and hemorrhage at segments of intussusception coupled with dehydration will lead to hypovolemia, which may complicate the septic shock from septicemia. The isolation of bacteria pathogens in this case secondary to intussusception is possibly due to the stasis of the intussuscepted segment of the intestine which will allow increased multiplication of bacteria flora (15).

This case has added valuable knowledge to the progression and outcome of gastroduodenal intussusception which seldom occurs in carnivores and probably never in adult lions. Also, it has brought to limelight the need for vigilance on the part of zoo authorities. This report represents, as far as we have been able to find, the first case of intussusception and torsion secondary to foreign body gastrointestinal obstruction in adult captive lions.

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