

Evaluation of Dog and Cat Patients with Intestinal Intussusception: A Retrospective Study in Egypt

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Abstract

The purpose of this retrospective study was to clinically characterize intestinal intussusception in dogs and cats in Egypt. Medical records including signalment, clinical findings, diagnostic imaging features, treatment, and outcomes of dogs (n = 40) and cats (n = 30) with confirmed intestinal intussusception were reviewed. On presentation, ages were 2.56±1 years for dogs and 2.6±2.07 years for cats, the common breeds were German Shepherd (42.5%) and Persian cat (46.66%). Male dogs (67.5%) and tom cats (73.3%) were commonly presented. For diagnosis, the effectiveness of radiography was 67.5% for dogs and 70% for cats, whereas ultrasonography accuracy was 87.5% for dogs and 80% for cats. Three cases need further confirmation of diagnosis by computed tomography. Leukocytosis, thrombocytopenia, hyponatremia, hypochloremia, hypokalemia, and hypoalbuminemia were mostly observed in laboratory abnormalities. The most common site for intussusception noted in both dogs and cats was the ileocolic junction (ICJ; 50% and 47.7%, respectively). Based on intestinal health status, treatment methods included (MR) manual reduction (17.5% for dogs, 16.66% for cats) or manual reduction plus intestinal resection and anastomosis (IRA) (72.5% for dogs, 73.33% for cats). The overall survival rate post-operatively was 87.5 for dogs and 90% for cats. In conclusion, this study identifies clinical, laboratory, and diagnostic results, as well as treatment methods, applied for intestinal intussusception in dogs and cats in Egypt. Moreover, this study suggests that early presentation, diagnosis, and surgical intervention are necessary to improve the outcome and reduce the simultaneous complications.

KEYWORDS

Intussusception, Radiography, Ultrasonography, Computed tomography, Dog, Cat.

INTRODUCTION

Intussusception means telescoping of a part of intestinal segment (intussusceptum) into lumen of adjacent segment (intussusciens) (Allman and Pastori, 2013). It has been reported that intestinal intussusception is considered a common cause of bowel obstruction in dogs and cats (Larose *et al.*, 2020). Causes of intestinal intussusception include idiopathic, bacterial, or viral enteritis, intestinal parasitic infestation, gastrointestinal foreign bodies, gastroenteritis, and neoplasia (Rallis *et al.*, 2000; Applewhite *et al.*, 2001; Applewhite *et al.*, 2002; Madrewar and Yaqub, 2016; Ko *et al.*, 2020). These irritants may change the peristaltic movement pattern leading to the telescoping of a hyper-motile segment into the lumen of a nearby less-motile segment and eventually forming an intussusception (Madrewar and Yaqub, 2016). The degree of luminal obstruction, mucosal congestion, and infarction caused by intussusception varies according to the length and size of the intussuscepted intestinal loops (Jones *et al.*, 1997). The commonly reported locations for intussusception include duodenojejunal, jejunojejunal, ileocolic, and jejunocolic (Larose *et al.*, 2020). Despite the experienced clinical signs of intussusception vary in severity, location, completeness, as well as the duration of the obstruction, there are common cardinal

clinical signs that are recurrent such as vomiting, bloody mucoid, diarrhea, anorexia, lethargy, hematochezia, abdominal pain, and palpable abdominal mass (Butler, 1972; Patsikas *et al.*, 2008; Larose *et al.*, 2020). Plain abdominal radiography is often non-specific, whereas ultrasonography (US) is the most appropriate tool for the diagnosis of intussusception in both dogs and cats (Patsikas *et al.*, 2003; Patsikas *et al.*, 2004; Penninck, 2008). Ultrasonography over other diagnostic tools has the advantages of being safe and non-invasive and can be performed without general anesthesia (Emery *et al.*, 2015). Computed tomography (CT) could be also used when necessary to confirm the diagnosis of intestinal obstruction and intussusception in animals (Minitier *et al.*, 2019). Although spontaneous reduction has been reported, however, surgical treatment by either manual reduction (MR) with or without intestinal resection and anastomosis (IRA) is commonly required (Applewhite *et al.*, 2001; Patsikas *et al.*, 2008). As previously reported, the common noted complications post-surgical treatment of intestinal intussusceptions included recurrence of the intussusception, enteric wound dehiscence, and septic peritonitis. Early presentation, diagnosis, and surgical correction are potentially critical to improving the outcomes and restoring bowel integrity (Levitt and Bauer, 1992). The purpose of this study was to clinically describe intestinal intussusception in

dogs and cats.

MATERIALS AND METHODS

Animals

Medical case records of dogs (n = 40) and cats (n = 30) were admitted to the Animal Clinic of Surgery, Anesthesiology and Radiology Department, at Zagazig University, Zagazig, Sharkia, Egypt, from February 2019 to July 2022 and had confirmed diagnosis of intestinal intussusception were reviewed. The current work was performed by the rules of the Ethical Committee and Animal Welfare of the Faculty of Veterinary Medicine, Zagazig University, Egypt. The animal study protocol was approved by the animal Ethics Committee of Zagazig University (ZU-IA-CUC/2/F/29/2022).

Data collection

For each case, the retrieved data included sex, age, breed, body weight, presenting clinical signs on presentation, and clinical examination results. For all cases, abdominal radiographic, ultrasonographic, and computed tomographic images were assessed. Radiographic examination was performed using a Toshiba Rotanode x-ray machine (POX-300BT, Japan), and ultrasonography was performed using Sonoscape A5V (Guangdong, China). Computed tomography was carried out using a helical CT Scanner of Hispeed NX/I Dual Slice CT (Xvision, TOSHIBA, Japan). Hematological and biochemical variables in all the cases were also analyzed. Details of perioperative procedures applied surgical treatment for all cases involving the kind of surgical technique and outcomes in this study, location of intussusception and associated gross lesions were also involved.

Preoperatively

All cases suffered from dehydration were stabilized for their hydration status and electrolyte imbalances by administration of fluid therapy before anesthesia and surgery. Preoperatively, all animals received cefoxitin (25mg/kg iv). As a tranquilizer in dogs, we use Xylazine HCL (Xylaject® 2%) (Amriya Pharmaceutical Co., 10th of Ramadan, Egypt) (at the dose of 0.5 mg/kg B.wt.) by intramuscular injection. For general anesthesia in dogs, we use (THIOPENTAL NA 2.5%, Amriya pharmaceutical industries, Egypt) at a dose of 20-30 mg/kg B.wt. by intravenous injection. For general anesthesia of cats, the combination of Ketamine HCL 5% (KETALARE® 5%; JHP Pharmaceuticals; 20 mg/kg) and xylazine HCL (XYLAJECT 2%; ADWIA; 0.5 mg/kg) was used via intramuscular injection.

Postoperatively

The analgesic applied was (Metacam; Boehringer Ingelheim, 0.1 mg/kg; orally) once daily for three consecutive days postoperatively. Intravenous fluid therapy was administered until the animal was clinically able to initiate feeding. The Antibiotic was administered for three days postoperatively using amoxicillin-clavulanate (12.5mg/kg, oral). Skin Stitches were removed 10-days postoperatively and complications were recorded.

Statistical Analysis

The obtained data were expressed as mean±SD. Statistical analysis was done by using SPSS software program (SPSS Inc.,

Chicago, USA).

RESULTS

Forty dog cases were diagnosed with intussusception. The commonly presented breed was German shepherd (42.5%), Labrador (25%), mixed breed (17.5%), and golden breed (15%). The mean±SD age was 2.56±1.0 years, (range 1.1 - 4.3). The mean±SD body weight was 20.24±6.8 kg (range 7.5 - 30.3). The gender percentages were males (67.5%) and females (32.5%). Thirty cat cases had confirmed diagnosis of intestinal intussusception. The commonly presented breed was Persian (46.67%), Shorthair (33.33%), Siamese (26.67%), and native breed (26.67%). The mean±SD age was (2.6±2.07 years) (range 0.3-4.5). The mean±SD body weight was 2.56±1.02 kg (range 0.5 - 5.1). The gender proportion for cat patients was 73.3% for males and 26.7% for females.

Clinical signs and physical findings

The most common clinical signs noted in intussusception for dogs and cat, respectively, were vomiting (80% and 83.3%), anorexia (77.5 and 63.3%), diarrhea (62.5% and 66.6%), tachycardia (33.3% and 64.6%), dehydration (67.5% and 73.3%) and abdominal distention (55% and 33.3%). On physical examination, median body temperature was 38.6 °C (range 38.1-38.9), median pulse rate was 120 beats per minute (range 100 - 148), and median respiratory rate was 30 bpm (range 24 - 36). Abdominal pain was noticed in 25/40 (62.5%) dogs and 21/30 (70%) cats, and intussusception was detected on abdominal palpation in 15/40 (37.5%) dogs and 11/30 (36.67%) cats.

Laboratory findings

Complete blood count and serum analysis tests were performed for the cases. Table 1 shows the noted results of common blood tests performed for dog and cat cases with intestinal intussusception. Leukocytosis, thrombocytopenia, hyponatremia, hypochloremia, hypokalemia, and hypoalbuminemia were mostly noted blood abnormalities.

Table 1. Findings of the common laboratory tests in dogs and cats presented with intestinal intussusception (Normal reference values according to Kaneko *et al.*, 2008 and Stockham and Scott, 2008).

Parameters	Dogs	Cats	Reference values
Hemoglobin (g/dl)	10.64±0.79.	11.92±2.57	12.0-18.0
Total WBCs (×10 ³ /mm ³)	17.86±1.90	15.60±5.01	6.0-15.0
Platelets (×10 ³ /mm ³)	176.72±38.10	152.02±24.75	200.0-500.0
Sodium (mEq/l)	117.6±45.96	135.10±44.90	145.0-185.0
Chloride (mEq/l)	92.26±14.28	89.92±8.75	107.0-113.0
Potassium (mEq/l)	3.04±1.90	2.86±1.85	3.4-5.6
Albumin (g/dl)	1.9±0.57	1.60±0.82	2.3-3.9

Imaging techniques evaluation

Abdominal radiography was accurate and diagnostic in 27/40 (67.5%) dogs and 21/30 (70%) cats with an intussusception. On radiographs, intestinal mass and intestinal loop distension with gases were noted (Figure 1). The ultrasonographic examination was done in all cases of dogs and cats, it was diagnostic in 35/40 (87.5%) dogs and 24/30 (80%) cats. On a cross view, the position of the wall layers of the intussusceptum and intussusciptum created hyperechoic and hypoechoic complete concentric rings, with a hyperechoic center referred to as the "target-like lesion" or

"multiple concentric rings sign. Measurements of the diameter of the target-like mass of the intussuscepted bowel were 26.81 ± 3.2 mm (range 20-31) in dogs, and 22.94 ± 4.13 (range 15-29 mm) in cats. (Figures 2A and B). On a longitudinal ultrasonographic view, multiple hyperechoic and hypoechoic parallel lines were the predominating ultrasonography pattern (Figure 3). Computed tomography was an effective and accurate diagnostic method for diagnosing three cats with intussusception after the failure of radiography and ultrasonography in diagnosing them. CT sections perpendicular to the intussusception demonstrate target-like mass with enveloped eccentrically located areas of hypo-density and interspersed hyper- and hypo- density stripes within the intussusceptions (Figure 4).

dogs and 6 (20%) cats. Manual reduction combined with intestinal resection and anastomosis was performed in 29/35 (72.5%) dogs and 22/35 (73.33%) cats. In 33/40 (82.5%) dogs and 24/30 (80%) cats, the cause was undetected – (idiopathic). In the other remaining cases, fecal parasitism (3 dogs and 3 cats), intestinal foreign body (2 dogs and 1 cat), and lymphoma (2 dogs and 2 cats) were recorded as primary causes (Figure 6).



Figure 1. A representative abdominal radiography of a dog patient with intussusception showing radiographic evidence of filling the intestinal loops with gases distension (arrow).

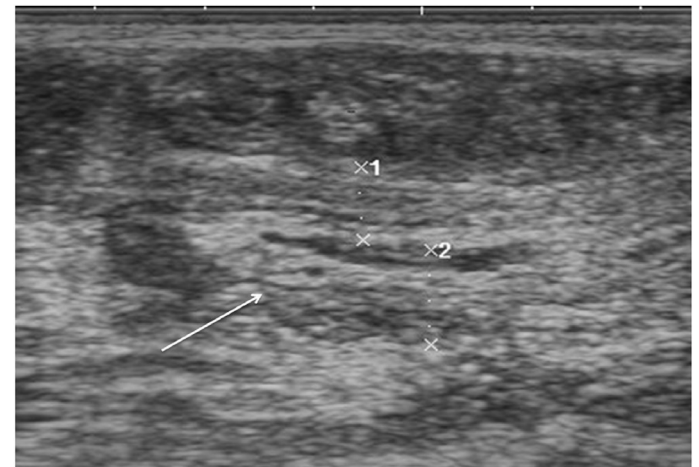


Figure 3. Longitudinal ultrasonographic image of a dog patient with intestinal intussusception showing multiple well-differentiated hyperechoic and hypoechoic parallel lines (arrow).

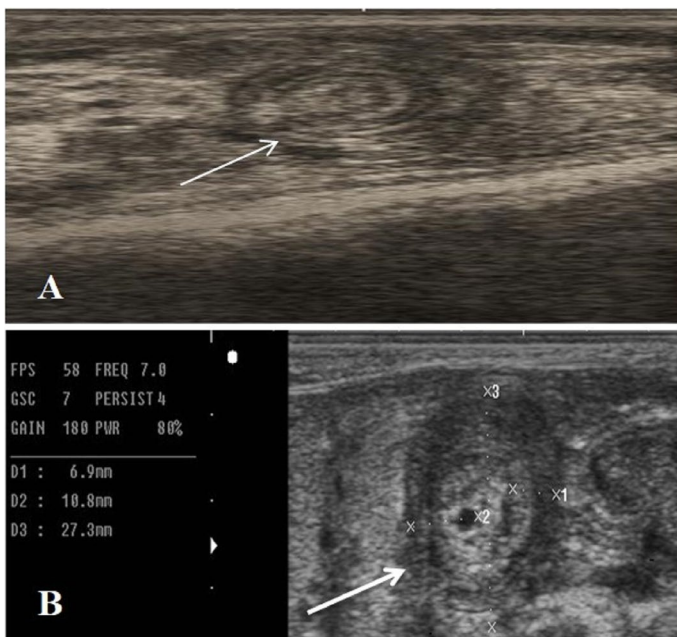


Figure 2. (A) Ultrasonographic pattern of intestinal intussusception of one-year cat (target-like lesion, arrow) with intussusception showing thick complete concentric rings and hyperechoic compressed serosal and mucosal layers. (B) Measurement of the diameter of the target-like lesion (27.3mm, arrow) in a dog case with intestinal intussusception.

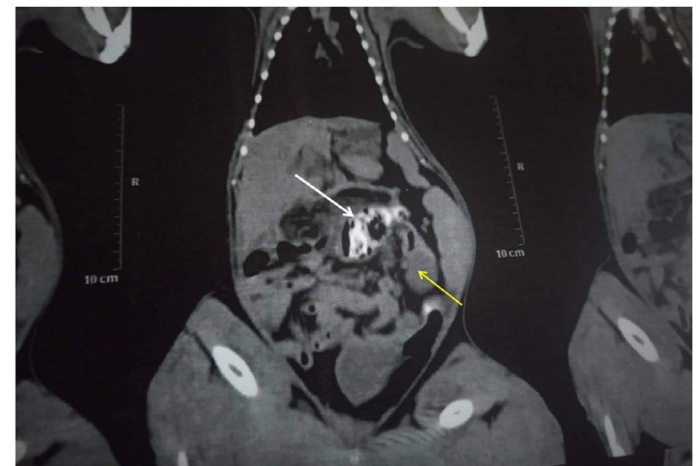


Figure 4. A representative computed tomographic image (dorsal plane) of intestinal intussusception in a cat, caused by foreign body. The white arrow indicates focal mineral opacity of a bone causing intussusception. The yellow arrow indicates fluid-distended small intestines.

Surgical findings of intussuscepted cases

36/40 dogs and 28/30 cats with intussusception had undergone laparotomy (Figure 5). Intussusception was noted at the following locations: ileocolic junction 17/40 (42.5%) for dogs and 12/30 (40%) for cats, jejunojejunal 12/40 (30%) for dogs and 7/30 (23.3%) for cats, jejunocolic 4/40 (10%) for dogs and 4/30 (13.3%) for cats, and duodenojejunal 3/40 (7.5%) for dogs and 5/30 (16.67%) for cats. Manual reduction performed in 7 (17.5%)



Figure 5. Resection operation of the necrosed intussuscepted part of a 1.5-year cat.

Complications and outcomes

Five dogs died (12.5%) of these dogs, 4 dogs died pre-operatively and 1 died post-operatively. Three cats died (10%); two cases died pre-operatively and 1 died post-operatively. Intraoperative surgical complications included serosal tearing that occurred while performing manual reduction in 5 dogs and 3 cats. Postoperative complications included mechanical intestinal obstruction in 2 (5%) dogs and 1 (3.33%) cat for reasons of adhesion formation. Skin wound dehiscence occurred in 6 (15%) dogs and 4 (13.33%) cats. Recurrence of intussusception was noted in only 1 (2.5%) dog. The overall survival rate post-operatively was 87.5 for dogs and 90% for cats. The mortality rate was 12.5%, and 10% for dogs and cats, respectively.

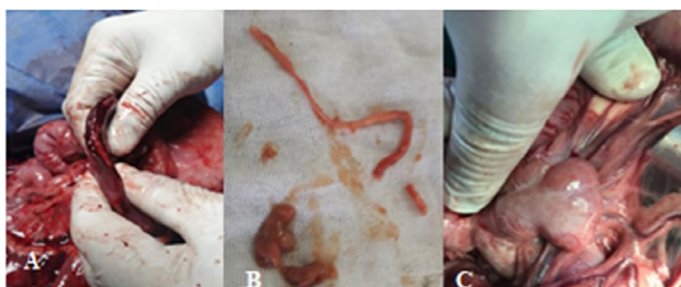


Figure 6. (A) Tearing of the intestinal serosa during manual reduction. (B) parasitic infestation and (C) lymphoma were detected during surgery as causes of intestinal intussusception.

DISCUSSION

This study clinically described the main features of intussusception in dogs and cats in Egypt, the dog breeds over-presented were German shepherd (42.5%), and Labrador Retriever (25%), which were consistent with previous studies (Sivasankar, 2000; Jennes, 2022) were in disagreement with the study finding and recorded a prevalence of Labrador Retriever 14.4%, whereas German Shepherd dog 9.2% (Larose *et al.*, 2020) this result attributed to country-to-country variation or there was either difference in feeding regimens, genetic susceptibility, behavior, and the type of feed. In cats, the over-presented breeds were Persian (46.67%) and shorthair (33.33%) this result was similar to results reported by (Nordquist and Culp, 2013), and unlike that reported by (Larose *et al.*, 2020). This might be due to the increased interest of people in our society to keep these breeds. The mean age affected was (2.56±1.0 year) for dogs, (2.56±1.0 year) for cats this was similar to that described in previous studies (Nordquist and Culp, 2013). The mean body weight was 20.24±6.8 kg for dogs, and (2.56±1.02 kg) for cats. Like the previous report (Larose *et al.*, 2020), the over-presented gender was males in both dogs (67.5%) and cats (73.3%).

Herein and like other retrospective studies (Applewhite *et al.*, 2002; Larose *et al.*, 2020), the common clinical signs recorded were vomiting, anorexia, diarrhea, and dehydration. The most common clinical signs were vomiting (80% and 83.3) in dogs and cats respectively due to gastrointestinal obstruction and this finding was in accordance with Tams and Seim (2013). Anorexia (77.5 and 63.3%), diarrhea (62.5% and 66.6%), tachycardia (33.3% and 64.6%), dehydration (67.5% and 73.3%), and abdominal distention (55% and 33.3%) for dogs and cats, respectively.

Radiography was diagnostic in 67.5% of dogs and 70% of cats with an intussusception. This was inconsistent with another previous study (Drost *et al.*, 2016), where the noted specificity of radiography for diagnosing intussusception cases was (69.4%). Moreover, and relative to another study where the effectiveness of the ultrasound examination was 88.2% of intussusception cases (Madany *et al.*, 2020), we also found that ultrasonographic examination was effective in diagnosing 87.5% of dogs and

80% of cats. Concerning the ultrasonographic cross-section, the intussuscepted part appeared as a "target-like lesion" or "multiple concentric rings sign, this shape representing the hypoechoic mucosal edema and the hyperechoic compressed serosal and mucosal layers, whereas in longitudinal ultrasonographic section appeared with multiple hyperechoic and hypoechoic parallel lines that were the predominating ultrasonography pattern (Lee *et al.*, 2005; Nyland *et al.*, 2015). On our sonar images, our results indicate the measurements of the diameter of the target-like mass of the intussuscepted bowel was (26.81±3.2) in dogs and (22.94±4.13). Similarly, it has been reported in dogs that the diameter of the target-like mass ranged from 19 to 29 mm (Patsikas *et al.*, 2008) or ranged from 16 to 32 mm in cats (Patsikas *et al.*, 2003). Additionally, as observed, CT sections demonstrated target-like mass with enveloped eccentrically located areas of hypodensity and interspersed hyper- and hypo-density stripes within the intussusceptions this results as previously described (Patsikas *et al.*, 2019).

The most common laboratory findings observed in the present study for both dogs and cats were a decrease in the hemoglobin level, leukocytosis, thrombocytopenia, hyponatremia, hypochloremia, hypokalemia, and hypoalbuminemia. These results were in agreement with the findings of Boag *et al.* (2005); Kaewamatawong *et al.* (2010). On the contrary, a previous study found hyperkalemia in the serum of dogs had double intussusception of the intestine. These results were attributed to that those dogs were presented with vomiting which accordingly led to disturbance in the potassium level (Kim *et al.*, 2012).

In this study, the ileocolic junction (ICJ) was found most common location for intussusception in dogs and cats (50% and 47.7%, respectively). In this regard, as previously reported, ICJ was the common site of intussusception (43.1%) (Larose *et al.*, 2020), The reason is explained based on the lack of homogeneity theory. Based on this theory the sudden change in the diameter of the bowel in the case of ileocolic junction can lead to inhomogeneity of the bowel wall that can alter motility and predispose to the occurrence of the condition (Lewis and Ellison, 1987).

As described by other groups (Brown, 2003; Larose *et al.*, 2020), most of the dogs and cats involved in this study were treated with a manual reduction in combination with IRA (72.5% and 73.33%, respectively).

The primary causes for intussusception could not be identified in 82.5% (dogs) and 80% (cats) and thus those cases were categorized as idiopathic intussusception (Lewis and Ellison, 1987; Applewhite *et al.*, 2001; Larose *et al.*, 2020), overestimation of the idiopathic cause of intussusception in this study may be attributed to lack of fecal examination and histopathological evaluation of resected part of the intestine.

Like previous observations, the obtained results revealed that skin wound dehiscence, mechanical intestinal obstruction, and recurrence of intussusception mostly occurred complications which are in line with previous reports of IRA outcomes (Levitte and Bauer 1992; Applewhite *et al.*, 2002; Ralphs *et al.*, 2003; Davis *et al.*, 2018).

CONCLUSION

Herein, clinical findings, laboratory analysis, diagnostic imaging, management, and outcome of intestinal intussusception were described for the first time in dog and cat patients in Egypt. Moreover, this study suggests that early presentation, diagnosis, and surgical intervention are necessary to improve the outcome and reduce the simultaneous complications.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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