

A case report on the Implementation of contrast radiography for the diagnoses of Jejunojejunal Intussusception and its surgical management in a Persian cat



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A case report on the Implementation of contrast radiography for the diagnosis of Jejunojejunal Intussusception and its surgical management in a Persian cat



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List of abbreviations and symbols used

Abbreviations and symbols	Elaboration
CVASU	Chittagong Veterinary & Animal Sciences University
TTPHRC	Teaching and training pet hospital and research center
GIT	Gastrointestinal tract
CT	Computed tomography
MR	Manual reduction
IRA	Intestinal resection and anastomosis (IRA)
kg	Kilogram
e.g.	Example
<i>et al.</i>	And his associates
etc.	Et cetera
%	Percent
/	Per

Abstract

Intussusception is one of the most common cause of bowel obstruction in small animals practice. The purpose of the study was to assess how contrast radiography identify the gastrointestinal blockage and also to share the successful correction method. A 7-months old female Persian cat was referred to Teaching and Training Pet Hospital and Research Center (TTPHRC), Purbachal, Dhaka, because of chronic vomiting, anorexia, weight loss, severe dehydration lasting 31-days. On abdominal palpation, a sausage like firm mass was palpated in the abdomen. No common predisposing factors could be established. At diagnosis part, a barium contrast meal was offered to the patient and the gastrointestinal tract was imaged radiographically at 20-30 minutes' interval. The patient showed radiographic evidence of gastric dilatation, filling up of the barium meal in the stomach, gastric distention of the small intestine and a diagnosis of bowel obstruction was made tentatively. A surgical operation was decided upon immediately to correct the obstruction. Following exploratory laparotomy revealed presence of intussusception and concrete diagnosis was made as jejunojejunal intussusception. The intussuscepted segments were removed perfectly by applying manual traction without serosal adhesions. As a result of intensive and supportive postoperative care, the patient fully recovered without facing any complications even after poor general condition. Therefore, the author can conclude that contrast radiography imaging technique was useful in diagnosing the gastrointestinal obstruction and will be helpful in early detection and to provide proper therapy. And finally, good prognosis depends on prompt and concrete diagnosis and exact treatment with considering underlying disease conditions.

Keywords: Intussusception, gastrointestinal obstruction, contrast radiography, laparotomy, jejunojejunal intussusception.

Introduction

Gastrointestinal (GI) obstruction is a common incidence in small animal practice. Intestinal intussusception in small animals has been well described in the veterinary literature. Intestinal Intussusception stands for the telescoping or invagination of a portion of the intestine (intussusceptium) into the lumen of an adjacent intestinal segment (intussusciens) (Allman and Pastori, 2013). It has been recorded as a common cause of bowel obstruction in dogs and cats (Larose et al., 2020). It also happens due to changes in peristaltic movement of intestine and has been found in various animal species, including humans (Queiroz et al., 2015). Although intussusception can occur in any portion of the gastrointestinal tract, the most common place is in the intestine.

There are numerous causes of intestinal intussusception which includes 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). Among them, the most common causes of intestinal intussusception reported in small animals are infectious gastroenteritis and neoplasm. (Rallis et al., 2000; Howard, 2013). Linear or small foreign bodies are more likely to cause partial obstruction whereas round objects are result of complete bowel obstruction (Gibson, 2015). These aforementioned cause irritate the intestinal mucosa and then irritations 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 developing an intussusception (Madrewar and Yaqub, 2016). Gastrointestinal intussusception can occur any parts of the intestine and the most frequently reported locations for intussusception are duodenojejunal, jejunojejunal, ileocolic, and jejunocolic (Larose et al., 2020).

The most common clinical signs are associated with partial or complete bowel obstruction. Clinical signs of gastrointestinal disease can vary widely in severity, location, completeness, as well as the duration of the obstruction. The most common cardinal clinical signs that are recurrent such as vomiting, bloody mucoïd, diarrhea, anorexia, lethargy, hematochezia, abdominal pain, and palpable abdominal mass (Patsikas et al., 2008; Larose et al., 2020). If intestinal intussusception left untreated, interference with venous drainage and arterial occlusion can lead to ischemia, edematous intestinal wall and necrosis of the bowel (Horne 1991; Levitt and Bauer 1992). Depending on the causing factor, the site of obstruction also

may undergo severe tissue damage and necrosis, perforation, leading to endotoxemia, and hypovolemic shock. Therefore, gastrointestinal obstruction should be treated as an emergency (Gibson, 2015).

To diagnose the gastrointestinal diseases in Bangladesh, commonly used diagnostic aids include evaluation of clinical signs, laboratory tests, manual palpating and manipulation of the suspected area to detect the presence of foreign bodies and imaging techniques. Without advance diagnostic facilities accurate diagnoses may not always be achieved. Plain gastrointestinal radiography is often nonspecific to identify the problem, whereas ultrasonography is the most eligible means for the diagnoses of GI intussusception in both dogs and cats (Patsikas et al., 2003; Patsikas et al., 2004; Penninck, 2008). Radiography helps for the diagnosis of GI obstruction depending on the nature of the foreign body, that is, radiopaque foreign particles and complete obstruction may result in radiography findings such as ileus and dilation of the intestinal loop with fluid or gas. Ultrasonography technique has the advantages of being safe and non-invasive and can be performed without general anesthesia (Emery et al., 2015). Sonography scanning techniques of the GIT reflect the normal anatomy and appearance of the stomach, small intestine and large intestine along with the ultrasound appearance of GIT inflammation, neoplastic disorders and obstruction (Larson and Biller, 2009). Computed tomography (CT) is an another advance imaging tool and it could be also used when required to concrete the diagnoses of intestinal obstruction and intussusception in animals (Minitier et al., 2019). Gastrointestinal tract can also be investigated by means of contrast radiography, fluoroscopy (Wray and Blunden, 2006), and magnetic resonance imaging (Kuriashkin and Losonsky, 2000) in animals and humans. Contrast radiography is very useful and commonly used in detecting radiolucent foreign bodies that create filling defects and in cases of intussusception. The most commonly used contrast reagent is Barium sulphate.

Correction of intussusception typically requires surgery. Although spontaneous reduction method is commonly used in small animal practice, 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). There are some commonly noted complications after surgical treatment of intestinal intussusceptions include recurrence of the intussusception, enteric wound dehiscence, and septic peritonitis. Early stage of clinical presentation, accurate diagnosis, and surgical correction are potentially critical to improving the outcomes and restoring bowel integrity (Levitt and Bauer, 1992).

This case study assessed the use of contrast radiography as a diagnostic tool to detect the intestinal obstruction and also aims to report a case of intestinal intussusception surgically corrected by manual reduction without intestinal resection and anastomosis.

Materials and Methods

Case description:

A referral case of a 7-months female Persian cat with a complaint of 31 days of chronic vomiting, anorexia, weight loss, and severe dehydration the history of previous several unsuccessful treatments such as fluid therapy, antiemetics, motility stimulants, vitamins, and series of antibiotics, was presented to Teaching and Training Pet Hospital and Research Center (TTPHRC), CVASU, Purbachal, Dhaka.

Clinical findings:

The patient was found dull, depressed and reluctant to move. On clinical examination rectal temperature, heart rate and respiratory rate were found below the normal limits. Eventually, body weight reduced to 1.25kg from 3.4kg due to dehydration and severe alopecia noticed throughout the body. On abdominal palpation, a sausage-like mass was palpated in the middle part of the abdomen.

Diagnostic protocol:

The condition was tentatively diagnosed as a case of intestinal obstruction. For definitive diagnosis, a series of contrast radiography was decided. Initially, a plain radiograph of lateral abdominal view was taken and gas distended stomach and large intestines were observed in the radiograph (Fig- 1A). Then, about 15ml of contrast suspension (barium sulphate) was administered orally to the patient. A sequence of lateral radiographic views was taken at approximately 20-30 minutes interval of each. First contrast radiograph was exposed after 20 min of barium meal administration. The contrast media is found in the upper gastrointestinal tract (esophagus) and the contrast media flows to the proximal stomach. After that, a third number contrast radiograph shows contrast media within the stomach (Fig- 1B). Contrast radiograph exposed 3hrs of barium meal administration shows contrast media found in the small intestine without moving forwards (Fig- 1C). Finally, another contrast radiography was taken after 24 hours of administration and found no change in barium movement and confirmed intestinal obstruction (Fig- 1D). Therefore, it was decided to perform exploratory laparotomy.

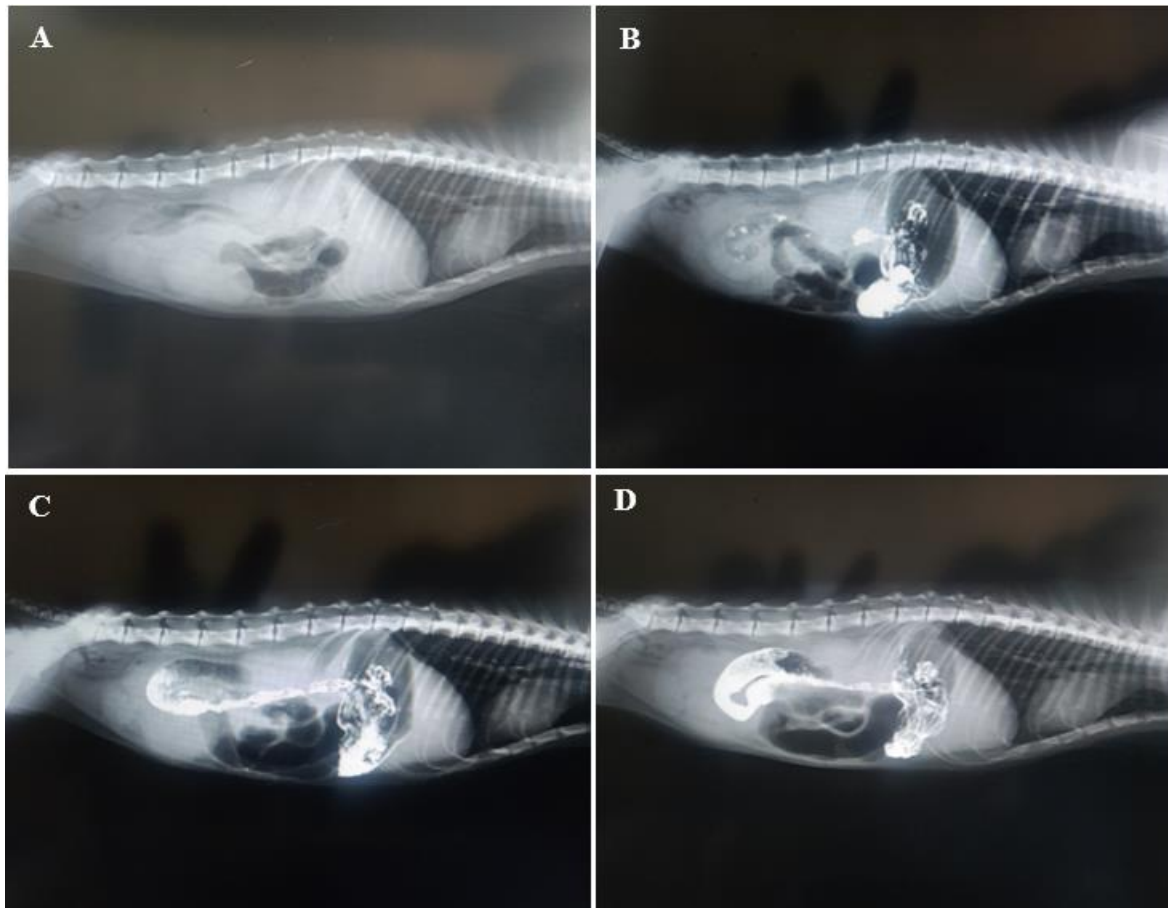


Figure-1: A) Plain abdominal radiography showing radiographic evidence of filling the intestinal loops with gas distension, B) Contrast radiograph after 45 minutes of administration demonstrating gastric filling with contrast media into the stomach, C) Contrast radiograph after 3hrs of ingestion showing forwarding contrast media into small intestine and D) Contrast radiograph after 24hrs of administration visualizing no change in location of contrast media comparing to earlier x-ray.

Treatment protocol:

The cat suffered from dehydration and was stabilized for hydration status and electrolyte imbalances by administration of fluid therapy before anesthesia and surgery. Abdominal contrast radiograph on the day of operation helps to choose the line of incision as contrast media shows the tentative obstruction region. The ventral midline was prepared aseptically for surgery. The cat was sedated with Xylazine at the rate of 1mg/kg body weight (Xylazin®, Indian Immunologicals Ltd., Hyderabad, India) and general anesthesia was induced with ketamine at the rate of 10mg /kg body weight and maintained at the rate of 5 mg/kg body weight (Ketalar®, Popular Pharmaceuticals Ltd., Dhaka, Bangladesh). A ventral midline laparotomy incision was given from the umbilicus to pelvic symphysis. The intestines were

exteriorized carefully and gently checked for blockage part. Finally, we identified the actual cause of obstruction, that is, jejunojejunal intussusception (Fig- 2A). The intussuscepted part was carefully exteriorized and telescoped segments were easily released by meticulous manual traction without any major complications even after 31 days old case (Fig- 2B). A small portion of the mesentery was teared during manipulation (Fig- 2C) and sutured perfectly (Fig- 2D). The intestine was returned back into the abdominal cavity and the laparotomy incision was closed in a regular manner.

Postoperatively, the cat was managed with ceftriaxone 50mg per kg body weight (Trizon®, ACME Laboratories Ltd, Dhaka, Bangladesh) for 7 days and the analgesic was given, meloxicam 0.2mg/ kg body weight (Melvet®, ACME Laboratories Ltd, Dhaka, Bangladesh) once daily for three consecutive days. Intravenous fluid therapy to correct dehydration was administered until the animal was able to start feeding. Skin sutures were removed on the 14th days of operation and successful recovery was noticed without any complications.

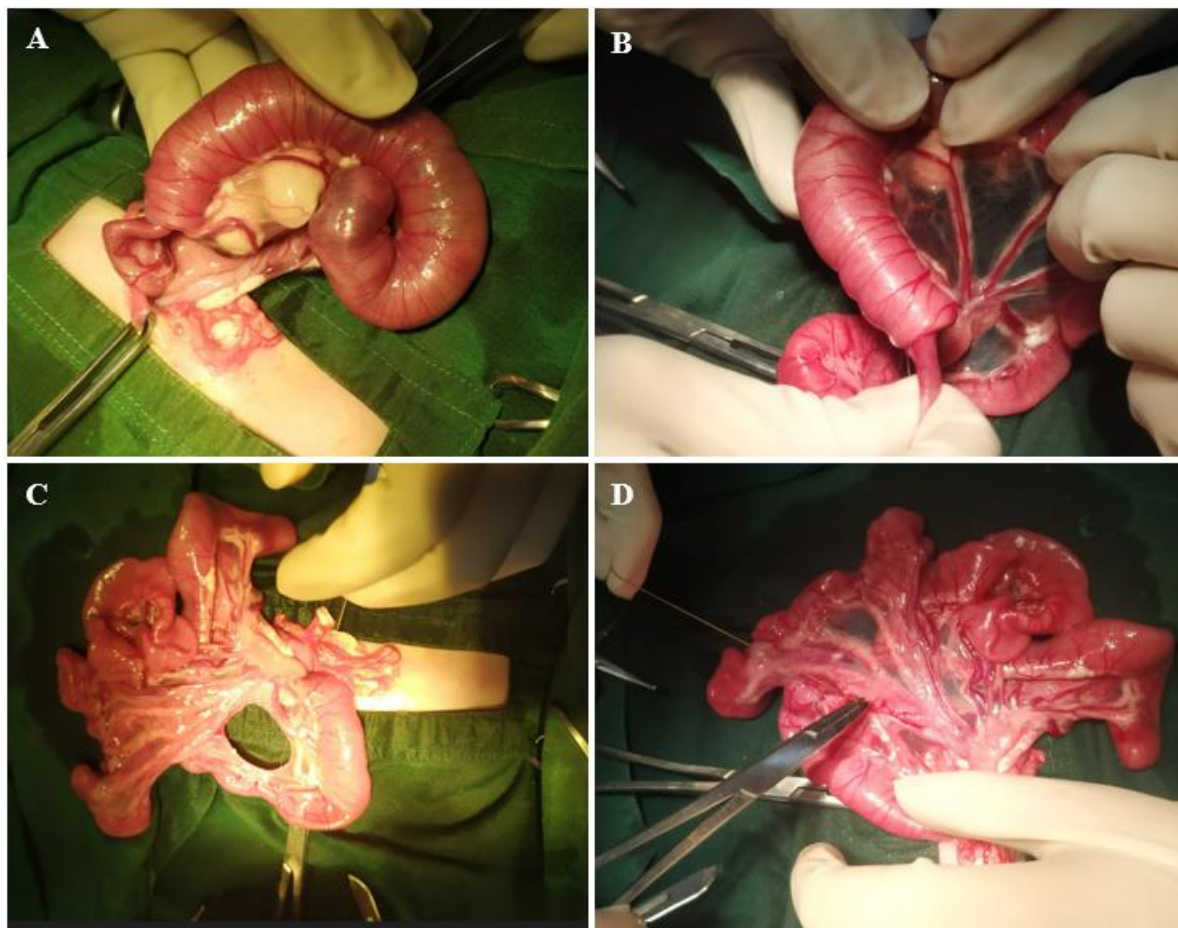


Figure-2: A) Intussusception in jejunum, B) Applying manual traction to correct intussuscepted part, C) Teared part of mesentery during manual reduction and D) Suturing the teared mesentery.

Results and Discussion

The present case was tentatively diagnosed as bowel obstruction based on history, clinical signs, palpable abdominal mass and then barium contrast radiography. On abdominal laparotomy, the condition was confirmed as jejunojejunal intussusception and successfully managed by manual traction avoiding resection. At the follow-up section, the owner ensured that the cat was doing well without facing any complexity when a telephone call was made approximately 2 months after surgery.

The word intussusception is a medical condition and the exact pathophysiology of intestinal intussusception is not clear till now. In general, any focal obstacle of bowel motility can agitate the invagination of a portion of the intestine into an adjacent part developing an intussusception. The predominance number of intussusceptions found in small animals is idiopathic (Wilson and Burt, 1974). Although distinctive causing agents have not been recognized in the induction of intussusception (Wilson and Burt, 1974), however, a number of inciting factors for intussusception have been reported and these include intestinal parasitism, linear foreign bodies, bacterial or viral-induced enteritis, intestinal masses and prior abdominal surgery and sudden diet changes causes vigorous and uncoordinated bowel motility or hypermotility and gas distension (Archer et al. 1988; Okamoto et al. 2007; Pravettoni et al. 2009, Rallis et al., 2000; Applewhite et al., 2001; Applewhite et al., 2002; Madrewar and Yaqub, 2016; Ko et al., 2020). Even though, several aforementioned conditions were responsible for the occurrence of intussusception, no common etiological cause could be established from our study but there was a history of diet change which could be the reason behind this or maybe idiopathic intussusception.

Clinical signs may differ with the amount of obstruction and the duration of the disease process. In our study, we raised common clinical signs which were chronic vomiting, anorexia, weight loss, severe dehydration and generalized alopecia. Like other studies (Applewhite et al., 2002; Larose et al., 2020; Ibrahim et al., 2022), the same common clinical signs recorded were vomiting, anorexia, diarrhea, and dehydration. In the report of Ibrahim et al., 2022, the most common clinical signs were vomiting (80% and 83.3%) in dogs and cats respectively due to gastrointestinal blockage and this finding was in accordance with Tams and Seim, 2013. On physical examination, we revealed a palpable sausage-like abdominal mass and some authors

have mentioned principal signs of intussusception as vomiting, and bloody mucoid diarrhea with a palpable cylindrical abdominal mass (Lewis and Ellison, 1987).

Contrast radiography was the main diagnostic tool in the present study and it was effective in confirming a presumptive diagnosis of intussusception. In our study, the diagnosis of intussusception was also accelerated by the ability of the clinician to palpate an abdominal mass. In small animals, diagnosis relies on patient history and physical findings, specifically palpation of an abdominal mass (Levitt and Bauer 1992; Patsikas et al. 2008). The report of Levitt and Bauer, 1992, identified 53.7% of cases by palpable abdominal mass (three cats, 17 dogs). Gastrointestinal contrast radiography is categorized into two types: upper gastrointestinal study, barium swallow, which is a radiographic contrast study showing the esophagus, stomach and small intestine and lower gastrointestinal study, commonly known as a barium enema, a radiographic contrast study reflecting rectum, colon and cecum (Lennox, 2013). Contrast barium enemas are used to relief enterocolic intussusception in human infants (Franken et al., 1983). Though in veterinary literature, there are no specific successful records of barium enemas; Levitt and Bauer 1992, have recorded one clinical case in their study that was successfully reduced by barium enemas. By plain radiography definitive diagnosis of an intussusception is difficult. On plain radiographs, the formation of gas can be observed proximal to the intussusception (Kumar et al., 2012). Ibrahim et al., 2022, reported radiography was appropriate diagnostic tools in 67.5% of dogs and 70% of cats having an intussusception. Similar result also found in another study (Drost et al., 2016), where by using radiography intussusception was diagnosed in 69.4% cases. The importance of ultrasonography in veterinary diagnosis is only next to radiography and is complimentary but we did not use it as a diagnostic tool in our study. There is a variety use of ultrasonography to adequate diagnosis of gastrointestinal obstruction and if we used it, could be easy in the diagnosis process in our study. However, many authors reported the use of ultrasonography to find out the probable cause of bowel obstruction in animals. About 88.2% efficacy of intussusception cases found in ultrasound examination (Madany et al., 2020), likewise Ibrahim et al., 2022, also found that ultrasonography examination was accurate in diagnosing 87.5% of dogs and 80% of cats. Even if, the radiology is quick and easily detectable, ultrasound diagnosis needs a more than average ability to identify. However, both imaging techniques are found to adequately demonstrate gastrointestinal obstruction to facilitate early therapeutic intervention.

The treatment goal of intussusception is to correct the both intussusceptum part and the intussusciptien part and restore gastrointestinal tract patency. An exploratory laparotomy was

necessary in the present study for a definitive diagnosis as jejunojejunal intussusception. In this case, though the general condition of the patient was critical, surgery was urgently needed to correct the underlying cause and intussusception was corrected successfully by manual traction without any serosal adhesions. However, there are multiple correction methods of intussusception which were mentioned by different authors during their research work. However, most cases are treated surgically during exploratory laparotomy for a definite diagnosis. The surgical treatment of gastrointestinal intussusception includes either manual reduction, resection and re-anastomosis, or both (Ellison, 2014) but the decision relies on the surgeon's gross evaluation of the viability of the intestinal segments of the intussusception (Levitt and Bauer 1992). Manual traction is possible when serosal adhesions are less but there is a risk of serosal rupture or vascular damage (Erkert et al. 2003). If manual reduction is not possible, resection of the intussuscepted part and intestinal anastomosis, mostly end-to-end type, is performed. Surgical resection and anastomosis of the intussusception are recorded to minimize the incidence of recurrence when compared with manual traction (Larsen and Bellenger, 1974).

The prognosis of intussusception depends largely on the duration of the lesion present prior to surgical correction, anatomical location, degree of mechanical obstruction, and the etiological cause (Levitt and Bauer 1992 and Erkert et al. 2003). Underlying systemic disease processes may increase morbidity and mortality rates. Patients suffering from intestinal obstruction should immediately undergo surgery (Valiei and Beheshti, 2011). Any delay in treatment makes a poorer prognosis. Despite, our patient was severely dehydrated and emaciated at admission, recovered perfectly and this could become possible via intensive post-operative care.

Conclusion

Gastro-intestinal intussusception is a life-threatening condition that requires an accurate, early recognition and prompt diagnosis with the urgent surgical approach. The cat with acute enteritis or gastroenteritis, intestinal masses, parasites, intestinal foreign bodies and abdominal surgery were the predisposing factors leading to intussusceptions in younger cats. The most common type of intussusception was the ileocolic. Animals suffering from intussusceptions have been having episodes of anorexia, depression, vomiting, and diarrhea. After a series of radiography, a sausage-shaped structure was revealed that led us to surgical intervention. In this case, manual traction without resection had been performed as there was less serosal adhesion. No postoperative recurrence was observed. The high survival rate that was achieved was due to the effective preoperative, surgical and post-operative therapy that was implemented. So, Immediate systemic stabilization of the patient followed by surgical correction of the intussusception, is possible to a successful outcome.

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References

- Allman, D.A., Pastori, M.P., 2013. Duodenogastric intussusception with concurrent gastric foreign body in a dog: A case report and literature review. *Jaaha*. 49, 64-69.
- Applewhite, A.A., Cornell, K.K., Selcer, B.A., 2002. Diagnosis and treatment of intussusceptions in dogs. *Comp, end. Contin. Educ. Vet.* 24, 110-127.
- Applewhite, A.A., Hawthorne, J.C., Cornell, K.K., 2001. Complications of enteroplication for the prevention of intussusception recurrence in dogs: 35 cases (1989-1999). *J Am. Vet. Med. Assoc.* 219, 1415- 1418.
- Archer, R.M., Cooley, A.J., Hinchcliff, K.W. and Smith, D.F., 1988. Jejunojejunal intussusception associated with a transmural adenocarcinoma in an aged cow. *Journal of the American Veterinary Medical Association*, 192(2), pp.209-211.
- Ellison, G.W., 2014. Intestinal Resection and anastomosis. In: Bojrab MJ, ed. *Current Techniques in Small Animals Surgery*. 5th eds. Philadelphia: Lea and Febiger, pp.280-303.
- Emery, L., Biller, D., Nuth, E., Haynes, A., 2015. Ultrasonographic diagnosis of gastroesophageal intussusception in a 7 week old german shepherd. *Israel Journal of Veterinary Medicine* 70, 41-46.
- Erkert, R.S., Crowson, C.L., Moll, H.D., Bentz, B.G., Confer, A.W. and Blaik, M.A., 2003. Obstruction of the cecocolic orifice by ileocecolic intussusception following jejunocecostomy in a horse. *JOURNAL-AMERICAN VETERINARY MEDICAL ASSOCIATION*, 222(12), pp.1743-1745.
- Franken Jr, E.A., Smith, W.L., Chernish, S.M., Campbell, J.B., Fletcher, B.D. and Goldman, H.S., 1983. The use of glucagon in hydrostatic reduction of intussusception: a double-blind study of 30 patients. *Radiology*, 146(3), pp.687-689.
- Gibson, W.G., 2015. *Gastrointestinal Obstruction in Small Animals*, Merck's manual. GA No. 13.
- Horne, M.M., 1991. Colonic intussusception in a Holstein calf. *The Canadian Veterinary Journal*, 32(8), p.493.
- Howard, B.G., 2013. Sistema Alimentar, Peritônio, Omento, Mesentério e Cavidade Peritoneal. *Bases da Patologia em veterinária*, pp.324-406.

- Ibrahim, N., Elmezyen, A.E., Abd-Elmaboud, M. and Ismail, A.A., 2022. Evaluation of Dog and Cat Patients with Intestinal Intussusception: A Retrospective Study in Egypt. *Journal of Advanced Veterinary Research*, 12(6), pp.706-710.
- Ko, H.Y., Kim, J., Geum, M., Suh, G.H., Shin, S.S., Kim, H.J., 2020. Cecocolic intussusception caused by *Ancylostoma caninum* infection in a dog. *J. Vet. Clin.* 37, 106-108.
- Kumar, V., Ahmad, R.A. and Pathak, R., 2012. Ileocolic Intussusception and its Surgical management in a Labrador Pup. *Intas Polivet*, 13(1), pp.108-110.
- Kuriashkin, I.V. and Losonsky, J.M., 2000. Contrast enhancement in magnetic resonance imaging using intravenous paramagnetic contrast media: a review. *Veterinary Radiology & Ultrasound*, 41(1), pp.4-7.
- Larose, P.C., Singh, A., Giuffrida, M.A., Hayes, G., Moyer, J.F., Grimes, J.A., Runge, J., Curcillo, C., Thomson, C.B., Mayhew, P.D., Bernstein, R., Dominic, C., Mankin, K.T., Regier P., Case, J.B., Arai, S., Gatineau, M., Liptak, J.M., Bruce, C., 2020. Clinical findings and outcomes of 153 dogs surgically treated for intestinal intussusceptions. *Veterinary Surgery* 49, 870-878.
- Larsen, L.H. and Bellenger, C.R., 1974. Stomach and Small Intestine. In: Archibald J, eds. *Canine Surgery*. 2nd ed. California: American Veterinary Publications, Santa Barbara, pp.583-585.
- Larseny, L.H. and Bellenger, C.R., 1974. Stomach and Small Intestine. In: Archibald J, eds. *Canine Surgery*. 2nd ed. California: American Veterinary Publications, Santa Barbara, pp.583-585.
- Larson, M.M. and Biller, D.S., 2009. Ultrasound of the gastrointestinal tract. *Veterinary Clinics of North America: Small Animal Practice*, 39(4), pp.747-759.
- Lennox, A.M., 2013. Radiographic interpretation of the abdomen. In *BSAVA Manual of Rabbit Surgery, Dentistry and Imaging* (pp. 84-93). BSAVA Library.
- Levitt, L. and Bauer, M.S., 1992. Intussusception in dogs and cats: A review of thirty-six cases. *Canadian Veterinary Journal, Canadá*, 33(10), pp.660-664.
- Lewis, D.D. and Ellison, G.W., 1987. Intussusception in dogs and cats. *Compend Contin Educ Pract Vet*, 9(5), pp.523-533.

- Madany, J., Milczak, A., Wrześniewska, K.B., Martinez, M.T., 2020. Diagnosis of gastrointestinal obstruction in dogs and cats using ultrasound – a retrospective study of 38 cases - *Med. Weter.* 76, 212-215.
- Madrewar, C.L., Yaqub, L.C., 2016. A review of intussusception in canines. *Journal of Remount Veterinary Corps.* 55, 70-81.
- Minitzer, B.M., Goncalves, A.A., Zuckerman, J., Caceres, A.V., Ben-Amotz, R., 2019. Use of computed tomography (CT) for the diagnosis of mechanical gastrointestinal obstruction in canines and felines. *PLoS ONE* 14, e0219748.
- Okamoto, M., Itoh, H., Koiwa, M., Inagaki, M., Nadao, T., Kurosawa, T., Kawasako, K., Komine, M., Akihara, Y., Shimoyama, Y. and Miyasho, T., 2007. Intussusception of the spiral colon associated with fibroserous granulation in a heifer. *The Veterinary Record*, 160(11), p.376.
- Patsikas, M.N., Papazoglou, L.G., Adamama-Moraitou, K.K., 2008. Spontaneous reduction of intestinal intussusception in five young dogs. *J. Am. Anim. Hosp. Assoc.* 44, 41-47.
- Patsikas, M.N., Papazoglou, L.G., Papaioannou, N.G., Dessiris, A.K., 2004. Normal and abnormal ultrasonographic findings that mimic small intestinal intussusception in the dog. *J. Am. Anim. Hosp. Assoc.* 40, 147-151.
- Patsikas, M.N., Papazoglou, L.G., Papaioannou, N.G., Savvas, I., Kazakos, G.M., Dessiris, A.K., 2003. Ultrasonographic findings of intestinal intussusception in seven cats. *J. Feline Med. Surg.* 5, 335-343.
- Penninck, D., 2008. Gastrointestinal tract. In: *Atlas of Small Animal Ultrasonography*. Penninck, D., d'Anjou M.A. Editors, Ames: Blackwell Publishing, pp. 281-337
- Pravettoni, D., Morandi, N., Rondena, M., Riccaboni, P., Zani, D.D., Scandella, M. and Belloli, A.G., 2009. Repeated occurrence of jejuno-jejunal intussusception in a calf. *The Canadian Veterinary Journal*, 50(3), p.287.
- Queiroz, R.M., Botter, L.A., Gomes, M.P. and Oliveira, R.G.G., 2015. Enteroenteric intussusception in an adult caused by an ileal angiomyolipoma. *Radiologia Brasileira*, 48, pp.339-340.
- Rallis, T.S., Papazoglou, L.G., Adamama-Moraitou, K.K., Prassinou, N.N., 2000. Acute enteritis or gastroenteritis in young dogs as a predisposing factor for intestinal intussusception: a retrospective study. *J. Vet. Med. A Physiol Pathol. Clin. Med.* 47, 507-511.

Tams, T. and Seim, H., 2013. Gastrointestinal foreign body obstruction in dogs. *Western Vet. Conf. SA*. 290, pp.1-7.

Valiei, K. and Beheshti, R., 2011. Double intussusception in dog. *Asian Journal of Animal and Veterinary Advances*, 6(9), pp.971-976.

Wilson, G.P. and Burt, J.K., 1974. Intussusception in the dog and cat: a review of 45 cases. *Journal of the American Veterinary Medical Association*, 164(5), pp.515-518.

Wray, J.D. and Blunden, A.S., 2006. Progressive dysphagia in a dog caused by a scirrhous, poorly differentiated perioesophageal carcinoma. *Journal of small animal practice*, 47(1), pp.27-30.

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