

CASE REPORT

Successful surgical management of pancreatic torsion in a 3-month-old Bernese Mountain dog without evidence of long-term pancreatic dysfunction

Ivan A Moses  | Theresa C Hallowell

Emergency and Critical Care Department,
Ocean State Veterinary Specialists, East
Greenwich, Rhode Island, USA

Correspondence

Dr Ivan Moses, Emergency and Critical Care
Department, Ocean State Veterinary
Specialists, 853 Gilbert Stuart Rd,
Saunderstown, East Greenwich, RI 02874.
Email: ivan_moses@hotmail.com

Abstract

To describe the clinical presentation, diagnosis, perioperative management and the short- and long-term outcomes of a dog diagnosed with pancreatic torsion. A 3-month-old female intact Bernese Mountain dog presented for an acute onset of vomiting, anorexia and abdominal pain. Abdominal ultrasonography showed a hypoechoic mass effect cranial to the stomach. A pancreatic torsion was diagnosed during exploratory laparotomy and treated with partial pancreatectomy. Histopathology confirmed pancreatic torsion. The patient recovered uneventfully and pancreatic function and inflammation testing that was performed 14 months postoperatively showed no evidence of ongoing dysfunction. This is the first report that demonstrates long-term follow-up with pancreatic function testing in a patient who had a partial pancreatectomy due to pancreatic torsion. There was no evidence of long-term pancreatic dysfunction due to partial pancreatectomy secondary to pancreatic torsion. Additionally, this is the youngest patient with pancreatic torsion to be described in the veterinary literature.

KEYWORDS

canine, pancreas, pancreatic lipase immunoreactivity, pancreatic torsion, partial pancreatectomy, small animal surgery

1 | CASE DESCRIPTION

A 3-month-old female intact Bernese Mountain dog was referred to a specialty veterinary referral hospital on suspicion of a gastrointestinal foreign body. She had presented to her primary care veterinarian earlier that day for evaluation of acute onset vomiting of 4-day duration. Her appetite had progressed from hyporexia to complete anorexia with no diarrhoea or change in defecation noted. She was previously healthy and incompletely vaccinated. She had a history of dietary indiscretion and had been noted to chew on plant material 4 days prior to presentation. Primary care laboratory testing revealed parvoviral antigen Snap

test negative.^a A complete blood count showed a neutrophilic leucocytosis (neutrophils $25.49 \times 10^9/L$, reference range $3-11.8 \times 10^9/L$, total white blood cells $30.32 \times 10^9/L$, reference range $6-17 \times 10^9/L$). Serum biochemistry showed a mild elevation to glucose (6.9 mmol/L, reference range 3.3–6.1 mmol/L), phosphorous (0.48 mmol/L, reference range 0.16–0.37 mmol/L), total calcium (0.67 mmol/L, reference range 0.48–0.61 mmol/L), alkaline phosphatase (260, reference range 20–150 U/L) and amylase (1564, reference range 200–1200 U/L). There was also noted to be a mild decrease in globulins (1.1 mmol/L, refer-

^a CPV Antigen SNAP Parvo, IDEXX Laboratories, Westbrook, ME, USA.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2024 The Authors. *Veterinary Medicine and Science* published by John Wiley & Sons Ltd.



FIGURE 1 Ventrodorsal abdominal radiograph with soft tissue mass effect highlighted by arrows in a 3-month-old Bernese Mountain dog treated for pancreatic torsion.

ence range 1.4–3.2 mmol/L) and blood urea nitrogen (0.33 mmol/L, reference range 0.29–1.4). Abdominal radiographs performed at the primary care veterinarian showed a mild reduction in serosal detail and a suspected soft tissue opacity mass effect cranial to the stomach on the ventrodorsal view (Figure 1). Based on these findings, the patient was referred to a local referral specialty emergency hospital for further diagnostics and treatment.

Physical exam showed her to be bright, alert and responsive. She had pale pink tacky mucous membranes and was estimated to be 5% dehydrated. She was panting and noted to have mild mid-cranial abdominal discomfort on palpation without a focal mass effect palpable. There was no diarrhoea noted during rectal exam and increased borborygmi were noted on abdominal auscultation. Triage abdominal ultrasonography showed scant effusion as expected for the patient's age. A venous blood gas analysis and electrolyte analysis showed a mild hypocapnia (29.9 mmHg, reference range 30–47), low base excess (−5.2 mmol/L, reference range −5.0 to 5.0), low sodium (139 mmol/L, reference range 140–151) and low blood urea nitrogen (0.33 mmol/L, reference range 0.29–1.4). There was an ionised hypercalcaemia (1.46, reference range 1.13–1.42 mmol/L). The packed cell volume and total solids were 37% and 6.6 g/dL respectively. Prothrombin time and activated partial thromboplastin time were within normal limits.

Abdominal ultrasonography showed a 6 × 8 cm mixed echoic partially fluid filled mass between the stomach and liver, caudally displacing the stomach (Figure 2). The pancreas was evaluated and the right limb was noted to be minimally enlarged and hypoechoic with sur-

rounding hyperechoic fat consistent with inflammation. The left limb of the pancreas was not able to be identified. All other structures were ultrasonographically normal for the age of the patient. Based on these findings, surgical exploration was recommended.

The patient was started on intravenous fluids (lactated ringers solution – LRS^b) at a rate of 90 mL/kg/day and administered maropitant citrate^c 1 mg/kg IV. After 6 h of rehydration and volume replacement, the patient was premedicated with midazolam^d 0.3 mg/kg, fentanyl^e 5 µg/kg, ketamine^f 4 mg/kg IV. General anaesthesia was induced with propofol^g IV to effect (required 1.8 mg/kg to facilitate intubation). The patient was intubated and maintained on 100% oxygen with sevoflurane^h gas inhalant anaesthesia. A transabdominal plane block under ultrasonographic guidance (bupivacaineⁱ 1 mg/kg, ketamine 1 mg/kg, dexmedetomidine^j 1 µg/kg) was performed preoperatively for analgesia (Campoy et al., 2022). During preparation for surgery, a single dosage of glycopyrrolate^k 0.02 mg/kg IV was administered once for relative bradycardia. Perioperative antibiotic coverage was cefazolin^l 22 mg/kg IV Q 90 min under anaesthesia. In surgery, a single 10 mL/kg bolus of LRS was required for a transient mild hypotensive episode.

A routine 18 cm ventral midline celiotomy was performed, and the falciform fat was excised with electrosurgery^m to aid exposure and surgical manipulations. A mild volume of serosanguinous fluid was noted within the abdomen and a 5 mm umbilical hernia was also identified. The distal 2/3 of the left pancreatic limb was noted to be severely engorged, firm and reddened (approximately 4 cm × 6 cm) (Figure 3). There was an apparent torsion immediately proximal to this area of the pancreas. Pancreatic tissue proximal to the torsion appeared normal. The torsed left pancreas was excised with a ligasure vessel sealing deviceⁿ as previously described (Wouters et al., 2011). No other abnormalities were identified within the abdomen. The abdomen was lavaged with 0.9% sterile saline^o and closed with a routine 3 layer closure (linea alba with 0 polydioxanone,^o subcutis and intradermal layers with 3/0 poliglecaprone 25^p). The umbilical hernia was repaired during the primary abdominal closure. A nasogastric feeding tube was placed during recovery due to concern for postoperative pancreatitis in the remaining organ and to enable early enteral nutrition.

The patient recovered uneventfully from anaesthesia, postoperative analgesia and anxiolysis provided with fentanyl CRI @ 3 µg/kg/h, gabapentin^q 100 mg PO Q8, trazodone^r 75 mg PO Q8 as required. The patient was continued on IV fluid therapy (LRS @ 90 mL/kg/day);

^b Lactated Ringer's Injection USP, Baxter, Deerfield, IL, USA.

^c Maropitant citrate, Cerenia, Zoetis, Kalamazoo, MI, USA.

^d Midazolam injection USP, Almaject Inc., Morristown, NJ, USA.

^e Fentanyl citrate injection USP, Fresenius Kabi, Lake Zurich, IL, USA.

^f Ketamine hydrochloride injection, Dechra Veterinary Products, Overland Park, KS, USA.

^g Propofol injectable emulsion, Sagent Pharmaceuticals, Schaumburg, IL, USA.

^h Sevoflurane USP, Lannett Company Inc, Philadelphia, PA, USA.

ⁱ Bupivacaine hydrochloride injection USP, Hospira Inc, Lake Forest, IL, USA.

^j Dexmedetomidine Hydrochloride, Dexmedes, Dechra Veterinary Products, Overland Park, KS, USA.

^k Glycopyrrolate injection USP, Hikma Pharmaceuticals USA Inc., Berkeley Heights, NJ, USA.

^l Cefazolin for injection, USP, Hikma Pharmaceuticals USA Inc., Berkeley Heights, NJ, USA.

^m Covidien Ligasure 10 mm to 20 cm handpiece on a Covidien Valleylab Forcetriad Unit, Medtronic, Minneapolis, MN, USA.

ⁿ 0.9% Sodium chloride irrigation USP, B Braun, Irvine, CA, USA.

^o PDS*Plus Antibacterial, Polydioxanone suture, Ethicon, Raritan, NJ, USA.

^p Monocryl* Poliglecaprone 25 suture, Ethicon, Raritan, NJ, USA.

^q Gabapentin capsules USP, ACI Healthcare USA Inc, Coral Springs, FL, USA.

^r Trazodone hydrochloride tablets USP, Zydus Pharmaceuticals (USA) Inc, Pennington, NJ, USA.

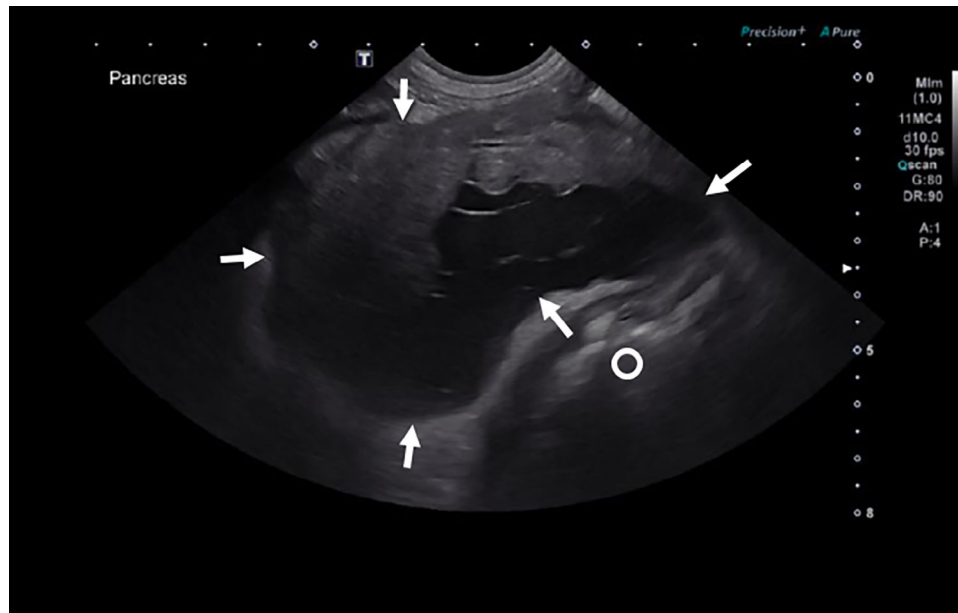


FIGURE 2 Ultrasonographic image of heterogeneous mass effect (highlighted by arrows), cranial to stomach (highlighted by circle) in a 3-month-old Bernese Mountain dog treated for pancreatic torsion.



FIGURE 3 Markedly enlarged left pancreatic limb of a 3-month-old Bernese Mountain dog treated for pancreatic torsion. Arrow indicates engorged distal tip. Circle indicates proximal point of torsion.

this was weaned to the calculated RER when hydration had improved on physical exam. Prior to the commencement of nasogastric tube feeding, the patient began to eat voluntarily. The gastric residual volumes were noted to be minimal overnight, and no nausea, vomiting, or diarrhoea were noted. The patient was transitioned to oral medications (maropitant citrate[§] 30 mg, gabapentin 100 mg, trazodone 75 mg) and discharged to the owners care 28 h postpresentation through the emergency room.

Histopathology of the mass showed moderate to marked haemorrhage and oedema throughout the pancreas and peripancreatic adipose tissue with occasional fibrin thrombi. In the most severely affected areas, there was noted diffuse coagulative necrosis. Moderately affected areas had multifocal coalescing areas of coagulative necrosis. Few scattered neutrophils were noted with mild mesothelial hypertrophy. Marked pancreatic and peripancreatic haemorrhage with pancreatic infarction were noted. No evidence of neoplasia, infection or primary inflammatory disease was noted; the scant inflammation was considered response to tissue necrosis. The haemorrhage and necrosis were typical of infarction secondary to torsion.

The patient had no complications following discharge and was reportedly normal 14 days postoperatively. The owner was contacted 14 months postsurgery for long-term follow-up. The owner reported she had been clinically well with no chronic gastrointestinal clinical signs or difficulties in growth. Physical exam noted a body condition score of 7/9 and no other clinically significant abnormalities. A Texas A&M University Laboratory maldigestion profile was submitted assessing trypsin-like immunoreactivity (TLI), pancreatic

[§] Maropitant citrate, Cerenia tablets, Zoetis, Kalamazoo, MI, USA.

lipase immunoreactivity (pLI), serum cobalamin and serum folate to evaluate for evidence of chronic pancreatitis or exocrine pancreatic insufficiency. This yielded normal TLI/pLI indicating no long-term pancreatic inflammation or exocrine pancreatic dysfunction. The TLI was 21.2 $\mu\text{g/L}$, reference range 5.7–45.2 $\mu\text{g/L}$ on a fasted sample, and the pLI was 39 $\mu\text{g/L}$ with a reference range of <200 $\mu\text{g/L}$. Normal cobalamin and folate indicated no evidence of chronic enteropathy or malabsorption.

2 | DISCUSSION

To date, only a single case report describing the clinical findings and surgical management of pancreatic torsion in a dog exists in the literature (Brabson et al., 2015). This is the first recorded case with long-term follow-up of pancreatic function regarding this condition.

A torsion is a disorder whereby an organ undergoes axial rotation about its long axis that often results in occlusion of the supplying vasculature and subsequent ischaemic injury (Brabson et al., 2015). Volvulus describes rotation of an organ around the mesenteric root (Flores-Ríos et al., 2015). The author chose to use torsion as opposed to volvulus as this nomenclature is in keeping with the previously published veterinary case report and is more anatomically correct as the rotation is around the long axis rather than the mesenteric root (Brabson et al., 2015; Flores-Ríos et al., 2015). In the human literature, both volvulus and torsion have been used interchangeably to describe abnormal rotation of the pancreas with subsequent ischaemia (Chevallier et al., 2001; Colombo et al., 2020; Flores-Ríos et al., 2015; Priyadarshi et al., 2013; Seif Amir Hosseini et al., 2019; Sheflin et al., 1984; Zimmermann & Cohen, 2000). It is likely this inconsistency in nomenclature is due to the relative infrequency of this condition causing a lack of consensus in the literature. Furthermore, human pancreatic malpositioning is more commonly associated with involvement of other abdominal organs which may further confuse consistent nomenclature (Chevallier et al., 2001; Colombo et al., 2020; Flores-Ríos et al., 2015; Priyadarshi et al., 2013; Seif Amir Hosseini et al., 2019; Sheflin et al., 1984; Zimmermann & Cohen, 2000).

In both this case and the previously reported case of pancreatic torsion, the left limb of the pancreas was the affected limb (Brabson et al., 2015). Anatomically the right limb of the pancreas is embedded in the mesoduodenum and the central body is adjacent to the pylorus, whereas the left limb lies within the greater omentum, with less connective tissue attachment to surrounding anchored structures (Evans & DeLahunta, 2013). The left limb still has some anatomic attachments: the omentum and the vascular structures of the gastroepiploic, splenic and small branches of the coeliac arteries (Evans & DeLahunta, 2013). It is possible that the left limb of the canine pancreas is more susceptible to torsion due to the reduced connective tissue when compared to the mesoduodenal and pyloric attachments of the remainder of the organ.

This degree of mobility likely both facilitates the torsion and allows for the different imaging findings between the reported veterinary pancreatic torsions. In the previous report, abdominal imaging showed

a soft tissue mass effect adjacent and caudal to the greater curvature of the stomach displacing the ascending and transverse colon caudally (Brabson et al., 2015). In the current case, the torsed pancreas, detected as a mass effect, was located on the left side, cranial to the stomach and caudal to the liver. This mass was unable to be definitively linked with the pancreas ultrasonographically. Colour flow Doppler may have been helpful to demonstrate a lack of blood flow within the torsed pancreatic limb. Contrast-enhanced computed tomography (CT) would have been useful in determining the organ of origin and lack of blood flow in this case (Colombo et al., 2020; Priyadarshi et al., 2013; Seif Amir Hosseini et al., 2019; Zimmermann & Cohen, 2000). Contrast-enhanced CT was not performed in this case due to a combination of patient and logistic factors. There was poor CT availability on the day of presentation, and it was viewed that CT would not alter the owner's decision to proceed with surgical exploration. Contrast CT is the diagnostic modality of choice and is utilised in the majority of acute abdominal presentations in the human literature.

Pancreatic torsion (also referred to as pancreatic volvulus) has been rarely reported in the human literature and is often associated with splenic malpositioning (Colombo et al., 2020; Flores-Ríos et al., 2015; Priyadarshi et al., 2013). This is likely due to anatomic differences when compared to the canine patient. The human pancreas is a single tailed organ with the head anchored to the mesoduodenum and tail affixed to the splenic hilum (Standing, 2020). As such, the majority of reported pancreatic torsions are secondary to splenic torsion or 'wandering spleen' (Colombo et al., 2020; Flores-Ríos et al., 2015; Priyadarshi et al., 2013; Seif Amir Hosseini et al., 2019; Sheflin et al., 1984; Zimmermann & Cohen, 2000). It has also been reported secondary to other congenital abnormalities such as hiatal hernia (Chevallier et al., 2001). This closer association between the pancreatic tail and spleen in humans may be why pancreatic torsion in the absence of other visceral organ malpositioning has not been reported. In the human literature, there is a biphasic presentation of this wandering spleen in young rapidly growing children and women of child bearing age (Flores-Ríos et al., 2015; Priyadarshi et al., 2013; Seif Amir Hosseini et al., 2019). It is suspected that the ligamentous laxity in these groups predisposes them to 'wandering spleen' and subsequent splenic and pancreatic torsion (Flores-Ríos et al., 2015; Priyadarshi et al., 2013; Seif Amir Hosseini et al., 2019). This rapid growth and ligamentous laxity may be why the reported canine cases of pancreatic torsion have been young, rapidly growing large and giant breeds. This change of abdominal domain could be a risk factor for the development of this rare disorder in the canine patient.

As the majority of partial pancreatectomies are performed for the treatment of neoplastic conditions, there is limited information on long-term outcomes for animals treated with partial pancreatectomy (Buishand, 2022; Del Busto et al., 2020; Hixon et al., 2019; Trifonidou et al., 1998). The majority of studies evaluate survival and prognosis regarding the neoplastic cause for pancreatectomy (Del Busto et al., 2020; Hixon et al., 2019; Trifonidou et al., 1998). There was a reported 10% mortality associated with pancreatectomy primarily reported in a population of pancreatic malignancy (Wolfe et al., 2022). There is a reported 10% incidence of postoperative pancreatitis in the acute

phase and 24.2% reported vomiting (Hixon et al., 2019). In one 2020 paper, there was a 19% incidence of persistent diabetes mellitus following partial pancreatectomy for insulinoma in dogs (Del Busto et al., 2020). This paper also demonstrated a 10% incidence of suspected postoperative pancreatitis (Del Busto et al., 2020). To the author's knowledge, there is no literature reassessing exocrine pancreatic function or inflammatory markers longer term in canines. Reassessment of the TLI/PLI, once the patient was fully grown, allows us to assess for chronic inflammation or evidence of exocrine pancreatic insufficiency. In addition, the patient had no clinical signs such as polyuria, polydipsia or weight loss consistent with diabetes mellitus noted at any point. It is likely that the reason for this normal pancreatic functionality is secondary to hypertrophy of the remaining pancreas following the surgery; however, without histologic assessment of the remaining pancreas, this cannot be proven.

Histologically the submitted pancreas was less severely necrotic and inflamed when compared to previously reported pancreatic torsion (Brabson et al., 2015). This is suspected to be due to the shorter duration of clinical signs prior to presentation to the veterinarian (4 vs. 7 days), potentially indicating a more chronic torsion in the prior case (Brabson et al., 2015). The prior case also had a moderate volume sterile neutrophilic exudate, likely indicative of the greater necrosis present histologically (Brabson et al., 2015). There was a small volume of abdominal effusion present in the current case; however, this was not deemed to be outside the acceptable normal range for a 3-month-old puppy. This fluid was not sampled and an inflammatory effusion cannot be ruled out.

The clinical presentation of pancreatic torsions has been noted to be similar to many other acute abdominal presentations with clinical signs of vomiting, abdominal pain and hyporexia. Pancreatic torsion should be considered as a differential diagnosis in young large breed dogs with a mass effect in the general area. Partial pancreatectomy for pancreatic torsion is a viable treatment with good outcomes. There was no long-term pancreatic inflammation or exocrine dysfunction noted in this case.

AUTHOR CONTRIBUTIONS

Dr Ivan Moses: conceptualisation (lead), data curation, investigation (lead), methodology, writing – original draft (lead) and writing – review/editing (equal). Dr Theresa Hallowell: conceptualisation, supervision, visualisation, writing – review/editing (equal).

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest regarding this report.

FUNDING INFORMATION

The authors received no funding in the preparation or publication of this manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request

ORCID

Ivan A Moses  <https://orcid.org/0009-0008-5457-2254>

PEER REVIEW

The peer review history for this paper is available at <https://publons.com/publon/10.1002/vms3.1467>.

ETHICS STATEMENT

Institutional ethical approval was given and the study was conducted in compliance with US Animal Welfare Act guidelines for research.

REFERENCES

- Brabson, T. L., Maki, L. C., Newell, S. M., & Ralphs, S. C. (2015). Pancreatic torsion in a dog. *Canadian Veterinary Journal*, 56(5), 476–478.
- Buishand, F. O. (2022). Current trends in diagnosis, treatment and prognosis of canine insulinoma. *Veterinary Science China*, 9(10), 540.
- Campoy, L., Martin-Flores, M., Boesch, J. M., Moyal, M. N., Glead, R. D., Radhakrishnan, S., Pavlinac, R. M., Sieger, J. L., Colon, C. S., & Magidenko, S. R. (2022). Transverse abdominis plane injection of bupivacaine with dexmedetomidine or a bupivacaine liposomal suspension yielded lower pain scores and requirement for rescue analgesia in a controlled, randomized trial in dogs undergoing elective ovariohysterectomy. *American Journal of Veterinary Research*, 83(9), ajvr22030037.
- Chevallier, P., Peten, E., Pellegrino, C., Souci, J., Motamedi, J. P., & Padovani, B. (2001). Hiatal hernia with pancreatic volvulus: A rare cause of acute pancreatitis. *Ajr American Journal of Roentgenology*, 177(2), 373–374.
- Colombo, F., D'Amore, P., Crespi, M., Sampietro, G., & Foschi, D. (2020). Torsion of wandering spleen involving the pancreatic tail. *Annals of Medicine and Surgery (London)*, 50, 10–13.
- Del Busto, I., German, A. J., Treggiari, E., Romanelli, G., O'Connell, E. M., Batchelor, D. J., Silvestrini, P., & Murtagh, K. (2020). Incidence of post-operative complications and outcome of 48 dogs undergoing surgical management of insulinoma. *Journal of Veterinary Internal Medicine*, 34(3), 1135–1143.
- Evans, H. E., & DeLahunta, A. (2013). *Miller's anatomy of the dog*. Elsevier Saunders.
- Flores-Ríos, E., Méndez-Díaz, C., Rodríguez-García, E., & Pérez-Ramos, T. (2015). Wandering spleen, gastric and pancreatic volvulus and right-sided descending and sigmoid colon. *Journal of Radiology Case Reports*, 9(10), 18–25.
- Hixon, L. P., Grimes, J. A., Wallace, M. L., & Schmiedt, C. W. (2019). Risk factors for gastrointestinal upset and evaluation of outcome following surgical resection of canine pancreatic β -cell tumors. *Canadian Veterinary Journal*, 60(12), 1312–1318.
- Priyadarshi, R. N., Anand, U., Kumar, B., & Prakash, V. (2013). Torsion in wandering spleen: CT demonstration of whirl sign. *Abdominal Imaging*, 38(4), 835–838.
- Seif Amir Hosseini, A., Streit, U., Uhlig, J., Biggemann, L., Kahl, F., Ahmed, S., & Markus, D. (2019). Splenic torsion with involvement of pancreas and descending colon in a 9-year-old boy. *BJR Case Reports*, 5(1), 20180051.
- Sheflin, J. R., Lee, C. M., & Kretchmar, K. A. (1984). Torsion of wandering spleen and distal pancreas. *Ajr American Journal of Roentgenology*, 142(1), 100–101.
- Standing, S. (2020). *Gray's anatomy: The anatomical basis of clinical practice*. Elsevier.
- Trifonidou, M. A., Kirpensteijn, J., & Robben, J. H. (1998). A retrospective evaluation of 51 dogs with insulinoma. *The Veterinary Quarterly*, 20(1), S114–S115.

- Wolfe, M. L., Moore, E. V., & Jeyakumar, S. (2022). Perioperative outcomes in dogs and cats undergoing pancreatic surgery: 81 cases (2008-2019). *Journal of Small Animal Practice*, *63*(9), 692–698.
- Wouters, E. G. H., Buishand, F. O., Kik, M., & Kirpensteijn, J. (2011). Use of a bipolar vessel-sealing device in resection of canine insulinoma. *Journal of Small Animal Practice*, *52*(3), 139–145.
- Zimmermann, M. E., & Cohen, R. C. (2000). Wandering spleen presenting as an asymptomatic mass. *Australian and New Zealand Journal of Surgery*, *70*(12), 904–906.

How to cite this article: Moses, I. A., & Hallowell, T. C. (2024). Successful surgical management of pancreatic torsion in a 3-month-old Bernese Mountain dog without evidence of long-term pancreatic dysfunction. *Veterinary Medicine and Science*, *10*, 1–6. <https://doi.org/10.1002/vms3.1467>