ABSTRACT
There is limited veterinary literature about dogs or cats with ileocolic junction resection and its long-term follow-up. To evaluate the long-term outcome in a cohort of dogs and cats that underwent resection of the ileocolic junction without extensive (>50%) small or large bowel resection. Medical records of dogs and cats that had the ileocolic junction resected were reviewed. Follow-up information was obtained either by telephone interview or e-mail correspondence with the referring veterinary surgeons. Nine dogs and nine cats were included. The most common cause of ileocolic junction resection was intussusception in dogs (5/9) and neoplasia in cats (6/9). Two dogs with ileocolic junction lymphoma died postoperatively. Only 2 of 15 animals, for which long-term follow-up information was available, had soft stools. However, three dogs with suspected chronic enteropathy required long-term treatment with hypoallergenic diets alone or in combination with medical treatment to avoid the development of diarrhoea. Four of 6 cats with ileocolic junction neoplasia were euthanised as a consequence of progressive disease. Dogs and cats undergoing ileocolic junction resection and surviving the perioperative period may have a good long-term outcome with mild or absent clinical signs but long-term medical management may be required.

1. Introduction
The ileocolic junction (ICJ) is characteristic in dogs and cats because the distal ileum communicates with the ascending colon, forming a tube that is joined by the caecum to one side. This is in contrast to other species where the caecum and colon are contiguous. The caecum communicates with the ascending colon through the caecocolic orifice, which is located approximately 1 cm from the ileocolic orifice in dogs but it is adjacent to the ileocolic orifice in cats (Dyce et al. 2010, Evans & de Lahunta 2013). The ICJ is reported to play a fundamental anatomical and physiological role in the regulation of intestinal transit (Folaranmi et al. 2011). It allows for intermittent movement of chyme from the distal ileum into the proximal colon in order to ease nutrient absorption and it prevents retrograde reflux from the proximal colon into the distal ileum. This is achieved by the sphincter properties of the ICJ and the synchronised motor activity between the ICJ and the adjacent gastrointestinal tract segments (Herdt & Sayegh 2013).

Ileocolic junction resection (ICJR) leads to a loss of anterograde and retrograde reflux regulation. Loss of anterograde resistance may potentially result in diarrhoea, nutrient malabsorption and even dehydration due to accelerated chyme transit. Moreover, lack of retrograde reflux control, can result in inflammation of the ileal mucosa and ileal colonisation with colonic bacteria, which may lead to small intestinal bacterial overgrowth and ileal and colonic dysbiosis (Folaranmi et al. 2011). ICJ resection is sometimes performed together with the resection of the terminal ileum. Bile acids and cobalamin are reabsorbed in the ileum and therefore if a large portion of the ileum is resected along with the ICJ, bile salt malabsorption, intestinal dysbiosis and hypocobalaminaemia may occur, which might cause chronic diarrhoea (Ruax 2013).

In cases of extensive small bowel resection in dogs, retention of the ICJ has been deemed important for survival and ICJR may contribute to the development of chronic diarrhoea (Reid 1975; Gorman et al. 2006). However, resection of the ICJ appears to be well tolerated in adult human patients when it is not associated with extensive bowel resection or Crohn’s disease, and the complications observed such as chronic diarrhoea are thought to arise from the resection of the adjacent ileum and colon rather than the ICJ itself (Folaranmi et al. 2011).

The limited number of reports for dogs and/or cats with ICJR described in the veterinary literature are often associated with extensive small bowel resection or subtotal colectomy in cats with megacolon (Reid 1975; Yanoff et al. 1992; Sweet et al. 1994; Gorman et al. 2006). In addition, long-term follow-up is not always available. Therefore, the primary aim of this study was to evaluate the long-term outcome in a cohort of dogs and cats that underwent ICJR in the absence of (>50%) extensive small or large bowel resection...
resection. The second aim was to describe aetiologies affecting the ICJ necessitating resection.

2. Material and methods

2.1. Case selection

The medical record database of the Animal Health Trust was searched for dogs and cats that had a disease involving the ICJ between 2001 and 2015. Cases were included if surgical removal of the ICJ was performed at some stage during the disease course. Cases were excluded if the resection included the ICJ and more than 50% of the length of the adjacent small or large intestine or if other intestinal segments were also resected.

2.2. Medical record review and follow-up information

Medical records were reviewed. Data collected included signalment, management prior to referral, presenting clinical signs, physical examination findings, relevant laboratory results, diagnostic imaging findings, aetiologies necessitating ICJR and histopathology results of the resected ICJ. Medical records were also reviewed for perioperative complications and length of hospitalisation after ICJR.

Long-term follow-up information was obtained by means of telephone interview or e-mail correspondence with the referring veterinary surgeons. Interview questions included whether or not the patient was still alive. If the patients were alive, whether or not they had any clinical signs suggestive of gastrointestinal disease (e.g. decreased appetite, vomiting or diarrhoea) and whether or not they were receiving any treatment. A Nestlé Purina Fecal Scoring system was used to characterise the episodes of diarrhoea, which was defined as a faecal score of ≥4 (Appendix). If the patient had died, the referring veterinary surgeon was asked the date and cause of death, whether the patient was showing gastrointestinal clinical signs prior to death and whether the patient was receiving any treatment.

2.3. Statistical analysis

Descriptive statistics are reported as medians and interquartile ranges (IQRs; first and third quartiles), which were calculated using computer software.

3. Results

3.1. Signalment, management prior to referral and presenting clinical signs

Nine dogs and nine cats met the study criteria. The median age of dogs was 1.2 years (IQR 0.7–5.3 years, Table 1). There were four female dogs, three spayed and one entire; and five male dogs, three neutered and two entire. Dog breeds included four crossbreed dogs, and one each of Cairn terrier, Weimaraner, German shepherd dog, Labrador and Border collie. The median age of cats was 10.1 years (IQR 4.0–13.7 years, Table 2). There were three females and six male cats, all of which were neutered. Cat breeds included three Domestic short-haired cats, three Domestic long-haired cats, two Siamese and one Birman.

All dogs were treated by the referring veterinarian for a median of 30 days (IQR 11–164 days) prior to referral. Five dogs were referred for persistent gastrointestinal clinical signs, three dogs were referred for the investigation of an intestinal mass/thickening, and one dog was referred for the acute deterioration of chronic gastrointestinal signs. Presenting clinical signs included diarrhoea (n = 7), vomiting (n = 5), anorexia (n = 5), haematochezia (n = 4), abdominal pain (n = 4), lethargy (n = 3), melena (n = 2), weight loss (n = 2) and polyuria/polydipsia (n = 1).

Eight cats were treated by the referring veterinarian within a median of 3 days (IQR 0–180 days) prior to referral. Three cats were referred for the presence of an abdominal mass, two cats were referred for persistent gastrointestinal clinical signs and one cat was referred for the acute deterioration of chronic gastrointestinal clinical signs. In addition, in two cats, ICJ disease was incidentally detected during the investigations of other diseases (lens luxation and assessment prior to radioactive iodine treatment for hyperthyroidism). One cat belonged to a staff member and presented directly to the referring centre due to persistent gastrointestinal signs. Presenting clinical signs included weight loss (n = 6), vomiting (n = 5), anorexia (n = 4), abdominal pain (n = 2) and lethargy (n = 2).

3.2. Physical examination, laboratory and diagnostic imaging findings, and perioperative management

Abdominal palpation identified the presence of an abdominal mass in 5/9 dogs and in 6/9 cats. All cases had haematology and serum biochemistry performed. Three dogs and two cats had a stress leukogram, two dogs and one cat were anaemic, two dogs and one cat were hypoalbuminaemic, one dog had elevated hepatocellular liver enzyme activities, and one cat was azotaemic. Serum cobalamin was measured in three dogs and one cat, and was found to be low in one dog (251 ng/L, reference ≥275 ng/L) and one cat (<150 ng/L, reference 270–1000 ng/L). Abdominal radiographs were performed in eight dogs and in seven cats. A soft tissue opacity was seen in the abdomen of 6/8 dogs, (four dogs with ICJ intussusception, and two dogs with ICJ masses), and 4/7 cats (all with ICJ masses). One dog with chronic enteropathy and
### Table 1. Summary of gross surgical and histopathological findings, and long-term outcome of canine patients.

| Dog | Age (months) | Gross findings at the ileocolic junction | Histopathology of the ileocolic junction | Status at last follow-up | Long-term clinical signs | Long-term treatment |
|-----|--------------|------------------------------------------|-----------------------------------------|---------------------------|--------------------------|----------------------|
| 1   | 14           | Intussusception                            | Lymphoplasmacytic enteritis             | Alive 358 days after surgery | None                     | Hydrolysed diet<sup>1</sup>  
                          |              |                                         |                          |                           | Amoxicillin/clavulanate (14.2 mg/kg BW twice daily)  
                          |              |                                         |                          |                           | Metronidazole (7.5 mg/kg BW twice daily) |
| 2   | 11           | Intussusception                            | Eosinophilic enteritis                  | Alive 647 days after surgery | Soft stool (faecal score of 5)  
                          |              |                                         |                          |                           | Novel protein diet<sup>2</sup>  
                          |              |                                         |                          |                           | Pancreatic enzymes<sup>3</sup>  
                          |              |                                         |                          |                           | Psyllium husks |
| 3   | 6            | Intussusception                            | Necrotising, haemorrhagic, neutrophilic enteritis | Alive 656 days after surgery | None                     | None                  |
| 4   | 3            | Intussusception                            | Lymphoplasmacytic enteritis             | Lost to follow-up 342 days after surgery | None                     | None                  |
| 5   | 10           | Intussusception                            | Ulcerative fibro-neutrophilic enteritis | Lost to follow-up 469 days after surgery | None                     | None                  |
| 6   | 30           | Mass                                      | High-grade lymphoma                     | Euthanised 3 days after surgery | -                        | -                    |
| 7   | 46           | Mass                                      | High-grade lymphoma                     | Deceased 1 day after surgery | -                        | -                    |
| 8   | 120          | Mass                                      | Leiomyosarcoma                           | Lost to follow-up 2121 days after surgery | None                     | None                  |
| 9   | 80           | Obstruction due to serosal adhesions       | Histiocytic and lymphoplasmacytic enteritis | Alive 152 days after surgery | None                     | Hydrolysed diet<sup>8</sup>  
                          |              |                                         |                          |                           | Psyllium husks |

### Table 2. Summary of gross surgical and histopathological findings, and long-term outcome of feline patients.

| Case | Age (months) | Gross findings at the ileocolic junction | Histopathology of the ileocolic junction | Status at last follow-up | Long-term clinical signs | Long-term treatment |
|------|--------------|------------------------------------------|-----------------------------------------|---------------------------|--------------------------|----------------------|
| 1    | 96           | Mass                                     | Adenocarcinoma with metastatic disease in the mesenteric lymph nodes | Euthanised due to progressive disease 78 days after surgery | Soft stool (faecal score of 5)  
                          |              |                                         |                          |                           | Novel protein diet<sup>10</sup>  
                          |              |                                         |                          |                           | Metronidazole (8.3 mg/kg BW twice daily)  
                          |              |                                         |                          |                           | Parenteral cobalamin (83.4 µg/kg BW every 4 weeks)  
                          |              |                                         |                          |                           | Chemotherapy using carboplatin (200 mg/m² every 4 weeks) |
| 2    | 170          | Mass                                     | Adenocarcinoma with metastatic disease in the mesenteric lymph nodes | Euthanised due to progressive disease 443 days after surgery | None                     | None                  |
| 3    | 162          | Mass                                     | Adenocarcinoma                           | Euthanised due to progressive disease 960 days after surgery | None                     | None                  |
| 4    | 121          | Mass                                     | Adenocarcinoma                           | Euthanised due to progressive disease 540 days after surgery | None                     | None                  |
| 5    | 138          | Mass                                     | High-grade lymphoma                      | Euthanised due to progressive disease 425 days after surgery | None                     | None                  |
| 6    | 166          | Mass                                     | High-grade lymphoma                      | Lost to follow-up after hospital discharge | -                        | -                    |
| 7    | 6            | Intussusception                           | Not submitted for histopathology         | Euthanised due to unrelated disease 257 days after surgery | None                     | None                  |
| 8    | 20           | Intussusception                           | Transmural neutrophilic enteritis        | Alive 566 days after surgery | None                     | None                  |
| 9    | 74           | Pseudo-obstruction                        | Lymphoplasmacytic enteritis              | Deceased due to unrelated disease 2167 days after surgery | None                     | Hydrolysed diet<sup>12</sup> |

<sup>1</sup> Amoxicillin/clavulanate (14.2 mg/kg BW twice daily)<br>2<sup>2</sup> Metronidazole (7.5 mg/kg BW twice daily)<br>3<sup>3</sup> Pancreatic enzymes<br>4<sup>4</sup> Psyllium husks<br>5<sup>5</sup> Tylosin<br>6<sup>6</sup> Parenteral cobalamin (30.8 µg/kg BW every 3 weeks)<br>7<sup>7</sup> Probiotic supplement<br>8<sup>8</sup> Psyllium husks<br>9<sup>9</sup> Chemotherapy using carboplatin (200 mg/m² every 4 weeks)<br>10<sup>10</sup> Chemotherapy using a CHOP-based protocol (the same protocol was re-instated 6 months after completion due to relapse of the lymphoma)<br>11<sup>11</sup> Highly digestible diet<br>12<sup>12</sup> Hydrolysed diet
one cat with adenocarcinoma had only a gravel sign suggesting some degree of intestinal obstruction. The remaining dog and two cats had unremarkable abdominal radiographs. Abdominal ultrasound was performed in all dogs and 8/9 cats, identifying an intussusception at the level of the ICJ in all five dogs and two cats. A mass at the ICJ was also detected in all cases with ICJ neoplasia. Two dogs and one cat ultimately diagnosed with high-grade lymphoma affecting the ICJ had fine needle aspirates performed from the identified ICJ masses, but the results were non-diagnostic. Hence, they underwent resection of the ICJ masses, which were suspected to be non-lymphoid neoplasms. Another cat with high-grade lymphoma was referred for surgical resection of an ICJ mass observed during an exploratory laparotomy. One cat and one dog referred for acute exacerbation of chronic gastrointestinal signs had a severely thickened muscularis propria of the distal ileum and caecum, respectively, with loss of normal layering.

All cases underwent exploratory laparotomy and all the ICJ intussusceptions and masses identified on abdominal ultrasonography were confirmed during surgery. The dog and cat with acute deterioration of chronic gastrointestinal clinical signs had a stricture between the distal ileum and proximal caecum caused by omentum adherent to both sides of the caecum and a severe thickening of the ileum without evidence of mechanical obstruction of the intestinal lumen, respectively. The ICJs were excised, including the caecum, between the proximal ileum and proximal ascending colon in six dogs and between the distal jejunum and proximal ascending colon in three dogs and all cats. A single layer, simple interrupted approximating suture pattern with absorbable monofilament suture material end-to-end anastomosis was used in six dogs and eight cats. Luminal disparity between the residual ileum or jejunum and the colon was eliminated either by spacing each suture further apart on the larger lumen site, or transecting the smaller segment at an angle creating a lumen of larger diameter. In cases of marked disparity, the antimesenteric border of the smaller segment was incised longitudinally to create a spatulated opening or the larger segment was reduced to equal the lumen of the smaller segment. In three dogs and one cat a functional end-to-end anastomosis was performed using a surgical stapling device and a stoma between the intestinal segments was created so that luminal disparity was not an issue. All anastomoses were leak-tested negative. Those cases with a mass involving the ICJ also had biopsies of the mesenteric lymph nodes. One dog with an ICJ mass and elevated hepatocellular liver enzyme activities had liver biopsies performed. One dog with intussusception also had biopsies from the duodenum and jejunum. No major intra-operative complications were reported and all patients recovered uneventfully. However, two dogs with high-grade alimentary lymphoma, one of which also had hepatic involvement, died or were euthanised one day and three days after surgery, respectively, due to the development of septic peritonitis secondary to anastomotic dehiscence. Both dogs were hypoalbuminaemic prior to surgery. No intestinal dehiscence was observed in cats. Dogs and cats were both hospitalised a median of five days (IQR 3–6 days in dogs, IQR 4.5–6 days in cats).

3.3. Histopathology results

The histopathological diagnosis of each of the resected ICJs is reported in Tables 1 and 2. ICJ neoplasia was diagnosed in nine animals. Two dogs were diagnosed with high-grade alimentary lymphoma and one dog with leiomyosarcoma although immunohistochemistry to exclude a gastrointestinal stromal tumour was not performed. Four cats had a histological diagnosis of intestinal adenocarcinoma, two of which had metastatic disease in the mesenteric lymph nodes. Two cats were diagnosed with high-grade lymphoma. Both dogs and one cat with high-grade lymphoma had regional lymph node involvement and one of the dogs also had hepatic involvement.

The histopathology of the resected ICJ from two dogs and one cat with intussusception revealed an ulcerative fibrino-neutrophilic enteritis; a necrotising, haemorrhagic and neutrophilic enteritis and a transmural neutrophilic enteritis, respectively. These histological abnormalities are likely a consequence of the vascular compromise that occurs with intussusceptions, which leads to oedema, haemorrhage, neutrophilic infiltration and even necrosis of the intestinal wall. Moreover, intramural and serosal haemorrhage can also result in fibrinous adhesions (Cave 2013). One of these two dogs required long-term antibiotic therapy to avoid the recurrence of diarrhoea that could be a consequence of the ICJR or an underlying antibiotic-responsive chronic enteropathy. An additional histological diagnosis may have been obtained in this case if additional intestinal biopsies from other intestinal segment were taken (Levien and Baines 2011). The histopathology results of the excised ICJ of the remaining three dogs with intussusception revealed underlying intestinal inflammation (lymphoplasmacytic enteritis in two dogs and eosinophilic enteritis in the third dog) that could be responsible of the intussusception. The dog with eosinophilic enteritis also had biopsies from the duodenum and adjacent jejunum and the histological diagnosis was consistent in all biopsy samples. This dog had a seven-day trial with fenbendazole before being referred and a faecal flotation test for the identification of parasites was negative.
3.4. Long-term outcome

The long-term outcome is also summarised in Tables 1 and 2. These tables also include the adjunctive therapies (such as specific antibacterials and dosage administered) that these patients were receiving in the long-term. Two dogs and one cat were fed a hydrolysed diet,6,10 two dogs and one cat were fed a novel protein diet4,6,10 and one dog and one cat were fed a highly digestible diet.8,11 All five dogs diagnosed with intussusception were either alive or lost to follow-up at the time of writing with a mean follow-up up of 494 days. Four dogs had no clinical signs and only one dog had mild diarrhoea (faecal score of 5). The diarrhoea of this dog had significantly improved from a faecal score of 7 with a combination of a novel protein diet4 and antibacterials, but it never resolved. All these dogs were young (median 10 months, IQR 4.5–12.5 months) and these findings are similar to those found in human infants, whom because of their capacity for rapid organ growth, tolerate intestinal resections better than adults (Thompson 1993). Antibiotic therapy was used long-term in two dogs and several attempts to decrease or discontinue antibiotic therapy led to recurrence of diarrhoea (faecal score of 6–7). The serum cobalamin concentration of one of these two dogs was measured three months after surgery and it was in the lower end of the reference range and monthly cobalamin supplementation administered subcutaneously was prescribed. Another measurement performed a year after surgery identified that the cobalamin levels had decreased below the reference range and therefore the frequency of cobalamin supplementation was increased to every three weeks. The other dog with intussusception and partial resolution of gastrointestinal signs had a serum cobalamin concentration measured seven and eleven months postoperatively that remained within the reference range.

Three of four cats with ICJR resection due to intestinal adenocarcinoma had a median survival time of 443 days after surgery (range 78–960 days). Only one of these three cats had mild diarrhoea (faecal score of 5). This cat was managed with a novel protein diet,10 antibiotics and weekly parenteral cobalamin, as the cat was hypocobalaminaeic already prior to surgery. The combination of a novel protein diet and antibiotics markedly improved the diarrhoea of this cat from a faecal score of 7 immediately following surgery to a faecal score of 5. Therefore therapy was continued until euthanasia was carried out 78 days after surgery due to clinical deterioration secondary to widespread metastases. Two cats had no ongoing gastrointestinal clinical signs until they were euthanised 443 and 960 days after surgery due to tumour recurrence. One cat with high-grade lymphoma was euthanised 435 days after surgery due to lymphoma relapse and progressive disease despite chemotherapy.

4. Discussion

The results of this study report that those animals that underwent ICJR, survived the postoperative period (7/9 dogs and 9/9 cats), and for which follow-up information was available (7 dogs and 8 cats), achieved a reasonable long-term outcome. Only one dog with a chronic enteropathy and one cat with a metastatic intestinal adenocarcinoma had chronic diarrhoea, with a faecal score of 5 in both cases.

The most common cause of ICJR in dogs was intussusception, diagnosed in five of nine dogs, and it is in agreement with the veterinary literature that indicates that the ICJ and the jejunoojejunum are the most common locations for intussusception to occur in dogs (Levitt & Bauer 1992; Cave 2013). In contrast to dogs, intussusception is more common in older cats than in kittens and it is usually secondary to infiltrative disease (Levien & Baines 2011). Only two cats were diagnosed with an intussusception at the ICJ and a possible explanation is that intussusions occur less commonly in cats than in dogs and the jejunum is a more common location than the ICJ (Cave 2013). Antibiotic therapy was used long-term in two dogs, and several attempts to decrease or discontinue antibiotic therapy led to recurrence of diarrhoea. The dog with persistent mild diarrhoea also needed long-term antibiotic treatment to avoid the worsening of the diarrhoea. Dogs with ICJR are predisposed to intestinal dysbiosis and irritation of the intestinal mucosa by bacterial endotoxins may lead to a worsening of diarrhoea due to an increase in water secretion (Payne & Brent 1993). Therefore, permanent or intermittent use of antimicrobials may be needed in some cases in order to control the clinical signs. The use of a multi-strain probiotic may also be useful in this setting modifying the intestinal microenvironment and promoting the growth of beneficial microbes, which may prevent the relapse of bacterial dysbiosis and alleviate intestinal inflammation (Rossi et al. 2014).

Neoplasia was the most common cause of ICJR in cats in this study. Intestinal adenocarcinoma is the most common non-lymphoid intestinal tumour in cats (Willard 2012). It can occur anywhere in the gastrointestinal tract but the ICJ, jejunum and ileum have been described as the most common location in cats (Kosovsky et al. 1988; Green et al. 2011). Only one cat of eight, for which long-term follow-up information was available, had persistent soft stools. In a retrospective study with cats with megacolon undergoing subtotal colectomy, those cats that underwent ICJR had significantly looser stools in the long term than those cats in which the ICJ was preserved (Sweet et al. 1994). However, the absence of clinical signs in the majority of cats in the present study could be attributed to the preservation of the colon. The presence of an intact colon is beneficial to patients with ileal resection because of the
ability of the colon to increase intestinal transit time and promote intestinal adaptation (Cummings et al. 1973; Nordgaard et al. 1994; Kouti et al. 2006).

One dog and one cat with chronic gastrointestinal signs were managed medically for approximately eight months. The dog was managed with a tapering course of prednisolone that was eventually discontinued, intermittent courses of antibiotics (metronidazole at 12.5 mg/kg BW twice daily or tylosin at 19 mg/kg BW twice daily) and a hydrolysed diet. The cat was managed with prednisolone (1.5 mg/kg BW once a day) and intermittent courses of metronidazole (14.7 mg/kg BW twice daily). Both cases acutely deteriorated and underwent surgery due to a suspected intestinal obstruction. Chronic enteropathies are usually managed medically. However, severe thickening of the intestines and ineffective antegrade intestinal propulsion may result in pseudo-obstruction and acute exacerbation of clinical signs with imaging findings compatible with an obstruction but without the presence of an obstructive lesion as seen in the cat with a severely thickened ileum. Moreover, serosal adhesions caused by chronic intestinal inflammation can also lead to the development of intestinal strictures and acute deterioration of chronic gastrointestinal signs as observed in the dog with a gravel sign on abdominal radiographs and a severely thickened caecum. In these cases, surgery may be necessary for therapeutic (relief of the obstruction) and diagnostic purposes (to rule out intestinal neoplasia and determine the type of inflammation present) (Brown 2012). Nutrition plays an important role in the management of chronic enteropathies and both patients were successfully managed long-term with hydrolysed diets supporting the diagnosis of a dietary-responsive enteropathy.

Resection of the ICJ accelerates intestinal transit time because the ICJ acts as a physical barrier between the small and large intestine. Hence, the use of a highly digestible diet could limit the residue in the intestinal lumen that could result in osmotic diarrhoea. Many veterinarians in cases of ICJR without an underlying chronic enteropathy recommend this type of diet. The only dog (intussusception without underlying inflammatory disease) and cat (high-grade lymphoma) receiving a highly digestible diet did not have gastrointestinal clinical signs but a larger number cases would be needed to try to ascertain whether these diets are beneficial in the management of dogs and cats with ICJR.

Cobalamin deficiency may develop in those dogs or cats with resection of the ICJ and ileum. Unfortunately, cobalamin concentration was measured postoperatively in only two dogs with intussusception and it was normal in both dogs although it decreased below the reference range one year after surgery in one dog despite monthly supplementation. Hypocobalaminemia itself may contribute to the development or worsening of gastrointestinal clinical signs through different mechanisms such as villous atrophy, changes in gastrointestinal mucosal permeability or changes in absorptive functions (Ruax 2013). However, some dogs or cats with low cobalamin levels may not develop overt clinical signs, at least initially, and regular monitoring may be necessary to detect hypocobalaminemia before overt clinical signs develop. Interestingly, a study reported normal postoperative intestinal function in cats undergoing subtotal colectomy with ICJR although the number of cases was small and similar studies have not been performed in dogs (Gregory et al. 1990).

There are several limitations in this study and the majority are related to its retrospective nature. A heterogeneous group of diseases were found and a small number of animals were included in each category. The majority of diseases were diffuse or infiltrative hindering the differentiation between clinical signs caused by the underlying disease or the removed ICJ. The histopathological diagnoses were not always classified according with the World Small Animal Veterinary Association guidelines given that some were performed before these were available (Day et al. 2008). This hinders the comparison of the histopathological diagnoses in this study with others that followed the standardisation proposed in the aforementioned guidelines. Treatment and monitoring after surgery was not standardised and therefore a comparison between different treatments could not be made. Future prospective studies including a larger number of cases including specific underlying diseases and standardised histopathology, treatment and monitoring are warranted.

In conclusion, the most common cause of ICJR was intussusception in dogs and neoplasia in cats. Patients undergoing resection of the ICJ and surviving the perioperative period may have a good long-term outcome with mild or absent clinical signs. Dogs with underlying chronic enteropathies may need long-term dietary and medical management to control the clinical signs. Most cats with ICJ neoplasia were euthanised due to progressive disease.

Notes
1. Fecal Scoring System, Nestlé Purina PetCare Company, St. Louis, MO.
2. Excel 2011, Microsoft, Redmond, WA.
3. Hypoallergenic Canine Dry, Royal Canin, Aimargues, France.
4. Finest Fish Complete, Fish4Dogs, Worcestershire, England.
5. Lypex, VetPlus Ltd, Lytham, UK.
6. Dermatosis FP Canine Dry, Eukanuba Veterinary Diets, Spectrum Brands Ltd, Surrey, England.
7. FortiFlora, Purina ProPlan Veterinary Diets, Nestlé Purina PetCare, Gatwick, UK.
8. Gastrointestinal Canine Dry, Royal Canin, Aimargues, France.
9. z/d Canine Dry, Hill’s Pet Nutrition, Topeka, KS, USA.
10. d/d Venison Feline Canned, Hill’s Pet Nutrition, Topeka, KS, USA.
11. Sensitivity Control Feline Dry, Royal Canin, Aimargues, France.
12. Hypoallergenic Feline Dry, Royal Canin, Aimargues, France.

Acknowledgments

The authors would like to thank the referring veterinary surgeons for their help providing the follow-up information and continuous care of these patients.

Disclosure statement

This study was not supported by a grant. The authors disclose no conflict of interest.

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Appendix

Nestlé Purina Fecal Scoring System. Available from: https://www.purinaproplanvets.com/media/1202/gi_quick_refer-ence_guide.pdf

Score 1: Very hard and dry; requires much effort to expel from body; no residue left on ground when picked up. Often expelled as individual pellets.

Score 2: Firm, but not hard; should be pliable; segmented appearance; little or not residue left on ground when picked up.

Score 3: Log-like; little or no segmentation visible; moist surface; leaves residue, but holds form when picked up.

Score 4: Very moist (soggy); distinct log shape visible; leaves residue and loses form when picked up.

Score 5: Very moist but has distinct shape; present in piles rather than as distinct logs; leaves residue and loses form when picked up.

Score 6: Has texture, but no defined shape; occurs as piles or as spots; leaves residue when picked up.

Score 7: Watery, no texture, flat; occurs as puddles.