



Prevalence and diagnostic methods of surgical pathology in the digestive system of animals

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Abstract. The relevance of the study is driven by the rapid increase in the number of small domestic animals with surgical pathology of the digestive system, requiring effective diagnosis and surgical intervention. In this regard, the purpose of this study is to investigate the prevalence of various diseases of the digestive organs in small domestic animals and to determine the most informative methods of their diagnosis. The primary approach in the study is to compare the informativeness of results obtained from examining sick animals, including general (history collection, examination, palpation) and special (ultrasound diagnostics of abdominal organs, endoscopy of the digestive

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tract, radiography) diagnostic methods. The advantages and disadvantages of different special diagnostic methods were identified and analysed, providing a comprehensive assessment of indications and contraindications for their application in clinical veterinary practice. Out of 1863 animals that presented to the veterinary clinic, pathologies of the digestive tract of various origins were diagnosed in 957 animals. Conservative care was provided to 79.7% of the affected animals (763 individuals). Complicated pathologies requiring surgical treatment were diagnosed in 194 (20.3%) animals. Among these, 170 (17.7%) had foreign bodies in the stomach, 14 (1.5%) had gastric erosions, 4 (0.4%) had neoplasms, 3 (0.3%) had perforations, and 3 (0.3%) had inflammatory diseases. The use of ultrasound diagnostics allowed for the detection of linear foreign bodies in the stomach and the identification of associated complications such as stomach or intestinal perforations caused by foreign bodies. Radiographic examination proved effective when radiopaque structures (metals, stones, bones) were present as foreign bodies. The materials of the study provide practical value for both researchers and practising veterinarians, offering the opportunity to utilise new instrumental diagnostic methods to assess the feasibility of surgical manipulations on the stomach and intestines in dogs and cats

Keywords: esophagogastroduodenoscopy; ultrasound diagnostics; radiographic examination; plateau level; diverticulum; hernia; inflammatory bowel disease

Introduction

In recent years, there has been a rapid increase in the number of animals with pathologies in the digestive tract. S.G. Lishchuk *et al.* (2023) indicate that among internal pathologies, gastrointestinal organ disorders were most frequently diagnosed, accounting for 44.6% of the total cases. The process of breaking down complex nutrients in the feed into simple ones, accessible for absorption by the animal's body, is referred to as digestion. A.M. Power *et al.* (2021) note that the digestive tract of small domestic animals, specifically dogs and cats, includes all organs involved in the intake and processing of food. The digestive system can be conventionally divided into three sections. The anterior part includes the oral cavity with auxiliary organs, the pharynx, and the oesophagus. The middle section comprises the stomach and the small intestine with digestive glands. The posterior section includes the large intestine. According to N.R. Barash *et al.* (2022), the anterior section is responsible for capturing, chewing,

and swallowing food, the middle section for digestion and absorption of nutrients, and the posterior section for the formation of faecal masses from undigested feed residues.

Studies by R.A. Didier *et al.* (2021) emphasise that the process of digestion in animals begins as soon as the feed enters the oral cavity. It involves chewing, processing food with saliva, the catalytic transformation of its components with the participation of enzymes, and further movement along the digestive tract. However, as mentioned by M. Murakami *et al.* (2022), the movement of feed mass from the stomach can be limited or completely stopped due to partial or complete obstruction of the intestinal lumen by tumours, foreign objects, polyps, excessive mucosal growth, or the presence of ulcers. M.G. Derré *et al.* (2022) clarified that intestinal obstruction can be partial or complete, caused by foreign objects, invagination, swelling, strangulation (e.g., hernia strangulation), certain infections, and neoplasms.

Symptoms indicating disruptions in the functioning of the digestive organs are diverse. A.B. Bongard *et al.* (2019) noted that clinical manifestations of digestive system pathologies are primarily characterised by excessive salivation and diarrhoea. R.A. Didier *et al.* (2021) mention that the onset of abdominal pain, abdominal distension, loss of appetite, vomiting or regurgitation, defecation disorders, constipation, dehydration, and shock can also indicate pathology of the digestive system. According to C. Demars *et al.* (2023), based on the clinical manifestation of symptoms in affected animals, it is possible not only to determine the nature but also to establish the localisation of the pathological process. For diseases of the oral cavity – teeth, jaws, or oesophagus in animals, worsening of biting, chewing, and swallowing processes is observed. Gastritis most commonly leads to vomiting due to irritation or infectious processes. Nevertheless, as asserted by V.I. Woolhead *et al.* (2020), the act of vomiting is also a characteristic symptom of kidney pathology.

C. Demars *et al.* (2023) demonstrated that attention should be paid to faeces, as any deviations from the norm (changes in colour, consistency, frequency of discharge) are also symptoms of intestinal diseases. In the case of gastric bleeding or in the area of the small intestine, faeces may turn black. R.A. Didier *et al.* (2021) described that straining during defecation occurs in cases of inflammation of the mucous membrane in the rectal area or obstruction of its lumen by a foreign body. Abdominal distension in animals can result from the accumulation of gases, fluids, or ingested feed, usually due to a decrease in the activity of muscles responsible for moving feed along the digestive tract. Intestinal stretching is possible, caused by physical obstruction due to the presence of a foreign object, invagination, or overeating.

Furthermore, E. Taillieu *et al.* (2021) note that abdominal pain arises from stretching or inflammation of the peritoneal membranes and can vary in severity. With the development of a painful reaction from the abdominal organs, animals often adopt unnatural body positions (stretching front limbs, lowering the chest to the floor, raising the pelvic limbs). Given the diversity of symptoms that develop in pathological conditions of the digestive system organs, the question of choosing the most informative method for diagnosing digestive tract diseases remains relevant. Unfortunately, there are only isolated studies by Ukrainian scientists on this issue in the literature. For example, I.S. Dekhnych *et al.* (2021) noted in their study that ultrasonography is an effective diagnostic method for diseases of most abdominal organs and is used in veterinary abdominal surgery. Nevertheless, a drawback of this method is the inability to perform the procedure in animals with a high content of adipose tissue around the examined organ.

Considering all of the above, the purpose of this study is to investigate the prevalence and types of pathologies most commonly encountered in the digestive system of small domestic animals and to analyse the informativeness of different diagnostic methods, the results of which may indicate the need for surgical intervention on the stomach or intestines.

Literature Review

In the study by F. Davoodi *et al.* (2021), attention was drawn to the fact that digestion is crucial not only for providing the body with nutrients but also for maintaining proper fluid and electrolyte (salt) balance in the body. I. Hennink *et al.* (2021), through their investigation of digestive system functions, suggested that they can be categorised into four main categories: digestion, absorption of nutrients, motility (movement along the digestive tract), and faecal elimination.

Diarrhoea is often a sign of digestive system disorders, and R.A. Didier *et al.* (2021) noted in their study that it can have various causes. Watery diarrhoea of large volume is usually associated with hypersecretion, a condition where excess fluid is secreted into the intestine. This can be caused by bacterial infection. Diarrhoea can also occur due to disruptions in absorption, affecting the assimilation of nutrients from the feed. Impaired absorption of hydrolytic breakdown products of feed components can occur due to destructive changes in intestinal cells responsible for absorption. This condition can be caused by various viruses (e.g., canine parvovirus, coronavirus, rotavirus).

C.I. Pratt *et al.* (2014) asserted that the treatment of animals with digestive system pathology should begin with determining the localisation of the pathology in the digestive tract, followed by identifying its cause and prescribing a treatment regimen, selecting the most optimal method for each specific case according to R. Terragni *et al.* (2014). D.A. Elsemore *et al.* (2017) indicated that the visualisation of tissue regeneration in damaged tissues due to digestive system pathologies will expand existing concepts of the course of the healing process and contribute to the search for innovative technologies to activate their full regeneration.

Refusal of food and vomiting in dogs and cats – all of these, according to B.A. Brisson *et al.* (2018), are vivid manifestations of diseases of the digestive system. Conventionally, for targeted diagnosis of this group of diseases in veterinary practice, both general methods (palpation, auscultation) and instrumental methods (radiography, contrast radiography) of examination are used, according to D.A. Elsemore *et al.* (2017). As noted by R. Terragni *et al.* (2014), using these methods, it is not always possible to objectively diagnose the presence of pathology. V.I. Woolhead *et al.* (2020) and F. Davoodi *et al.* (2021) demonstrated that achieving a

definitive diagnosis using these methods without detailed visualisation of digestive system structures, such as the oesophagus, stomach, and duodenum, is impossible.

K. Allenspach *et al.* (2015), Q. Cabon *et al.* (2017), and M. Binvel *et al.* (2020) emphasised that decisions regarding the necessity and advisability of surgical or conservative treatment should be based solely on research results. B.J. Rivers *et al.* (2017) noted that during surgical interventions on the stomach or intestines, attention should be focused on optimal tissue regeneration and the formation of a full-fledged scar. Studies on wound repair in the stomach, as indicated by M. Binvel *et al.* (2020), have allowed expanding existing concepts of the healing process and continuing the search for technologies to activate complete tissue regeneration. Various methods for activating regenerative processes, such as cellular technologies, fibrin gel, and platelet-rich plasma, were used for this purpose, possessing anti-inflammatory effects and containing adhesion molecules, cytokines, and platelet growth factors that stimulate reparative and anabolic processes in damaged tissues.

Scientific developments by R.K. Sellon *et al.* (2003) and D.A. Elsemore *et al.* (2017) related to veterinary medicine in Europe, the United States, and Ukraine have immensely enriched information on the diagnosis and methods of surgical interventions in small animals in recent years. R.A. Didier *et al.* (2021) improved diagnostic methods and treatment schemes, performed minimally traumatic surgical interventions, and developed methods to enhance healing and restoration of organ functions after surgical interventions. This is particularly important considering statistical data on the necessity of surgical interventions of varying complexity. As highlighted by B.J. Rivers *et al.* (2017), substantial progress has been made in recent years in surgical interventions on the

stomach and intestines, associated with the widespread adoption of endoscopic research methods. Using these methods, researchers refine the diagnosis with subsequent implementation of conservative or surgical treatment. A.M. Power *et al.* (2021) demonstrated that surgical interventions on the stomach (gastrotomy) in dogs and cats are typically performed in the presence of neoplasms, foreign bodies, or ulcers, allowing the preservation of the animal's life.

According to E. Gibson *et al.* (2020), special diagnostic methods for diseases of the digestive system include ultrasound examination, radiography, and endoscopy. E. Taillieu *et al.* (2021) noted that, when necessary, the most informative method of investigation was chosen, or several types of additional instrumental studies were conducted, as they effectively complement each other. Based on research results, decisions were made regarding the need for further surgical or conservative treatment. According to M. Mikiewicz *et al.* (2019), during surgical interventions on the stomach and intestines, special attention was paid to optimal tissue regeneration and the formation of a complete scar. Investigating the wound repair process in the stomach will allow expanding existing concepts of the healing process and contribute to continuing the search for technologies to activate full tissue regeneration. V.I. Woolhead *et al.* (2020) employed various methods to activate regenerative processes (cellular technologies, fibrin gel, platelet-rich plasma) with anti-inflammatory effects, containing adhesion molecules, cytokines, and platelet growth factors that stimulate reparative and anabolic processes in damaged tissues.

In connection with this, it is relevant to conduct a study on the use of various methods for diagnosing pathologies of the digestive system in dogs and cats to determine their informativeness and subsequently assess the advisability of choosing conservative or surgical treatment methods in each clinical case.

Materials and Methods

The study was conducted from 2022 to 2023 at the veterinary clinics "Zoolux" in Kyiv and at the Department of Surgery and Pathophysiology named after Academician I.O. Povazhenko, National University of Life and Environmental Sciences of Ukraine. Experiments on animals were conducted following the requirements of the "General Ethical Principles of Conducting Experiments on Animals" approved by the I National Congress on Bioethics (Law of Ukraine No. 3447-IV, 2006), and the provisions of the "European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes" (1986).

The object of the study was 957 animals (dogs – n=586; cats – n=371), aged from 3 months to 12 years. Upon admission to the veterinary clinic, anamnesis collection and clinical examination of sick patients were conducted. Animals with clinical symptoms characterising digestive disorders were selected for further investigation. During the preliminary acquaintance with the animal, the following clinical symptoms were identified: nausea, vomiting, refusal of food, diarrhoea (in some patients with blood and mucus), abdominal pain, abdominal wall tension, and absence of defecation.

To determine the type and exact location of the pathological process, animals underwent ultrasound examination (USG) using the Esaote 70 ultrasound machine (Italy) and a linear probe UST-5512U (Japan) with a frequency of 5-7.5 MHz. Instrumental diagnostics were performed to examine the abdominal organs. Before manipulation, the animal's fur was shaved in the abdominal area because it could degrade the quality of the study, and the animals were fixed in a ventro-dorsal position. Before the ultrasound examination, the skin was treated with an alcohol solution, and gel was applied on a starch basis. During the ultrasound examination, the condition of all organs of the

abdominal cavity was assessed to establish the cause of the deterioration of the patient's general condition. The complex of studies included the following organs: abdominal aorta, pancreas, stomach, liver, gallbladder and its ducts, small and large intestine, urinary bladder, urethra, ureters, spleen, kidneys, and adrenal glands, uterus and ovaries in females, and testicles and prostate in males.

During the diagnosis of diseases of the digestive system organs, survey radiographs were taken. When studying animals, a device for digital image reading, IMAX 1010 (China), was used, and animals were positioned laterally on the right and ventro-dorsally. Patients mainly did not require specific preparation or sedation. In cases where proper positioning for the examination was impossible, sedative drugs such as butorphanol, dexmedetomidine, gabapentin, or trazodone hydrochloride were used according to the instructions, considering the body weight of each patient. Prior to the use of medications, a thorough history was collected, and the overall condition of the patient was assessed. In breeds prone to cardiovascular pathologies, additional echocardiography and blood sampling were conducted to clarify not only the structural pathologies of organs but also the presence of functional disorders.

Endoscopic examinations of animals were performed using the Olympus 2T10 endoscope (Japan), under anaesthesia, with intravenous access using catheterisation of the subcutaneous vein of the forearm. Patient intubation was done with an individualised endotracheal tube, considering the thickness of the animal's nasal septum. Propofol (Lipuro, Germany) was used for anaesthesia as an ultra-short-acting hypnotic. Patient monitoring was conducted using a pulse oximeter (EDAN VE-H100B, China) and physical monitoring of the depth of anaesthesia, with the aid of a stethoscope (Littmann classic III, USA), manual

pulse palpation on the femoral and dorsal arteries, pressure in the tail artery region, femoral artery, or on the main brachial artery, counting the respiratory rate per minute, eye position, and the level of masticatory muscle (jaw muscles) relaxation. In specific cases, if the duration of manipulation exceeded 30-45 minutes, inhalation anaesthesia was used for animal anaesthesia. This provided better control of inhalation anaesthesia and reduced the percentage of statistical complications during prolonged anaesthetic support for various types of surgical interventions. The inhalation anaesthetic level was monitored using a capnograph and an air gas analyser, Capnomac ULTIMA (Germany).

Propofol was used for short-term manipulations and for the induction of patient anaesthesia, followed by a transition to inhalation anaesthesia (for patient intubation). The dosage was as follows: for continuous infusion at a rate of 6 mg/kg per hour and for bolus induction, 2-4 mg/kg. When using sedative or tranquillising drugs for premedication, the dosage for induction was kept at a minimum of 2 mg/kg. For sedation of animals, in the absence of contraindications, medetomidine or dexmedetomidine was used at a dose of 0.01 mL/kg for dogs, and butomidol (relaxant) at 0.1-0.4 mg/kg.

Results and Discussion

During 2022-2023, about two thousand animals were examined to identify the spread of pathologies of the digestive tract in dogs and cats. Based on the results of collecting anamnesis and clinical and instrumental studies, the types of pathologies of the digestive canal organs most often identified in small pets were established. The total number of receptions of animals with surgical pathology and pathology of the digestive system organs is presented in Table 1.

Table 1. The total number of animals in which pathologies of the digestive system are detected (on the basis of the veterinary clinic “Zoolux” in Kyiv)

| Total number of animals with surgical pathology, heads | Total number of pathologies of the digestive system, heads | Number of cases of conservative care | Complicated pathologies of the digestive canal (number of operations). | | | | |
|--|--|--------------------------------------|--|-------------------------------|----------------------|------------------|-----------------------------|
| | | | Foreign bodies in the stomach | Neoplasms in the stomach area | Gastric perforations | Gastric erosions | Inflammatory bowel diseases |
| 1863 | 957 | 763 | 170 | 4 | 3 | 14 | 3 |
| 100% | 51.4% | 79.7% | 17.7% | 0.4% | 0.3% | 1.5% | 0.3% |

Source: compiled by the author of this study

The total number of animals diagnosed with the pathology of the digestive system was 957 animals. Conservative care was provided to seven hundred sixty-three animals, accounting for 79.7%. Gastroscopy was performed on 122 patients with stomach pathology, accounting for 12.7% of the total number of visits. 194 surgical interventions were performed for stomach and intestinal pathology, representing 20.3% of the total number of visits. During gastric surgery, 170 animals (87.6%) had foreign bodies removed, and 4 (2.1%) operations were performed to remove neoplasms. Surgical intervention for gastric perforation was performed in 3 animals (1.5%), for gastric erosion – in 4 animals (7.4%), surgical care for Inflammatory bowel diseases was provided to 3 animals (1.5%). Of the 194 operated animals, four underwent repeated gastric surgeries associated with repeated eating of foreign objects.

During the collection of anamnesis, it was established that most often, the clinics were visited by owners of animals with functional disorders of the digestive system, which occurred due to unbalanced feeding and violations of the conditions of keep. For the most

part, in the animals under study, pathologies occurred during injury to the tissues of the gastrointestinal tract due to eating foreign bodies (feeding meat with bones), during games (swallowing rubber, plastic toys, and other foreign bodies), or a distorted appetite (eating inedible objects). Complicated pathologies (194 cases) of the digestive canal organs caused perforation of the stomach wall, erosion, and inflammatory bowel diseases. In a separate group of animals (4 cases), malignant neoplasms in the stomach and intestines were diagnosed, which, like foreign bodies, completely or partially obturated the intestinal lumen.

Some of the examined animals had digestive disorders caused by bacterial or viral factors and irrational use of antibiotics (dysbiosis) applied by animal owners without consulting a doctor. During the analysis of statistical indicators, it was noted that the development of pathology of the digestive system can occur as a concomitant pathology or symptom of other diseases, such as chronic renal pathology and, especially in the terminal stage, with erosive lesions of the digestive system, due to a substantial and prolonged increase in the

concentration of urea in the blood. Results of the study by M. Binvel *et al.* (2017) highlighted that the absorption process can be disrupted due to any induced defect that restricts the intestinal ability to absorb fluid or disorders in the secretion of pancreatic juice necessary for efficient digestion. In rare cases, newborn pups may have diarrhoea, as noted by R.A. Didier *et al.* (2021), when they are fed milk because they are unable to digest lactose. During diarrhoea, shock can occur due to dehydration and an electrolyte (salt) imbalance.

According to the results of the analysis of the obtained statistical data, it was determined that among all surgical pathologies, 52% are diseases that occur in the organs of the digestive system. Among these diseases, in 25% of cases, animals needed surgical treatment. The following instrumental diagnostic methods were used to clarify the diagnosis of surgical pathology of the digestive system in animals: X-ray examination (Figs. 1-11), ultrasound diagnostics (Fig. 12), and esophagogastroduodenoscopy (Fig. 13).

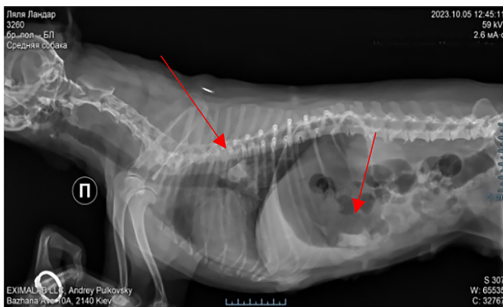


Figure 1. Overview image of the dog's thoracic and abdominal organs, lateral projection
Note: arrows indicate multiple foreign bodies in the thoracic oesophagus and stomach of the dog. The examination was conducted without the use of contrast agents
Source: developed by the author

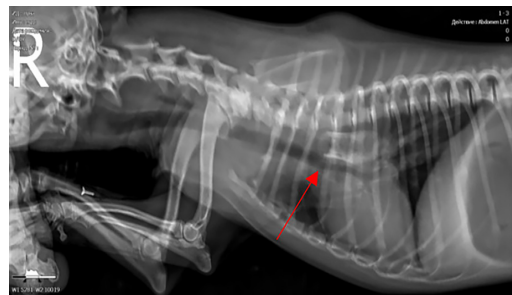


Figure 2. Overview image of the chest organs, lateral projection
Note: the arrow indicates a foreign body in the thoracic oesophagus
Source: developed by the author

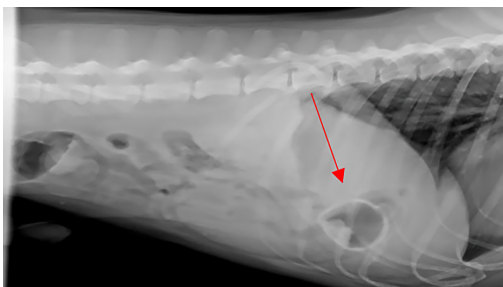


Figure 3. Overview image of the abdominal organs, lateral projection
Note: the arrow marks a hollow foreign object in the patient's stomach
Source: compiled by the author



Figure 4. Overview image of the abdominal organs, front projection
Note: arrows indicate multiple foreign bodies and their fragments in the dog's stomach
Source: compiled by the author

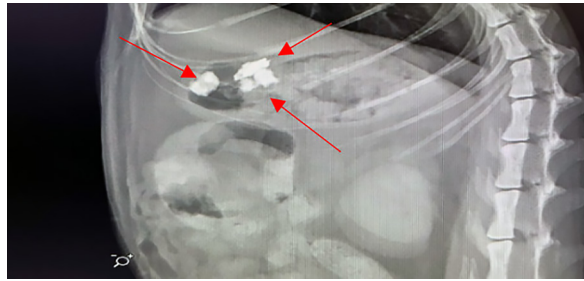


Figure 5. Overview image of the abdominal organs, lateral projection

Note: arrows indicate multiple X-ray contrast foreign bodies in the animal's stomach cavity

Source: compiled by the author

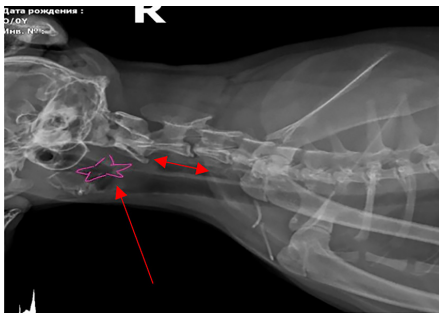


Figure 6. Overview image of the cervical oesophagus, lateral projection

Note: the red arrow indicates a foreign body, the contours of which are circled in pink to improve visualisation, and the air-expanded lumen of the oesophagus is also visible (marked with a red two-sided arrow)

Source: compiled by the author



Figure 7. Patient after the removal of the alien body

Note: cat after removal of the side body (star) in the area of the oesophagus, which was previously visualised in Fig. 6

Source: developed by the author

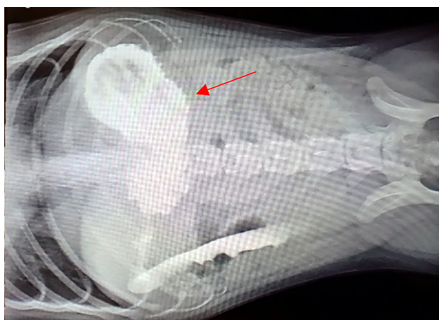


Figure 8. Overview image of the abdominal cavity, ventro-dorsal projection

Note: X-ray examination with a contrast agent (barium sulfate) identified a foreign body (marked with an arrow) in the stomach without signs of mechanical obstruction

Source: compiled by the author

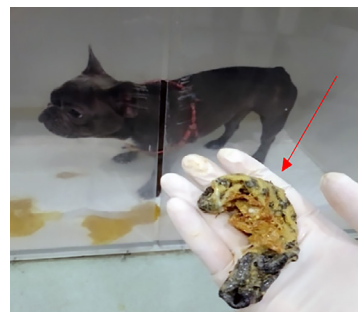


Figure 9. Foreign body after removal from the animal's stomach

Note: removed foreign body visualised (marked with a red arrow)

Source: compiled by the author

According to the results of the examination, it was established that X-ray examination is especially effective in the presence of X-ray contrast structures (foreign objects) in the digestive organs, such as metals, stones, bones (and other objects that are more noticeable in their density when using this diagnostic method). In particular, C.I. Pratt *et al.* (2014) and A.M. Power *et al.* (2021) emphasised that using this method is not 100% effective because not all foreign bodies are X-ray contrast or denser than body tissues. In the example of clinical cases, they showed the informative value of various diagnostic methods for surgical pathology of the gastrointestinal tract of animals.

Example 1. Cat Arnold, Abyssinian breed, age 3 years. From the history data, it was determined that the animal had swallowed a toy. Based on the diagnostic investigation results, it was found that the removal of the foreign body through endoscopy was not possible due to the risk of perforation during manipulation and the presence of feed masses in the stomach. Therefore, the decision was made to perform upper midline laparotomy along the white line and gastrotomy, followed by the removal of feed masses and the foreign body. Lembert-Schmieden sutures were applied to the stomach wall using monofast 4.0 suture material with a cutting needle. The abdominal cavity was flushed with sterile physiological saline at a volume of 200 mL/kg. The abdominal wall was sutured with a nodular suture using PDS 4.0 thread, the subcutaneous tissue with a continuous suture, and the skin with an intradermal suture.

In cases where the presence of foreign bodies in the gastrointestinal tract was confirmed, esophagogastroscope or esophagogastroduodenoscopy was not always performed on animals. According to the research results, linear foreign bodies that passed into the small intestine and caused its corrugation were not subjected to endoscopic removal due to the high

risks of perforation, which could lead to the development of peritonitis.

Example 2. Luna dog, Labrador breed, 7 months old. Owners presented to the clinic with complaints of the animal's attempts to vomit and refusal to eat. There was suspicion of ingestion of a foreign body (they allowed chewing on ribs). To refine the diagnosis, a radiographic examination was performed, revealing the foreign body. A radiographic examination was conducted in two projections (lateral on the right side and ventro-dorsally) (Fig. 10, 11).

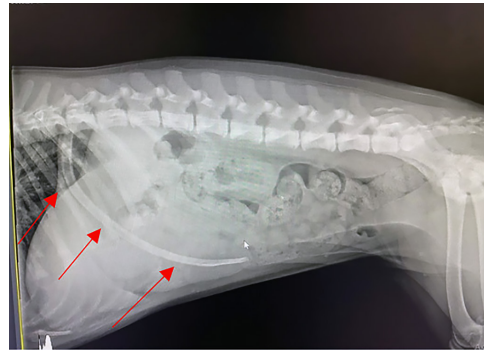


Figure 10. Overview image of the dog's abdominal organs (lateral projection on the right side)

Note: the red arrows indicate the extent of the foreign body (pig rib) in the dog's stomach

Source: developed by the author

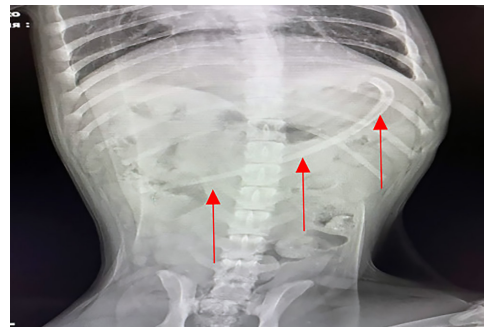


Figure 11. Overview radiograph of the abdominal organs (ventro-dorsal projection)

Note: the red arrows on the image indicate the extent of the foreign body in the dog's stomach

Source: developed by the author

In many cases, radiographic examination is highly informative and allows choosing the most effective surgical treatment method for animals with foreign bodies in the digestive system. In addition to radiographic examination, ultrasound diagnostics (US) were used to detect linear foreign bodies in the stomach and accompanying complications, such as thickening of the stomach wall due to inflammation. They diagnosed perforations in the stomach and intestine caused by a foreign body, the presence of fluid in the abdominal cavity, and neoplasms in the stomach, protruding into the pyloric region and causing obstruction of gastric outflow. This type of study provided information on the shape, size, echogenicity, and location of the foreign body, identified signs of thickening of the stomach and intestinal walls, and determined the sizes of regional lymph nodes. It is worth noting that ultrasound also has a drawback.

With a large amount of feed masses in the stomach, the informative value of this research method decreases. The results described are consistent with those of other researchers. For example, E. Gibson *et al.* (2020) indicated that the presence of feed masses or gases in the stomach makes ultrasound examination of the digestive tract less informative. Therewith, J.S. Mattoon *et al.* (2020) demonstrated the usefulness of ultrasound examination, especially in the diagnosis of neoplasia in the stomach of dogs. The results of the ultrasound corresponded to the localisation of the tumour obtained by other diagnostic methods. The authors stated that the clinical picture of ultrasound is difficult to interpret because benign gastric polyps are rarely found in dogs, and most of them are discovered accidentally. Despite the fact that ultrasound examination allowed assuming the presence of a polyp in the gastric mucosa, the final diagnosis can be established based on histopathological examination.

V. Barberet *et al.* (2008) used advanced ultrasound diagnostic methods in their studies. Using transgastric ultrasound, they examined organs located centrally, such as the pancreas. These organs can be well examined transgastrically using endoscopic ultrasound, without interfering with the upper intestinal segments, as is usually the case with transabdominal ultrasound. It is necessary to consider factors that can affect the quality of the study. Parameters that negatively affect the visibility of organs are air or feed in the digestive organs. According to A. Otomo *et al.* (2020), these parameters positively influenced the visibility of the pancreas and duodenum, likely related to the different body positions used for the study. E. Gibson *et al.* (2020) expressed that a retrospective analysis of cases involving simultaneous abdominal US and endoscopy to assess the presence of anomalies in the stomach walls, foreign bodies, tumour localisation, and changes between the two examinations is more informative. Sonography and endoscopy are useful for diagnosing gastric neoplasia, with endoscopy being a more precise method for detecting gastric neoplasia. However, sonography can raise clinical suspicion of gastric neoplasia and provide a less invasive way to gather information before endoscopy. The presence of gas or fluid in the stomach lumen limited the diagnostic capabilities of sonographic evaluation.

Example 3. Dog Nicole, Labrador breed. During the history collection, it was established that at 9:00 in the morning, the owners observed the dog playing with a ball, and within 5 minutes, the toy was not found. Therefore, the decision was promptly made to seek veterinary care. The animal underwent an ultrasound examination of the abdominal cavity to determine the presence of a foreign body in the stomach (Fig. 12). After confirming the presence of the foreign body, endoscopic removal was performed (Fig. 13).

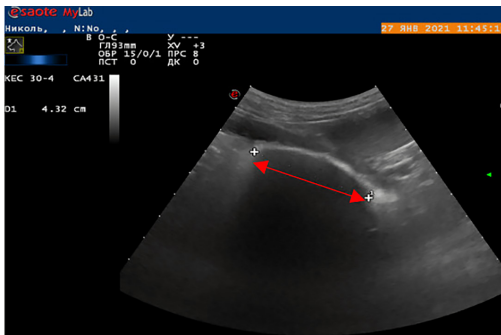


Figure 12. Ultrasonographic diagnosis of the foreign body in the stomach of the dog Nicole
Note: the red arrow indicates the extent of the foreign body in the patient's stomach
Source: developed by the author

Esophagogastroduodenoscopy (EGD) is one of the most effective diagnostic methods for detecting foreign bodies in the oesophagus, stomach, and duodenum. Through EGD (with the availability of special equipment), the removal of a foreign body from the stomach and biopsy for oesophageal strictures or mucosal trauma and neoplasms in the gut were conducted. This diagnostic method allows for the final diagnosis to be established, as supported by the findings of E. Gibson *et al.* (2020) and helps determine the need for surgical intervention on the stomach and intestines.

Endoscopic examination was also used to diagnose and perform therapeutic balloon dilation of oesophageal strictures. According to the results of the study by R.K. Sellon *et al.* (2003), who conducted endoscopic balloon dilation of benign oesophageal structures in animals, regurgitation is the most common clinical symptom observed on average 4 weeks before the dilation of the oesophageal segment to the stenotic zone. Oesophageal perforation was the only serious complication and occurred in one patient. I. Hennink *et al.* (2021) indicated that this manipulation should be performed under anaesthesia, preceded by necessary diagnostics,

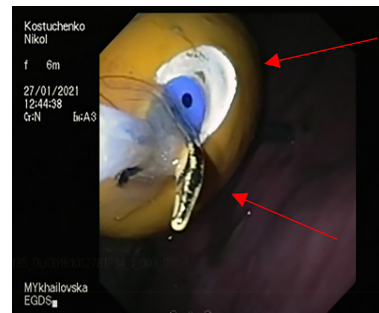


Figure 13. Endoscopic removal of the foreign body from the stomach of the dog Nicole
Note: the red arrows indicate the foreign body in the stomach, which was removed using endoscopy (esophagogastroduodenoscopy)
Source: developed by the author

to determine the presence of systemic disorders and reduce the patient's anaesthetic risk. D.A. Elsemore *et al.* (2017) emphasised the importance of examining the stomach wall throughout its entire area to select the treatment strategy based on the patient's overall condition and considering all aspects of the history and results of previous investigations. However, M. Pinheiro Souto *et al.* (2023) demonstrated that a drawback of this diagnostic method is the need for anaesthesia, with contraindications being the occurrence of perforation in the stomach or intestines. The risk of perforation may arise during the examination or attempted removal of a foreign body and in the presence of free fluid or diaphragmatic or hiatal hernias.

R.K. Sellon *et al.* (2003) noted that the diagnosis and treatment of diseases of the digestive system organs in dogs and cats increasingly rely on the collection and interpretation of biopsy samples from the mucous membrane obtained endoscopically from one or more areas of the digestive system. The physician's goal is to distinguish between normal and affected tissues, characterise the nature and severity of their changes, and make an accurate diagnosis based on morphological or etiological features,

facilitating prognosis formation and appropriate therapy selection. The application of histopathological methods allows for the rapid diagnosis of adenocarcinomas or alimentary lymphomas. Conversely, the interpretation of inflammatory changes in the mucous membrane proved much more complex.

A. Zamprakou *et al.* (2016) indicated that veterinary clinics often create surgical intervention protocols based on generally accepted rules and modern trends in veterinary medicine development. The authors compared various suture materials with Monocryl, which were selected according to surgical recommendations and research results. Nevertheless, the use of Monofilament Maxon contributes to obtaining much more reliable knots. Sliding knots with Monocryl (poliglecaprone 25) were similar, square knots were three times less reliable than those tied with PDS-2 monofilament, and Braided Dexon-Plus suture material was stronger than Monocryl for sliding knots. Therewith, braided Vicryl did not significantly differ from Monocryl.

I. Hennink *et al.* (2021) demonstrated that the mechanical properties of the Monocryl knot are identical to those of Vicryl. Still, they are less reliable than those in other synthetic absorbable monofilament threads (Maxon) and respective alternatives (PDS). These conclusions and other characteristics, such as degradation rate, should be used to determine the application of Monocryl. The positive aspect of using Monocryl is the lower trauma volume during surgery and the use of appropriate biological preparations that stimulate the activation of regenerative activity in the damaged area of the organ or tissue under investigation.

Therefore, the use of modern diagnostic methods in most cases allows for a clear diagnosis and resolution of the problem without surgical intervention or the most effective implementation of surgery on the stomach

and intestines with minimal possible complications. The choice of the method depends on the situation and the reason for the surgical intervention.

Conclusions

Pathologies of the digestive system are quite often recorded in dogs and cats. The sharp increase in their incidence is attributed to the irresponsible attitude of owners who violate the conditions and rules of keeping and feeding their pets. It was established that among animals with surgical pathology, 51.4% had diseases of the gastrointestinal tract, of which 25% of animals required surgical treatment. The most common surgical intervention was performed for the removal of foreign bodies (87.5%), erosion of the stomach (7.4%), diagnosis of neoplasms (2.1%), and stomach perforation (1.5%). Instrumental, radiographic, and ultrasound methods were used for the diagnosis of gastrointestinal tract pathologies, and their informativeness was determined. The results of these methods were considered when choosing the surgical treatment method for sick animals.

High efficiency of radiographic examination was observed in the presence of radiopaque structures in the digestive organs, which are more visible in this diagnostic method due to their density. The drawback of this method is that not all foreign bodies are radiopaque or denser than the body's tissues. Ultrasound diagnostics allows the detection of linear foreign bodies in the stomach and complications, such as thickening of its wall due to inflammation. This method is also informative for perforations in the stomach and intestine caused by a foreign body, the presence of fluid in the abdominal cavity, and tumours in the stomach protruding into the pyloric part, causing obstruction of gastric outflow.

The application of ultrasound allowed obtaining information about the shape, size,

echogenicity, and location of foreign bodies and identifying signs of thickening of the stomach and intestinal walls. The drawback of this method is a decrease in informativeness due to the large volume of feed masses and gases in the stomach of the examined animal. Clinical cases demonstrated the algorithm for examining animals with digestive system pathologies and the use of various diagnostic methods, the results of which allowed choosing the most optimal method of surgical treatment. It should be noted that in some cases, it is possible to avoid invasive treatment methods for pathological processes in the digestive system. These include minimally invasive surgical intervention using non-invasive methods such as gastroscopy, which shortened the patient's recovery process after eliminating the cause

of the pathological process. The correct choice of the instrumental diagnostic method in each specific case, considering the data of the history and clinical examination of the animal, allowed selecting the most effective method of surgical intervention, reducing tissue trauma, and shortening the recovery period for patients.

In the future, a study on the use of cell-regenerative therapy to activate the process of reparative regeneration and the formation of a complete scar on the stomach to reduce post-operative complications is planned.

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Conflict of Interest

None.

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Поширеність та методи діагностики хірургічної патології апарату травлення тварин

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Анотація. Актуальність дослідження зумовлена стрімким зростанням чисельності дрібних домашніх тварин з хірургічною патологією органів апарату травлення, що потребує ефективної діагностики та хірургічного втручання. У зв'язку з цим, мета цієї роботи полягала у дослідженні поширеності різних видів хвороб органів травного каналу в дрібних домашніх тварин, а також у визначенні найінформативніших методів їх діагностики. Провідним підходом у роботі було порівняння інформативності результатів досліджень хворих тварин, а саме: загального (збір анамнезу, огляд, пальпація) та спеціальних (ультразвукова діагностика органів черевної порожнини, ендоскопія травного каналу, рентгенографія). Визначено та проаналізовано переваги та недоліки різних спеціальних діагностичних методів дослідження, що дозволяє комплексно оцінити показання та протипоказання до їх застосування у клінічній ветеринарній практиці. Встановлено, що з 1863 тварин, які звернулися до ветеринарної клініки у 957 тварин діагностовано патології травного тракту різного генезу. Хворим тваринам у 79,7 % випадків (763 голів) надано консервативну допомогу. У 194 (20,3 %) тварин діагностовано ускладнені патології, що потребували оперативного лікування. Серед останніх виявлено у 170 (17,7 %) тварин – сторонні тіла у шлунку, в 14 (1,5 %) – ерозії шлунку, у 4 (0,4 %) – новоутворення, у 3 (0,3 %) – перфорації і у 3 (0,3 %) – запальні захворювання. Використання ультразвукової діагностики дозволяє виявляти лінійні сторонні тіла в шлунку, наявність супутніх ускладнень (перфорації шлунка чи кишечника стороннім тілом). Рентгенологічне

дослідження ефективне за наявності в якості сторонніх предметів рентген-контрастних структур (метали, каміння, кістки). Матеріали статті становлять практичну цінність як для науковців, так і для практикуючих лікарів, надаючи можливість використовувати нові інструментальні методи діагностики для з'ясування доцільності хірургічних маніпуляцій на шлунку та кишечнику в собак і котів

Ключові слова: езофагогастродуоденоскопія; ультразвукова діагностика; рентгенологічне дослідження; рівень плато; дивертикул; кіла; запальне захворювання кишечника