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A PROTOCOL FOR MANAGEMENT OF ACUTE GASTRIC DILATION-VOLVULUS SYNDROME IN THE DOG.

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Introduction:
Canine acute gastric dilation with volvulus (GDV) is a potentially catastrophic event that requires emergency medical and surgical therapy and intensive post-operative care, to optimize the chance of a successful outcome.

The clinical features of GDV include restlessness, retching, abdominal distension and discomfort and abdominal tympany. Initial patient evaluation and treatment is aimed at determining the degree of cardiovascular compromise and restoration of intravascular deficits by intravenous fluid administration. The emergency team must also perform gastric decompression and determine the presence or absence of gastric volvulus. Finally, careful patient monitoring and frequent re-evaluation is required in order to adjust therapy, and thereby maintain patient stability whilst in the emergency room.

Dogs with GDV should receive prompt surgical attention. An anesthetic protocol that has minimal deleterious effects on the cardiovascular and respiratory systems should be used. The aims of surgery are first, to achieve gastric decompression, second, the removal of any devitalized tissue (stomach, spleen) and third, to perform a gastropexy.

Intensive post-operative care is essential for dogs recovering from surgery for GDV. The majority of animals will recover without complications, in two to three days. Others, however, will develop complications that will prolong their hospital stay and may be life threatening. Such complications must be investigated and treated on their individual merit. Although a challenge to treat, a good survival rate can be achieved for dogs that present with GDV.

Management of suspected acute GDV:

**Therapeutic goals:**
1. Restore and support the circulation.
2. Decompress the stomach.
3. Establish whether GDV or simple dilation is present.
4. Rapid surgical correction if volvulus has occurred.
5. Prophylaxis:
   - surgical
   - environmental

**Emergency care:**
Management of hypovolemia, to prevent or treat shock, is the primary goal of emergency treatment. Two large bore catheters (ideally 16g or 18g) should be placed in cranial veins (cephalic or jugular) and blood taken for “baseline database”. Fluid therapy should be started at a rate of 90 ml/kg/hr using a balanced electrolyte solution.
In giant breeds, an hypertonic saline-dextran (HSD) combination (7% NaCl in 6% dextran 70) administered at 5ml/kg over a five minute period may, provide more rapid initial circulatory resuscitation. If available, continuous ECG should be started or a baseline recording made.

Gastric decompression should only be attempted once correction of the intravascular volume deficit is well underway. Close patient monitoring is essential at this time. In most instances, gastric decompression can be achieved by orogastric intubation of the conscious or sedated animal. For sedation, a combination of fentanyl (2-4 micrograms/kg) or oxymorphone (0.1 mg/kg IV) followed by diazepam (0.25-0.5 mg/kg IV) can be used. Gastric decompression by a combination of either orogastric intubation or trans abdominal gastrocentesis should be done.

The patient should be frequently re-assessed by analysis of subjective and objective clinical data such as; peripheral pulse pressure and quality, heart rate, mucous membrane color, capillary refill time (CRT), PCV and TP concentration, degree of abdominal distension, and ECG. Intravenous fluid type and composition should be tailored to each individual patient’s needs, to optimize tissue perfusion and oxygen delivery.

**Radiography:**
Radiography is not necessary to diagnose gastric dilation but is an invaluable aid to diagnosing volvulus. A right lateral recumbent view of the cranial abdomen is the initial examination of choice. This view should be supplemented by further views if the diagnosis is still uncertain. The radiographic features of GDV include a large dilated gas-filled gastric shadow which may be divided into two compartments by the soft tissue of the folded lesser curvature. Splenic enlargement and malposition may be evident. Gas within the gastric wall may indicate gastric wall compromise, if gastric rupture has occurred, free gas will be present in the abdominal cavity.

**Anesthesia:**
In practice situations, the choice of anesthetic agents may be limited. If the previously mentioned sedative combination has been used preoperatively, endotracheal intubation may be achieved after a further intravenous infusion of the same cocktail. The inclusion of lidocaine into the induction protocol (2 mg/kg IV) will help desensitize the larynx and facilitate endotracheal intubation in addition to enhancing the overall state of anesthesia. In addition, if a different induction agent is to be used, the quantity required will be reduced because of residual effects of the sedative. It is also important to realize that circulatory compromise will influence the speed and efficiency of drug distribution. Since intravenous access should already be established, small amounts of induction agent should be given to effect. Maintenance should be with halothane or isoflurane and oxygen. Nitrous oxide should not be introduced until permanent gastric decompression is achieved.

Intraoperative monitoring should ideally consist of: blood pressure, ECG, urine production, pulse oximetry and capnography. Evaluation of PCV and TP should be
performed intraoperatively at 30 to 60 minute intervals. Intravenous fluid type and composition should be tailored to each individual patient’s needs, in an attempt to ensure adequate tissue perfusion and oxygen delivery by maintaining a mean arterial blood pressure above 65mmHg, and an hematocrit at or above 25-30%.

**Surgical therapy:**
The immediate aims of surgery are to return the stomach to its normal position and evaluate it and the spleen for signs of irreversible vascular compromise. If present, necrotic portions of stomach and spleen should be removed. The stomach should be emptied completely. Finally, a gastropexy should be performed in an attempt to prevent recurrence.

Following routine aseptic preparation a cranial ventral midline laparotomy is performed. The stomach is usually immediately visible and covered by greater omentum when a clockwise volvulus of 180° - 270° has occurred. Gastric decompression, at this stage, will help subsequent manipulation and relocation of the stomach. This can be achieved intraoperatively by needle gastrocentesis, or placement of an orogastric tube. After decompression, the stomach and spleen should be returned to their normal positions.

A systematic evaluation of the abdomen should then be performed. Active sites of hemorrhage should be identified and ligated. Careful inspection of the stomach and spleen should be carried out. If all organs look grossly normal, an assistant should lavage the stomach using clean, warm water via the orogastric tube to empty it completely. If large particles persist within the stomach, it is advisable to remove them surgically.

The junction between the fundus and body and the greater curvature are the most common sites of gastric necrosis following GDV. Gentle palpation for pulsation in the gastric and splenic vessels is helpful, examination of the gastric wall for tears or colour changes, (grey/green or black) following anatomical reduction of the stomach, will help determine if partial gastric resection is needed. Following partial resection, gastric wall closure using a simple continuous suture pattern in the submucosa is followed by a simple interrupted pattern in the muscularis and serosa. Oversewing the suture line with a continuous or interrupted inverting pattern such as a Cushing or Lembert can reinforce this closure. Polydioxanone (PDS-Ethicon), polyglactin 910 (Vicryl-Ethicon), polyglycolic (Dexon-Davis and Geck) acid and polyglyconate (Maxon-Davis and Geck) are all suitable suture materials. Alternatively, surgical stapling devices can be used to perform partial gastric resection. The GIA-50, (US Surgical) or the TA-90, (US Surgical) can be used for this. Again, this closure should be reinforced using a continuous or interrupted Cushing or Lembert inverting pattern to oversew the staple line.

Part or all of the spleen can sustain vascular damage or vascular occlusion following GDV. Any devitalized portion of splenic tissue should be resected either by hand or using a surgical stapling device. If the spleen has undergone torsion around its pedicle splenectomy should be performed before reducing the twist.
A gastropexy should be performed. Currently, the most popular include “incisional”, “belt-loop” and “tube” gastropexy. The fundamental aim is to create a permanent adhesion between the pyloric antrum and the right body wall. Closure of the abdominal incision is routine. A bandage is placed around the abdomen to protect a gastropexy tube.

**Postoperative care**

Fluid therapy is maintained at a rate of 8-10 ml/kg/hr using a balanced electrolyte solution for the first 24hrs. Systemic administration of opioid analgesics (e.g. Morphine at 0.5 mg/kg IM every 4–6 hrs) will reduce postoperative discomfort and facilitate recovery. During this period, it is useful to monitor PCV and TP intermittently along with peripheral pulse quality, mucous membrane color and urine output. Again, if continuous ECG is available it should be used or intermittent records made. If present, the stomach tube should be vented as needed. Nothing should be given by mouth.

If complications do not occur, water can be offered the second day after surgery and the intravenous fluid rate reduced (4 ml/kg/hr). Patient comfort level and the need for further analgesia should be assessed and analgesia provided on an as needed basis. Small amounts of food can be offered by the end of the second day. The clients should be informed of the signs of recurrence and encouraged to seek veterinary attention as soon as possible if they are encountered.

**Post operative complications**

Animals that have undergone partial gastrectomy may take longer to regain normal gastric motility. Metaclopramide (1-2mg/kg/day IV) or very low dose erythromycin (0.5-1.0mg/kg every 8 hours) might be beneficial in this situation, along with intermittent gastric decompression.

Persistent hypotension may be suspected if peripheral pulse quality is poor, if tachycardia and poor capillary refill time are evident and urine output is low. Most commonly, this is caused by inadequate fluid therapy in the post-surgical period. If PCV & TP levels reveal hemoconcentration a return to high volume, rapid infusion of crystalloid may be necessary for a short time (i.e., 1 hr at 90 ml/kg) followed by a return to 10-15 ml/kg/hr. If the PCV and/or TP are low, blood products or synthetic colloid should be administered to correct the deficit(s). The patient should be re-evaluated frequently following any change in fluid therapy.

Cardiac arrhythmias are common following an acute episode of GDV. They are usually ventricular in origin and range from intermittent ventricular premature conduction to sustained ventricular tachycardia. Occasionally supraventricular abnormalities (e.g. atrial fibrillation) are seen. It may be necessary to treat cardiac arrhythmias if they are associated with primary heart disease (e.g. Dilated cardiomyopathy) or if there is evidence of poor cardiac performance.
Alterations in breathing rate and pattern coupled with crackles and wheezes on thoracic auscultation are suggestive of pneumonia or acute lung injury. Thoracic radiographs, arterial blood gas evaluation and tracheal/bronchioalveolar wash fluid cytology and culture will help confirm a clinical diagnosis of pneumonia. Treatment with the appropriate antibiotic(s), local fluid therapy (nebulization), thoracic coupage, supplemental oxygen and frequent small amounts of exercise should aid recovery.

Gastric necrosis and perforation can occur up to five days postoperatively, especially if resection was performed, and in spite of careful intraoperative assessment of gastric wall viability. If gastric necrosis and perforation occurs, the prognosis is grave.

Persistent ongoing hypotension, despite appropriate fluid therapy, is a serious concern. Persistent hypovolemia despite aggressive fluid therapy and the development of pulmonary complications, where systemic inflammation is suspected, are poor prognostic signs. Therapy for such patients may include oxygen supplementation and ventilator-assisted breathing in addition to continued intensive circulatory support, as previously described. The prognosis for animals with these complications is very poor.