EMERGENCY MANAGEMENT OF THE GASTRIC DILATATION-VOLVULUS (GDV) PATIENT

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Introduction

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- ELITE members only
- Email / contact with ANY questions
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Thank you!

- To the generous donation of Jan MacLennan-Kennedy, in memory of her Giant Schnauzer, Meg.

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Introduction

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CEO, VETgirl

Signalment

- Great Dane
- Standard poodle
- Gordon setter
- Weimaraner
- Saint Bernards
- Irish Setters
- German shepherds

- Basset hound
- Puppies

Risk factors

- High thoracic depth-to-width ratio
- Older dogs
- Lean
- 1st degree relative
- Greedy eaters ("wolfers")
- Temperament (e.g., nervous)
- Dietary factors
- Dry food

GDV

- Life-threatening
- Cause of “sudden death”
- Complications:
  - Cardiac arrhythmias
  - Sepsis
  - DIC
  - Peritonitis
  - MODS

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Risk factors

- Laxity or agenesis of perigastric ligaments
- Pyloric outflow mechanics
- Feeding of a single large meal
- Raised dog bowl
- Abnormal eructation
- Gastric foreign body

Pathophysiology

- Hypovolemic shock and decreased $O_2$ delivery ($DO_2$)
- Gastric distension $\rightarrow$ compression of intraabdominal veins $\rightarrow$ decreased CVC blood flow
- Respiratory compromise due to increased intraabdominal pressure $\rightarrow$ decreased total thoracic volume

Clinical signs

- Non-productive retching
- Agitation
- Waking pet owner up in middle of night
- Restlessness
- Attempting to vomit
- Tachypnea
- Distended stomach
- Tachycardiac
- Collapse
- Acute death

Physical examination findings

- Sprung ribs
- Decompensated shock
  - Poor pulse quality
  - Prolonged CRT
- Pallor tachycardia
- Tachypnea
- Pulse deficits/arrhythmias
- Typanic abdomen
- Splenomegaly
- Obtunded
- Comatose

Diagnosis of GDV

- Historical findings
- Clinical signs
- PE findings
- Normally left lateral
- Single right lateral AXR

Diagnosis of GDV

- What’s happening on AXR?
  - Pylorus moves craniodorsal $\rightarrow$ separated by soft tissue opacity from gastric fundus
    - Double bubble, you’re in trouble
    - Popeye sign
    - Reverse C
  - When in doubt, consider doing a DV or VD
    - Pylorus on left of midline on DV (normally on right)

http://gsrne.org/bloat/
What other diagnostic tests should you do?

- Chest radiographs
  - 3 view
  - Metastasis check
  - 14% aspiration pneumonia (Green et al, 2012)
- BIG 4 (PCV/TS/BG/AZO)
- Lactate
- CBC/chemistry
  - Mild elevation in LFT
  - Mild azotemia

Results

- BIG 4
  - Hemoconcentration
  - SOD hyperglycemia
  - Mild azotemia?
- Lactate
  - > 6 mmol/L → gastric necrosis, worse prognosis (de Papp, JAVMA 1999)
  - > 7.4 mmol/L → gastric necrosis (Zacher, JAVMA 2010)
  - Decrease by 50% within 12 hours → good indicator of survival (Green, JVECC 2011)

Treatment goals for GDV

- Fluid resuscitation
- Gastric decompression
- Surgical intervention
- Treatment of life-threatening complications
- Analgesia
- Monitoring and supportive care

FLUID THERAPY

Shock dose of IV fluids

- 60 kg Great Dane GDV
  - Shock dose = 3600 – 5400 mls
  - Does it really take this much?

“Using the ‘shock dose’ of fluids”

- Where does this dose come from?
  - Blood volume
- Use small amounts frequently
  - It’s easier to give small amounts frequently than to take it away later
  - ± 1/3 of a shock dose IV over XX amount
Fluid therapy

- Crystalloids
  - 20-30 ml/kg IV
  - Repeat and reassess
  - Repeat and reassess
  - What type?
- Colloids (e.g., Hetastarch, VetStarch)
  - 5 ml/kg IV
  - Repeat and reassess
- Continue fluid therapy

GASTRIC DECOMPRESSION

Trocharization vs. orogastric intubation

- Which is easier?
- Which has less side effects?
- Weight pros and cons
- Goodrich (JSAP, 2013)
  - 77% success with OG; 38% needed sedation
  - 86% success with trocharization

Gastric decompression: Trocharization

- Locate most tympanic region
- Sterile prep
- 14-16 ga. catheter
- Listen for hissing sound → evacuate gas
- Pros:
  - Easy
  - Cheap
  - Fast
- Cons:
  - Risk of splenic laceration
  - Risk of gastric perforation
  - Septic peritonitis

Gastric decompression: Orogastic intubation

- Sedate
- Pass orogastric tube
- Gavage
- Immediately to surgery
- Pros:
  - Removes gastric content and gas
- Cons:
  - Risks of sedation
  - Risks of trauma
  - Technically challenging

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GDV Surgical Challenges

Don’t Flip Out

Success

- Adequate stabilization
- Appropriate diagnostics
- Peri-operative monitoring
- Surgical technique and experience
- Successful prevention of recurrence

Be CONSISTENT.
Be SYSTEMATIC.

have a plan, and
be ready to change your plan!

Why it happens
How it happens
At risk breeds and predispositions
Outcome variables

- Initial lactate
- Preoperative stabilization
- Preoperative decompression
- Gastroscopy techniques

When to Cut?

Plan:
- Correct gastric malpositioning
- COMPLETE abdominal exploratory
- Prevent recurrence

- Gastric resection
- Splenectomy
- Cultures
- Drainage

Large clip and prep area
Xiphoid to pubis
COMPLETE abdominal exploratory
The Exploratory

- Ventral midline
- No wimpy incisions
- Excise falciform ligament and fat
- Radiopaque laparotomy sponges and Balfour retractor

Gastric Resection

- Cut and suture
- Stapler
- Invaginate?

Gastric Resection - Stapler

- Linear Stapler 55 or 90
- Blue or green cartridge (3.5mm or 4.8mm)
- Overview

Gastric ulceration subsequent to partial invagination of the stomach in a dog with gastric dilatation-volvulus

A Retrospective Study of Factors Influencing Survival Following Surgery for Gastric Dilatation-Volvulus Syndrome in 306 Dogs

Arrhythmias
Splencetomy
Splencetomy with gastric resection

Gastropexy

“a surgical operation in which the stomach is sutured to the abdominal wall or the diaphragm.”
At risk:

- GDV first relative
- Large, deep chested, dogs
- Splenic and colonic torsion
- Splenectomy?

**Prevention = Survival**

Any dog with a GDV or GV
- Recurrence rate 70%-80%
- Mortality rate >80%

**Recurrence = Mortality**

**Techniques**

- Circumcostal
- Belt-loop
- Incisional
- *open*
- Laparoscopic
- Grid
- Endoscopic grid
- Tube gastropexy

**Other Techniques**

- Gastrocolopexy
- Fundic gastropexy
- Incorporating
- Percutaneous gastropexy
- Do nothing

**Evaluation of splenectomy as a risk factor for gastric dilatation-volvulus**

Andrew N. Grange, et al., University of California, Davis. University Animal Hospital.

**Evaluation of a skin stapler for belt-loop gastropexy in dogs**

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Incisional Gastropexy

Efficacy of Incisional Gastropexy for Prevention of GDV in Dogs

Melanie E. Benbow, DVM; Chad W. Schriever, DVM, DAOS; MaryAnn G. Redlinsky, MD, DAVCO; Karen K. Conner, PhD, DAVCO

ABSTRACT

Incisional gastropexy (IG) is routinely performed as either a prophylactic procedure to prevent recurrence of gastric dilatation-volvulus (GDV) or at the time of surgical correction of GDV to prevent recurrence. Despite its common use, the long-term efficacy of the IG procedure has not been reported. The hypotheses of this study were that IG performed either during surgical treatment of GDV or as a prophylactic procedure would effectively prevent GDV. Medical records of 61 dogs undergoing IG following either a gastrotomy for treatment of GDV or as a prophylactic procedure were evaluated retrospectively. Median follow-up time for all dogs was 87.5 days (range, 0-1,550 days). Of the 61 dogs, 27 had antral gastric IG performed. The remaining 34 dogs presented for GDV and had IG performed during surgical treatment of GDV. No dog experienced GDV after IG. Recurrence of gastric dilatation (GD) alone was noted in 3 of 27 dogs (11.1%) medically prophylactically with IG. This study confirmed the efficacy of IG for the long-term prevention of GDV in dogs. (J Am Vet Med Assoc 2016; 249: 103-109, doi: 10.2460/javma.249.2.103)


Sarah Kozicki, DVM; Catherine Pappertock, DVM, DACOVS, DACGCS

ABSTRACT

The objectives of this retrospective study were to report any complications associated with incorporating a gastrotomy incision into a prophylactic gastropexy. The medical records of 21 dogs that underwent gastropexy for the removal of gastric foreign material and had a prophylactic right-anterior incisional gastropexy performed at the antrum during left costal incisions between April 2011 and February 2013 were reviewed. A total of 21 gastropexies were reviewed and none were excluded or altered as a result of follow-up. In 13 cases were reviewed, 16 with long-term follow-up, the complications of the surgeries were reported. It was concluded that a prophylactic right-anterior incisional gastropexy would not be associated with any complications leading to death or intervention. J Am Vet Med Assoc 2016; 249: 103-109; doi: 10.2460/javma.249.2.103

Clip/Gastric Tube

Incisional
- entire antrum
- parallel to the rib
- muscular to seromuscular
- Belt loop over circumcostal
- Tube with gastric resection
Complications of Gastropexy

- Motility
- Outflow obstruction
- Failure and recurrence
- Gastric dilation

Motility

- Normal dogs that undergo circumcostal gastropexy have normal gastric emptying (90% emptying at 5.5 hours)
- Dogs with GDV that undergo circumcostal gastropexy have delayed gastric emptying time (90% emptying at 13 hours)

Postoperative Care

- Continue to correct any fluid deficits
- Treat any anticipated fluid losses
- Antibiotics?
- Analgesia
- Ileus
- FEED THE GUT!
- NSAIDS?

Common Postoperative Concerns: Arrhythmias

- Reported in GDV patients both pre- and post-op
  - Pre: 11-38%
  - Post: 50.6-77%
- ECG monitoring imperative
- Usually develop within the first 24-48 hours postoperatively
- When do you reach for a lidocaine?

Risk of anastomotic leakage with use of NSAIDs after gastrointestinal surgery

Christine Frederick Bunholz, Brian Svendsen - Ascend Veterinary

Abstract

Purpose: Anti-inflammatory drugs (NSAIDs) are an important component of anti-spasmodic regimens in the treatment of gastric dilatation volvulus (GDV) and gastric dilatation- volvulus related arrhythmias. NSAIDs may indirectly disturb gastrointestinal motility by inhibiting inflammation as an important part of the healing process in an early critical phase after surgery. If NSAIDs may induce anastomotic leakage by inhibiting inflammation as an important part of the wound healing process in an early critical phase after surgery, this may contribute to the increased risk for anastomotic leakage with the use of NSAIDs.

Methods: A structured search in PubMed of clinical and experimental studies investigating the effects of NSAIDs on anastomotic healing and leakage rates after surgical anastomosis, as well as prospective studies across species.

Results: Three recent observational cohort studies (n=780) indicated an increased risk of anastomotic leakage (35% vs 15%) associated with cyclosporine-treatment in dogs undergoing gastrointestinal surgery. Three prospective studies are needed to confirm these findings.

Conclusion: The reported effects of NSAIDs on anastomotic healing suggest an increased risk for leakage. A better understanding of the complex interactions of NSAID-induced inhibition on gastrointestinal motility is imperative for the safe use of NSAIDs. Until more data are available, careful use of NSAIDs may be warranted in gastrointestinal anastomosis surgery.
Clinical application

• Treat the underlying disease

• Assess the patient
  – Still hypotensive?
  – Painful?
  – Hypoxic?
  – Electrolytes?
  – Anemia?

• Perfusion?

Common Postoperative Concerns: 
Arrhythmias

• NO - Slow idioventricular rhythm
  – Rates < 130 BPM

• Yes
  – Sustained > 160–180 beats per minute
  – Multiform (i.e. R on T)
  – Hypotension

• Lidocaine – 2mg/kg followed by CRI 40-50 mcg/kg/minute

• Procainamide - 6-8 mg/kg IV slow → CRI 25-40 mcg/kg/min

Common Postoperative Concerns: 
Blood Pressure

• 'Gold standard' - DABP, arterial catheter

• Doppler

• Oscillometric equipment.

Common Postoperative Concerns: 
Urine Output

• Particularly in the recumbent patient

• Urinary catheter (renal concerns? Hygiene?)

• Minimum urine production should be 2 ml/kg/hr

• Patients on fluid therapy should have a higher output

Common Postoperative Concerns: 
Blood Values / Electrolytes

• Lactate / Perfusion

• Electrolytes
  – Hypokalemia is a common finding
  – Especially if there is also alkalosis

• Acid-base status

• Coagulation status

Common Postoperative Concerns: 
Incision / Sepsis

• Contamination from the gastrotomy incision

• Gastric necrosis

• Incision is checked regularly for signs of infection.

• Abdominal effusion?
Common Postoperative Concerns: Pain / Analgesia

- Beneficial pre-emptive treatment with lidocaine (50–100 mcg/kg/minute IV CRI)
  - Preventing arrhythmias
  - Providing an analgesic effect
  - Promoting gastrointestinal motility.
- Post-operative pain management is essential.
  - Fentanyl as a constant rate infusion (3–7 mcg/kg/hour)
  - Buprenorphine (0.01–0.015 mg/kg IM or IV)
  - Morphine sulfate (0.5–2.0 mg/kg IM or SQ)
  - Hydromorphone (0.1–0.2 mg/kg IV, SQ, IM).

Common Postoperative Concerns: Gastrointestinal / Motility Support

- Metoclopramide (1–2 mg/kg/day)
- Dolasetron (Anzemet 0.6 mg/kg IV once daily)
- Ondansetron (0.22 mg/kg IV Q8–12h)
- Maropitant 1 mg/kg IV, SQ Q24h
- Reflux esophagitis?
  - Famotidine (0.5–1 mg/kg IV once to twice daily)
  - Omeprazole (0.5–1.0 mg/kg PO once daily)

Common Postoperative Concerns: Nutrition

- Enterocytes will undergo atrophy within 24–48 hours of lack of luminal nutritional support.
- Feeding should begin as soon as possible.
- Simple, routine GDV without evidence of gastric necrosis can be fed with 12–24 hours of anesthetic recovery.
- Gastric resection? Gastric atony? Feeding tube can be placed to allow enteral nutrition
- RER (Kcal/day) = (30 x Body weight in kg) + 70

Common Postoperative Concerns: Fluid Therapy

- Crystalloid fluids
- Maintenance rate 50-60ml/kg/day
- Body weight
- Ongoing losses
- Colloid?

Common Postoperative Concerns: Antibiotic Therapy

- Cefazolin (22 mg/kg IV TID - QID)
- Add Gram – if needed?
- Concern for sepsis / necrosis?
- Concern / DX of aspiration pneumonia?

Prognosis

- Fair to good
- 80%+ survival rate
- Poorer prognosis with:
  - Gastric necrosis → importance of lactate?
  - Hypotension
  - Collapsed/obtunded
  - Combined splenomegaly/partial gastrectomy
  - Sepsis/DIC/MODS/peritonitis
Lightening Round Literature

**Plasma lactate concentration as a predictor of gastric necrosis and survival among dogs with gastric dilatation-volvulus: 102 cases (1995-1998)**


**RESULTS:** 85 of 79 (88%) dogs with plasma lactate concentration >6.0 mmol/L died, compared with 16 of 31 (52%) dogs with plasma lactate concentration ≤6.0 mmol/L. Dog survival for nosocomial reasons was not recorded. Gastric necrosis was identified in 38 (27%) dogs. Median plasma lactate concentration in dogs with gastric necrosis (9.0 mmol/L) was significantly higher than in dogs without gastric necrosis (3.3 mmol/L). Specificity and sensitivity of plasma lactate concentration (with a cutoff of 6.0 mmol/L) in predicting which dogs had gastric necrosis were 98% and 88%, respectively. Neither of 93 (99%) dogs without gastric necrosis survived, compared with 5 of 38 (24%) dogs with gastric necrosis.

**CONCLUSIONS AND CLINICAL RELEVANCE:** Plasma lactate concentration was a good predictor of gastric necrosis and outcome in dogs with GDV. Prognostic measurement of plasma lactate concentration may assist in determining prognosis of dogs with GDV.

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**Evaluation of plasma lactate concentration and base excess at the time of hospital admission as predictors of gastric necrosis and outcome and correlation between those variables in dogs with gastric dilatation-volvulus: 78 cases (2004-2009).**


**RESULTS:** Gastric necrosis was identified in 12 dogs at the time of surgery and in 4 dogs at necropsy. Forty-five (58%) dogs survived to hospital discharge, whereas 23 (29%) dogs died as a result of surgery. Of the 83 surviving dogs, 56 (68%) had uneventful outcomes. In the 34 uneventful cases, 25 (74%) had no evidence of gastric necrosis. Median plasma lactate concentration of 6.4 mmol/L, and was 66% accurate in predicting gastric necrosis (specificity: 98%; sensitivity: 66%) for predicting outcome (specificity: 96%; sensitivity: 80%). Among all dogs, the combination of initial plasma lactate concentration and base excess was significant. Although base excess was a poor discriminator for predicting gastric necrosis or outcome (area under the receiver operating characteristic curve, 0.81 and 0.84, respectively).

**CONCLUSIONS AND CLINICAL RELEVANCE:** In dogs with GDV, plasma lactate concentration at the time of hospital admission was a good predictor of gastric necrosis and outcome. However, despite the correlation between initial base excess and plasma lactate concentration, base excess should not be used for prediction of gastric necrosis or outcome in these patients.

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**Evaluation of lidocaine treatment and risk factors for death associated with gastric dilatation and volvulus in dogs: 112 cases (1997-2005).**


**MEASUREMENTS AND MAIN RESULTS:** Time to death, age, body weight, size of anastomosis, presence of anastomosis (gastric wall necrosis), and presence or absence of abdominal or abdominal wall necrosis, were significantly different between dogs that received lidocaine vs those that did not (P < 0.01). Mean (± SD) hospitalization time was longer in the lidocaine-treated group (P < 0.01). Mortality of gastric dilatation-volvulus in dogs was 94% vs 81% in the lidocaine-treated and non-lidocaine-treated groups, respectively (P < 0.05). Mean (± SD) hospitalization time was longer in the lidocaine-treated group (P < 0.01). Mortality of gastric dilatation-volvulus in dogs was 94% vs 81% in the lidocaine-treated and non-lidocaine-treated groups, respectively (P < 0.05).

**CONCLUSIONS AND CLINICAL RELEVANCE:** Administration of lidocaine treatment was associated with mortality rate or postoperative complications, but mortality was associated with postoperative hospitalization time.

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**Cardiac dysrhythmias associated with gastric dilatation-volvulus in the dog.**


**Article Abstract:**

Ch 16 dogs treated medically and surgically for gastric dilatation-volvulus, 11 developed electrocardiographic evidence of ventricular dysrhythmias. Seven of these dogs had ventricular dysrhythmias for the first time during their hospitalization after surgery. The ventricular dysrhythmias included ventricular premature depolarizations, short ventricular rhythms, and ventricular tachycardias. There were no differences in electrocardiographic evidence of ventricular dysrhythmias at the time of hospitalization, Treatment with lidocaine had no effect.

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**Evaluation of lidocaine treatment on frequency of cardiac arrhythmias, acute kidney injury, and hospitalization time in dogs with gastric dilatation volvulus.**


**MEASUREMENTS AND MAIN RESULTS:** There were no group differences in age, body weight, time from arrest to cardiac arrest, external defibrillation, exit block, or mortality rate. The presence of sustained ventricular fibrillation at the time of hospitalization was not a risk factor for mortality. No differences were observed in the proportion of dogs with ventricular dysrhythmias between the lidocaine and non-lidocaine treated groups (P > 0.05).

**CONCLUSIONS AND CLINICAL RELEVANCE:** Early treatment with lidocaine, followed by the use of lidocaine for 24 hours, decreased the occurrence of cardiac arrhythmias, AV and HV conduction, and hospitalization time. Lidocaine administration was not associated with mortality.
**Lightening Round Literature**

**Coagulation abnormalities and gastric necrosis in canine gastric dilation-volvulus.**


Clinical study in 15 dogs with gastric dilation-volvulus and in whom a clotting profile had been run. Gastric necrosis was graded and multiple linear regression with the clotting profile values done to determine if there was an association between gastric necrosis and coagulation abnormalities. RESULTS: Coagulation abnormalities were found in 10/15 dogs and included thrombocytopenia (5/15), increased fibrinogen (12/15), decreased ADP (15/15), prolonged PT (3/15), prolonged aPTT (4/15), and hypofibrinogenemia (4/15). An association between gastric necrosis and coagulation abnormalities was seen but there was no causal relationship.

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**Lightening Round Literature**

**Preoperative thoracic radiographic findings in dogs presenting for gastric dilation-volvulus (2000-2010): 101 cases.**


**RESULTS:** Findings on preoperative thoracic radiographs included: small vena cava (43%), anastomotic defect (35%), intramural vistas (35%), aspiration pneumonia (16%), cardiomegaly (16%), peribronchial edema (13%), pulmonary edema (9%), pleural effusion (8%), and pulmonary oligemia (5%). Eighty-six percent of dogs (86/101) survived to discharge. Dogs without cardiomegaly on presenting thoracic radiographs had a 31.2% greater rate of surviving to discharge.

**CONCLUSIONS:** The most common findings on preoperative thoracic radiographs included, respectively, distended vena cava, intramural vistas, and a small vena cava. The incidence of cardiomegaly was low. A negative association between survival and presence of cardiomegaly or preoperative thoracic radiographic findings in dogs with GDV supports the need to obtain fewer images for prognostic information in lieu of the emergent surgical needs of the patient. The main limitations of this study include the possibility of off-type and off site, the retrospective nature of the study, and the lack of well-defined criteria for obtaining thoracic radiographs.

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**Lightening Round Literature**

**Comparison of Hb-200 and 6% hetastarch 450/0.7 during initial fluid resuscitation of 20 dogs with gastric dilatation-volvulus.**


**MEASUREMENTS AND RESULTS:** Resuscitation was defined as meeting at least 2 of 3 criteria: (1) capillary refill time ≥ 2 seconds, (2) maximum heart rate < 160 beats/min, or (3) rectal temperature ≤ 98.6°F. HR, SBP, packed cell volume, hemoglobin, base excess, and colloid osmotic pressure were compared in hospital arrival and within 15 minutes post-resuscitation. Compared to the HES group, the Hb-200 group required significantly less crystalloid (3.2 versus 18.4 ml/kg) and hetastarch (1.3 versus 4.1 ml/kg) to reach resuscitation points (P < 0.01). Time to resuscitation was significantly shorter in the Hb-200 group (2.3 versus 9.5 min).

**CONCLUSIONS:** Dogs with IDDM receiving IDDM during initial resuscitation required smaller volumes of crystalloid and colloid fluids and reached resuscitation points faster than dogs receiving HES 450/0.7 (P < 0.05).

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**Conclusion**

- Aggressive recognition and client education  
  - Triage via phone?
- Aggressive treatment
- Early fluid resuscitation and gastric decompression
- Stabilize prior to surgery!
- Prevention ➔ gastropexy

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**Check out our 2016 upcoming VETgirl appearances!**

**Dr. Justine Lee**
- CVC (KC), October 2016

**Dr. Garret Pachtinger**
- SWVS, Sept 2016
- IVS (Aruba), Dec 2016
- NAVC, Feb 2016
- WVC, March 2016
Thank you!

- To the generous donation of Jan MacLennan-Kennedy, in memory of her Giant Schnauzer, Meg.