Gastrointestinal Surgery: Review with Tips and Tricks

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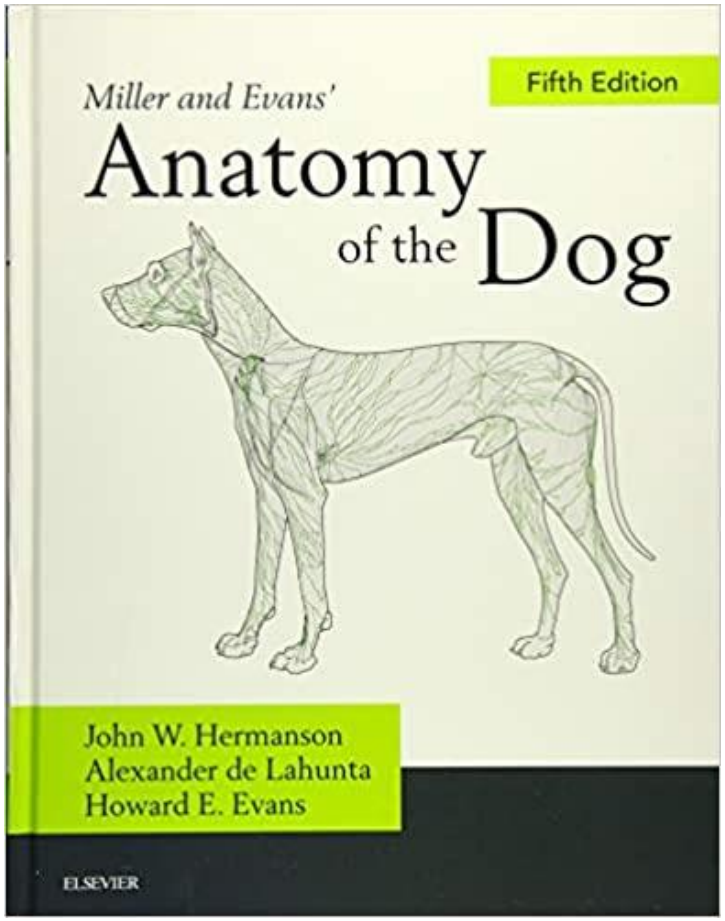
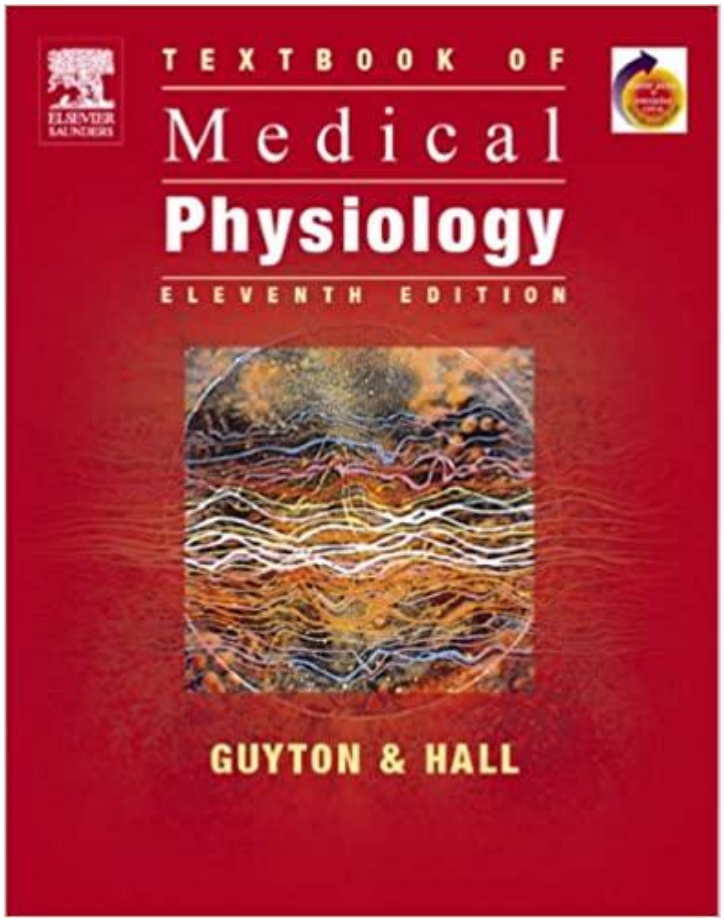
Leading Specialty Healthcare for Pets

Objectives

- Review essential gastric and intestinal anatomy and physiology germane to common GI surgery
  - Focus on obstruction
- Essential preoperative management
- GI surgery with tips and tricks (operative management)
- Essential postoperative management
- Recognizing, mitigating and managing complications

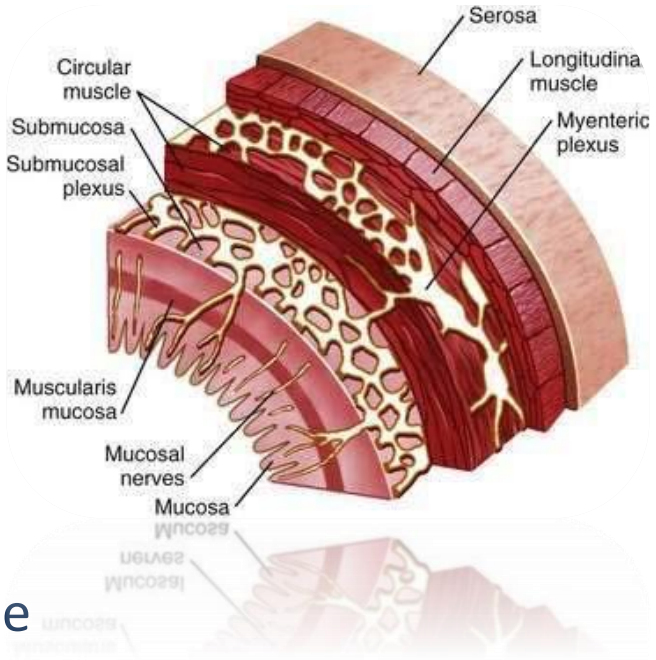
Essential A & P…





GI Anatomy

- Regions
  - Stomach
  - Small intestinal tract
  - Large intestinal tract
- Vascular supply
  - Celiac artery - stomach
  - Cranial mesenteric artery – small intestine
  - Caudal mesenteric artery – large intestine
- Histologic layers
  - Serosa, muscularis, submucosa, mucosa
  - Submucosa is most important layer



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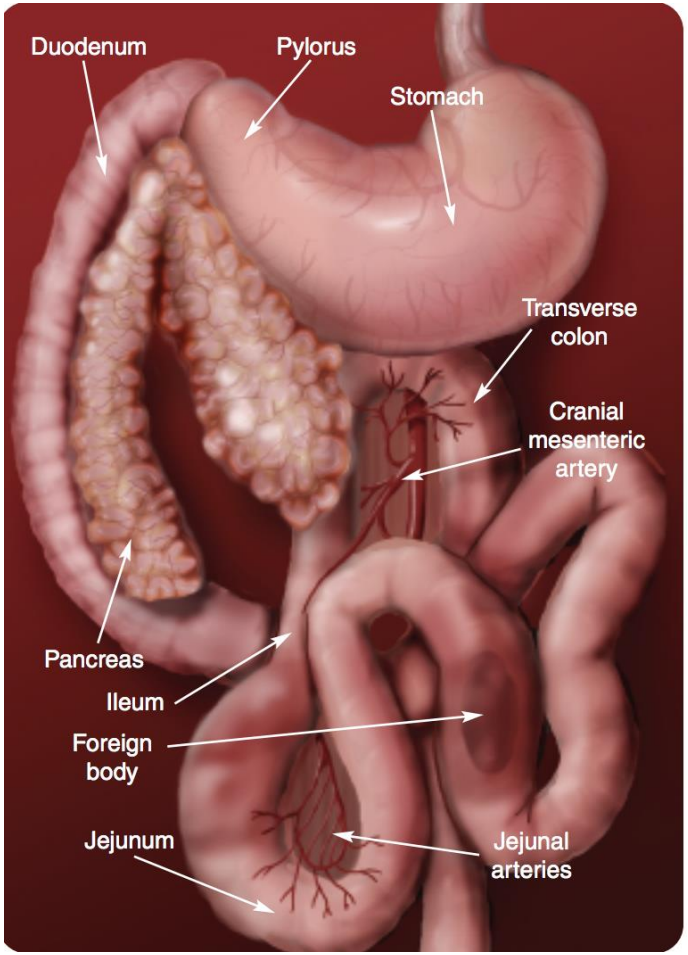
GI Anatomy

Common sites for foreign body obstruction

1. Gastric – large objects
2. Gastric and duodenum – cloth, towels, rope toys
3. Jejunal – smaller firm objects, socks



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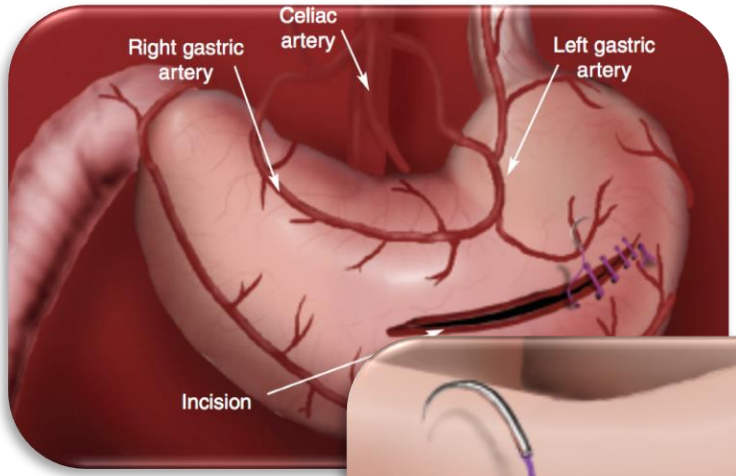
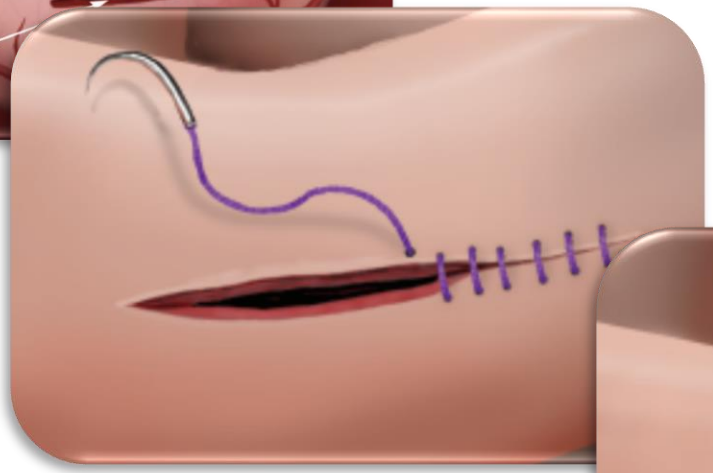
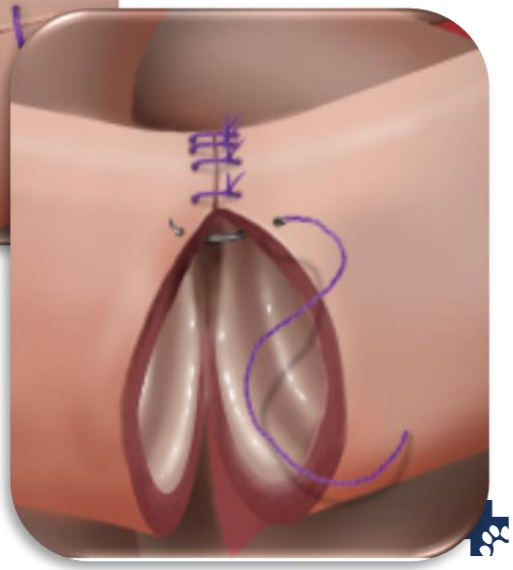
GI Anatomy



Gastrotomy



Enterotomy



Intestinal Anastomosis

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Essential Pre-operative Management

Diagnosing GI Obstruction

- History
- Physical Exam
- Minimum Data base
- Abdominal Radiographs
  - +/- contrast
- Abdominal Ultrasound
- Endoscopy

Pre-operative Management

- Analgesia
- Client communication
- Fluid therapy
  - Correct hypovolemia
  - Correct electrolyte abnormalities

GI: Obstruction

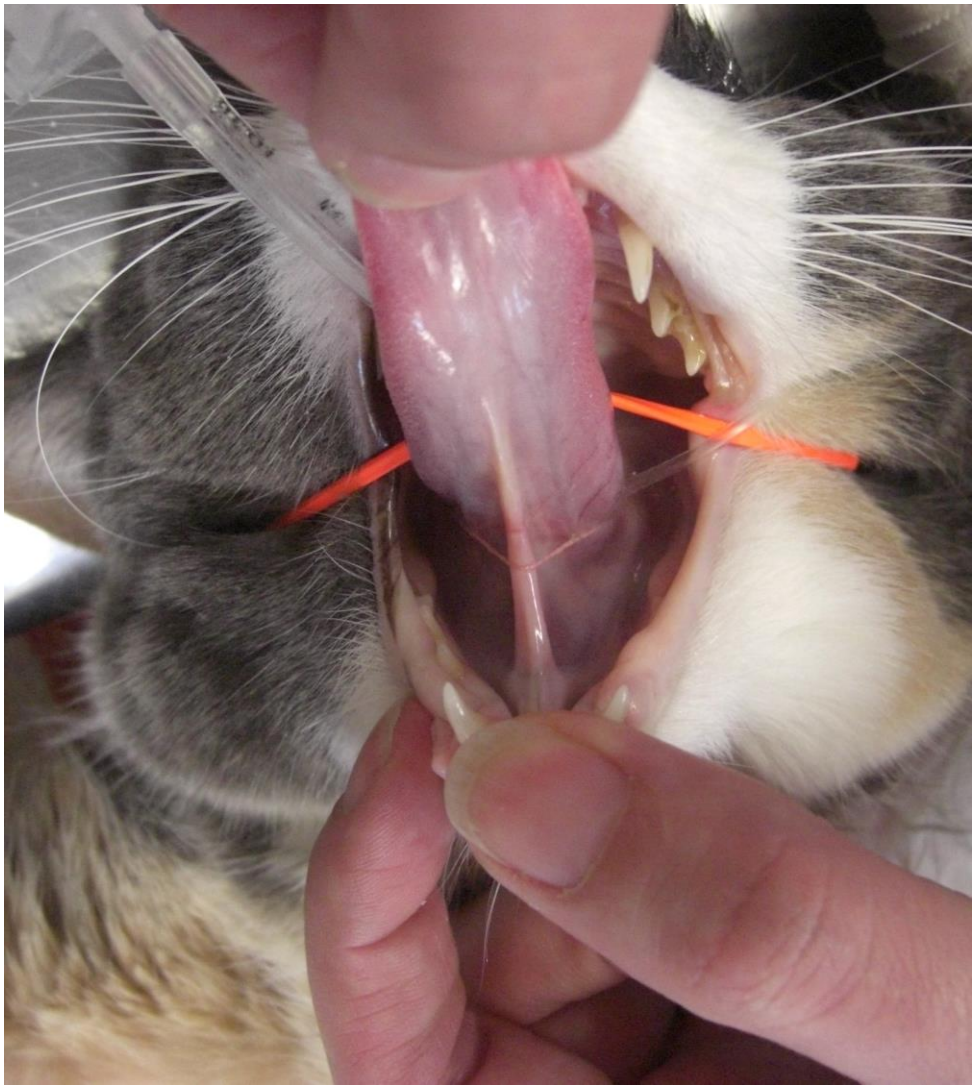
- Obstruction: Is it or isn't it?
  - Radiographs
  - Ultrasound
  - Radiographs with contrast
  - Radiographs, fluids, repeat

GI Obstruction

- Lateral Radiograph:
  - Ratio of small intestinal diameter to L5 height
    - Dogs: > 1.6:1 = pathologic
    - Cats: >1.2:1 = pathologic

GI Surgery: To Operate or Not

- That looks really dilated to me, but it might be colon… What should I do?
- Pneumocolonogram



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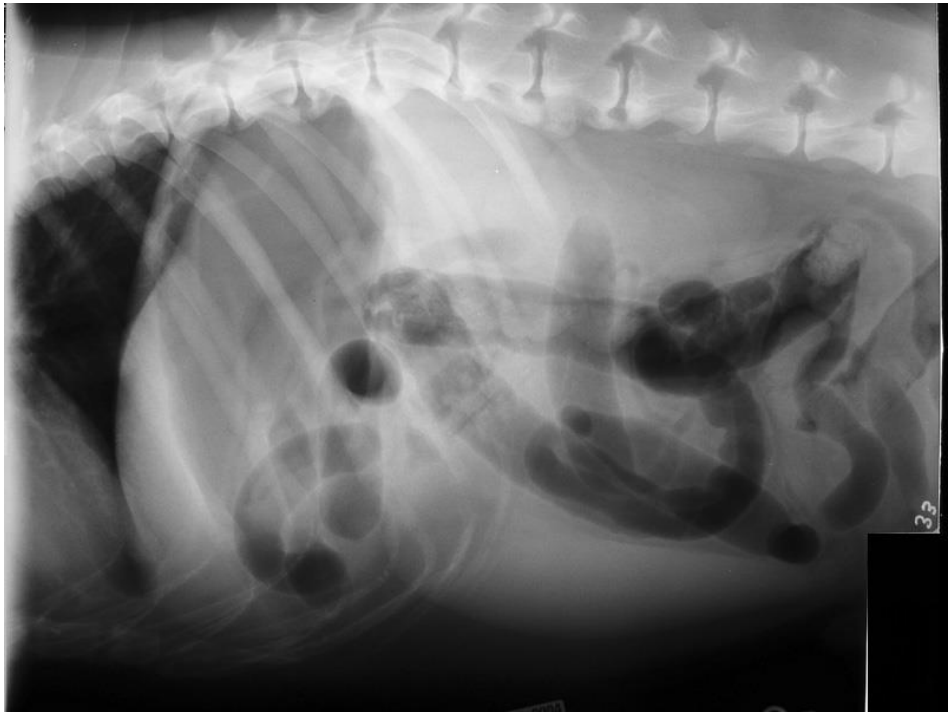
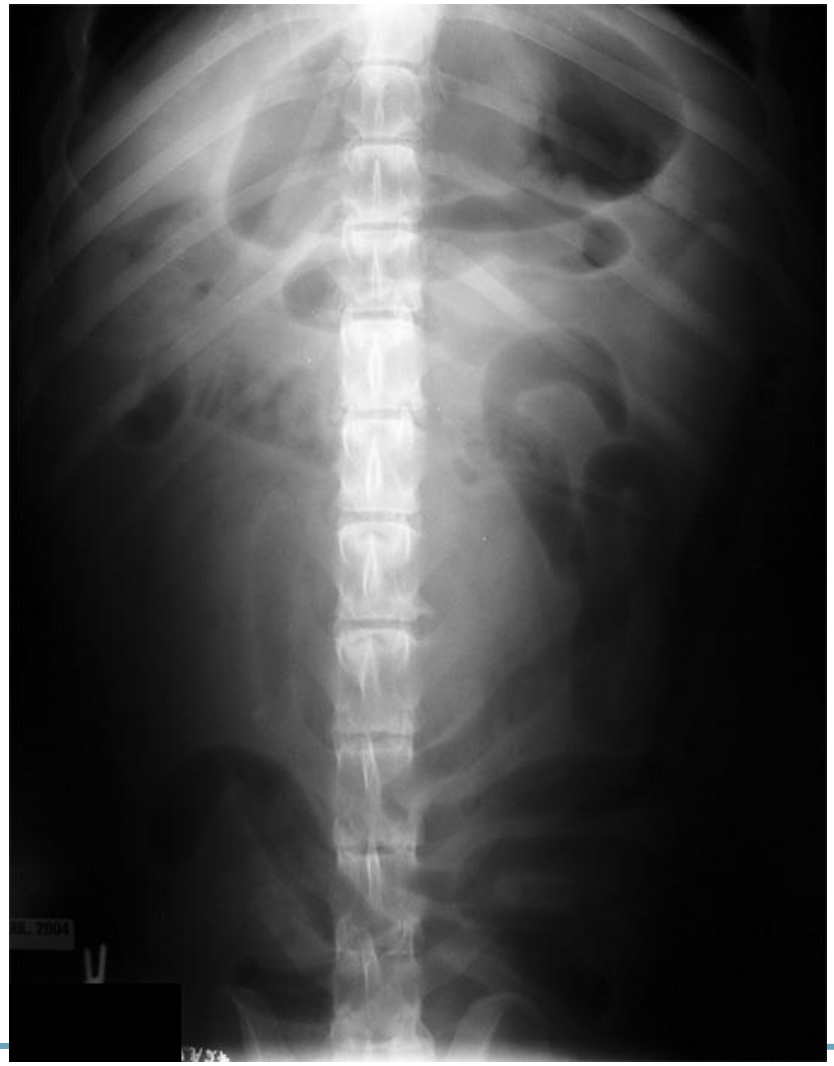
GI Surgery: To Operate or Not





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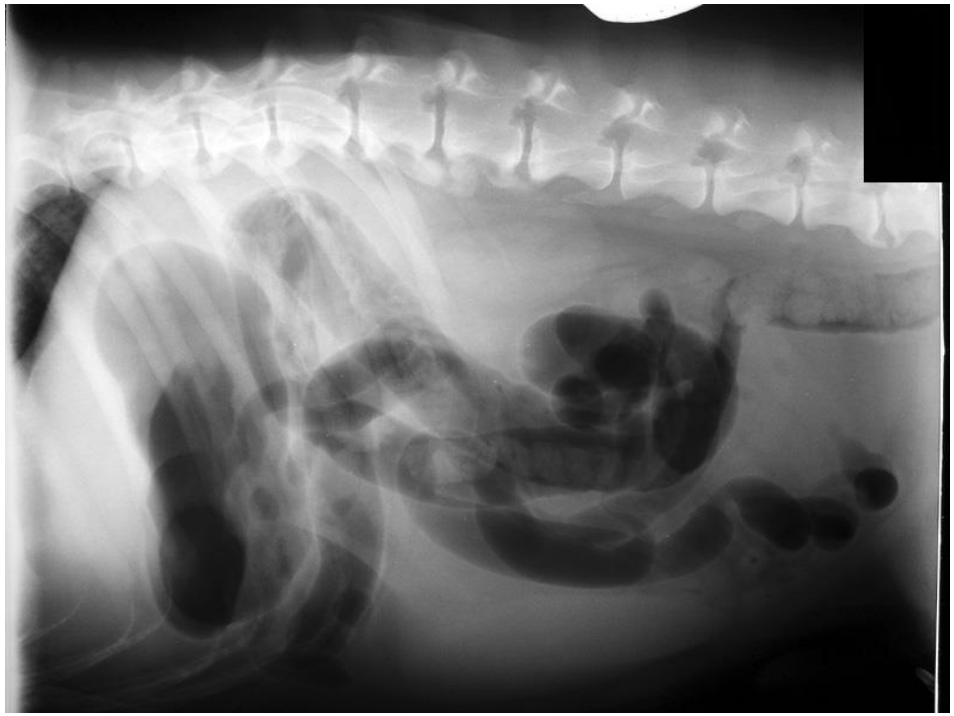
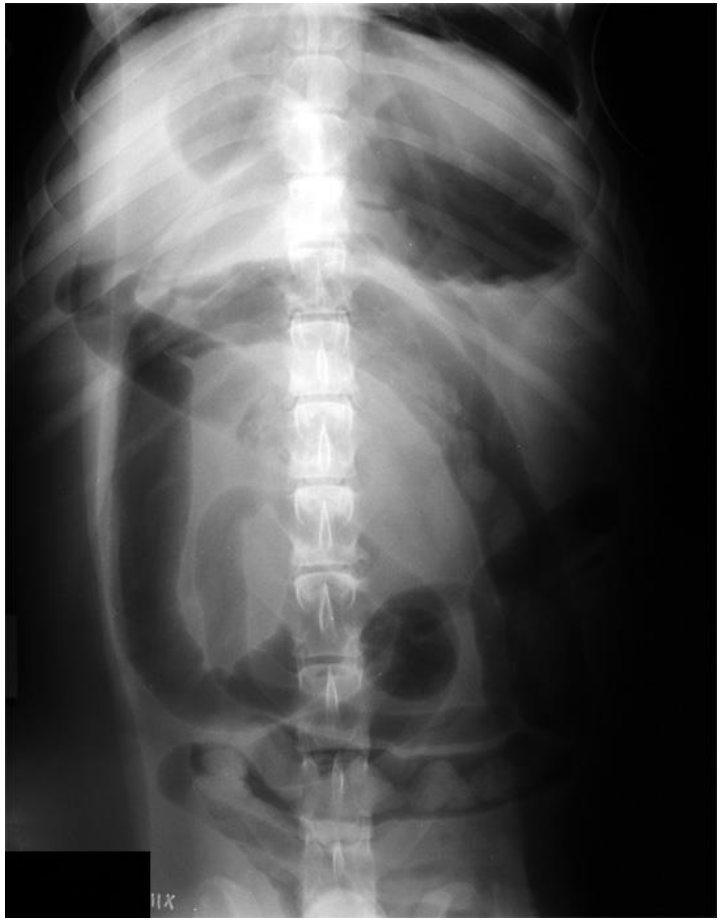
GI Surgery: To Operate or Not





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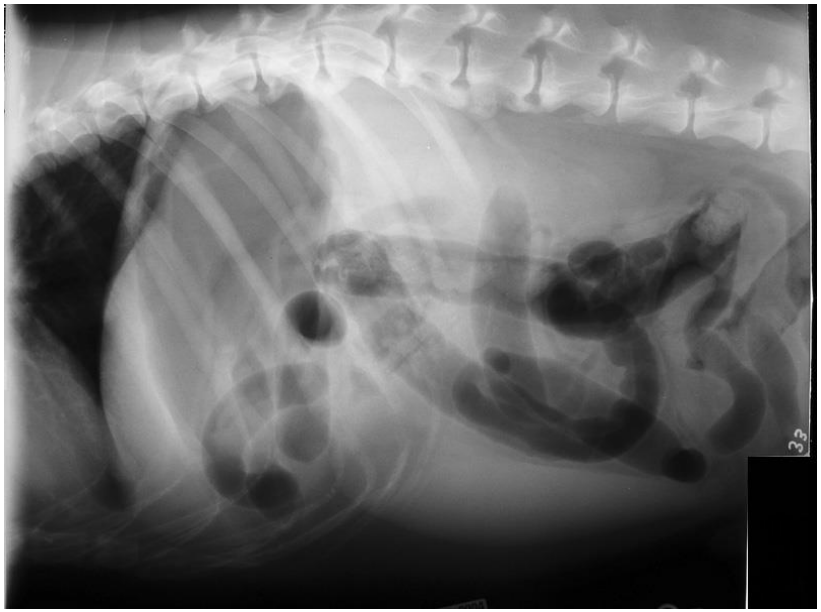
GI Surgery: To Operate or Not

Pre



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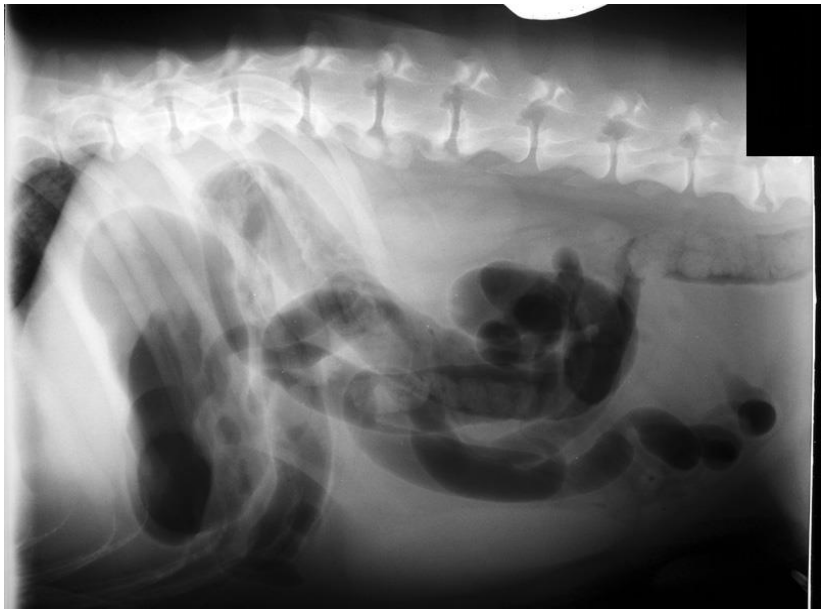

GI Surgery: To Operate or Not

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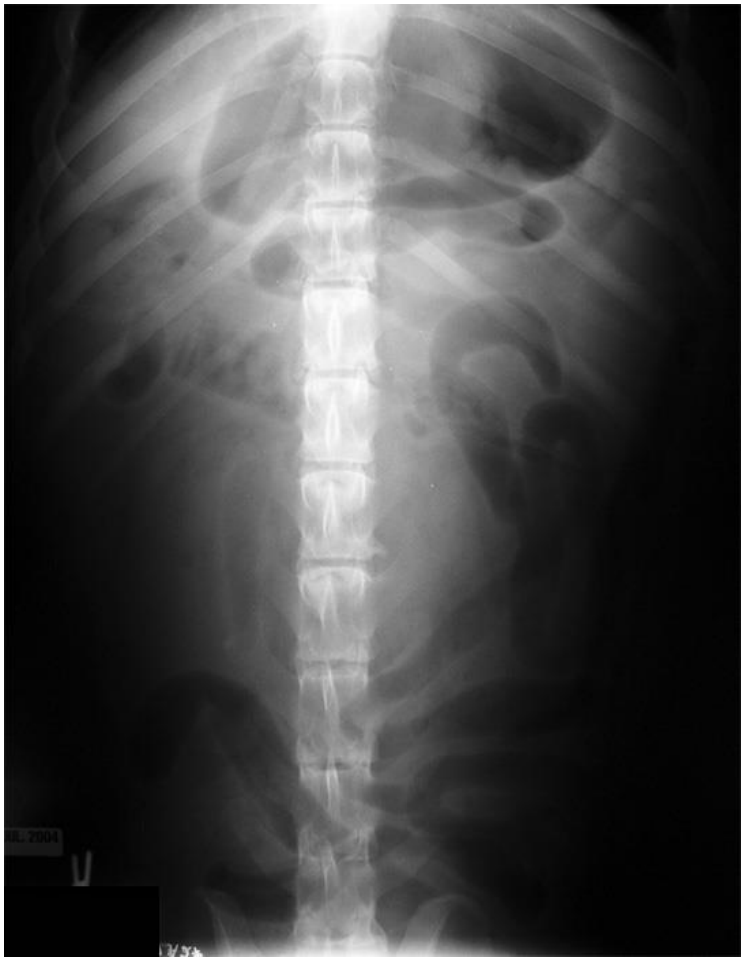

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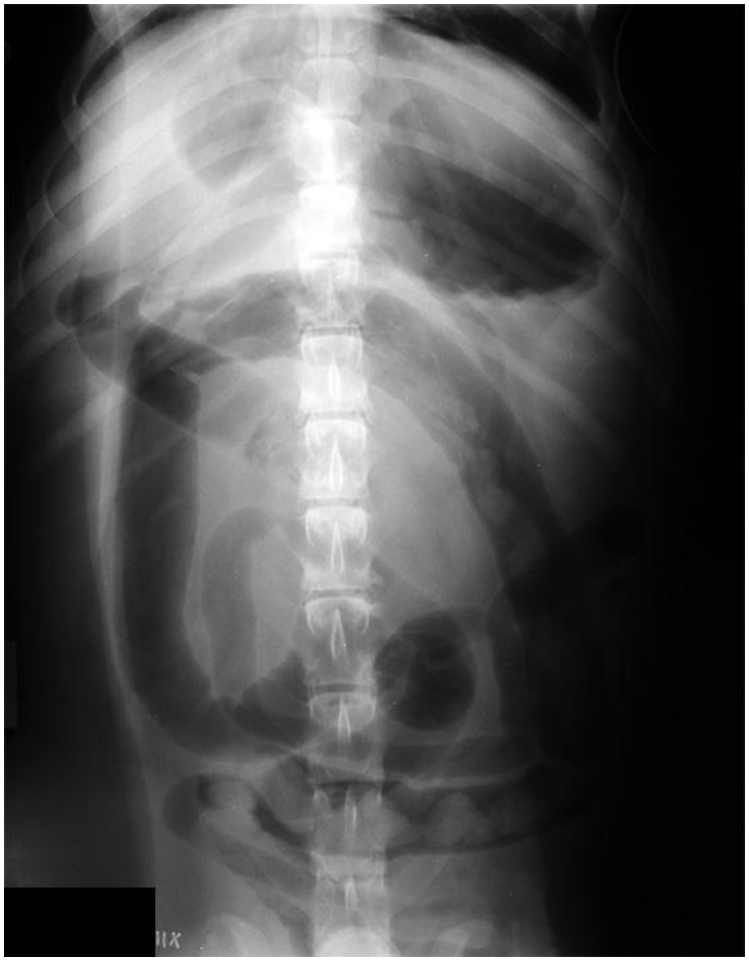

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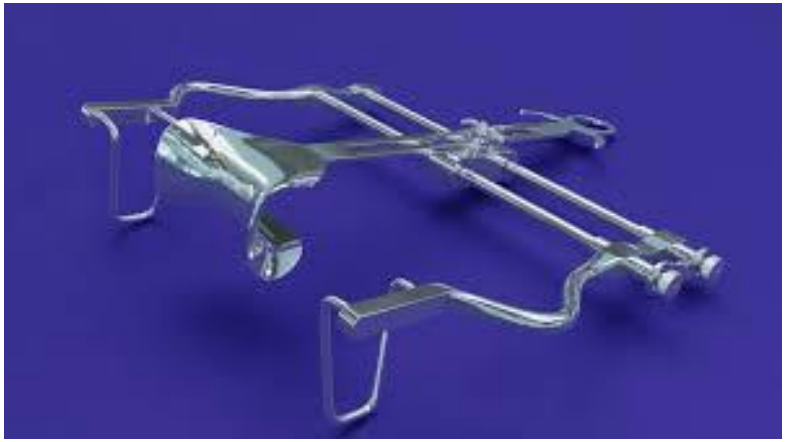
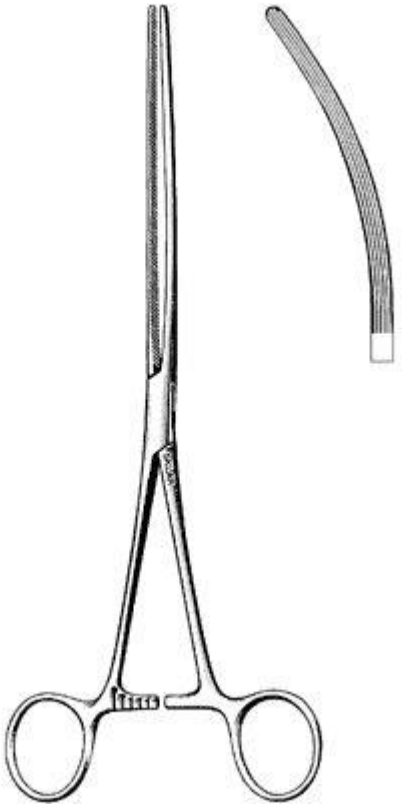
Pre-op Tips & Tricks: Instrumentation



Pre-op Tips & Tricks: Instrumentation



Pre-op Tips & Tricks: Instrumentation

- Suction
  - Vital to completely evacuate the peritoneum
  - Neutrophils can't swim!

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- Ratio of small intestinal dilation to L5 *in a dog* that is diagnostic for pathology is

A. 1.2 : 1

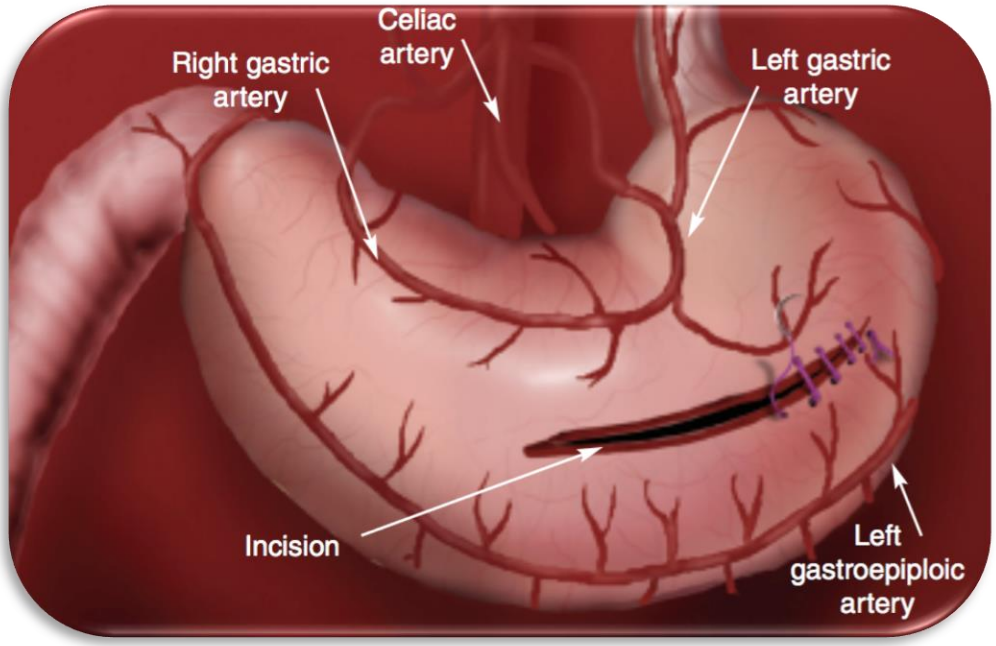
B. 1.6 : 1

C. 2:1

D. I never look at x-rays, I just read the Radiologist's report or call a Surgeon

Operative Management: Gastrotomy

GI Anatomy



Stomach

- Thicker tissue
- High vascularity
- Lower bacterial count (10^3)
- Lower complications
  - Dehiscense ~5%

Gastrotomy: two layer closure

- Simple continuous pattern – mucosa/submucosa
- Inverting pattern – muscularis/serosa

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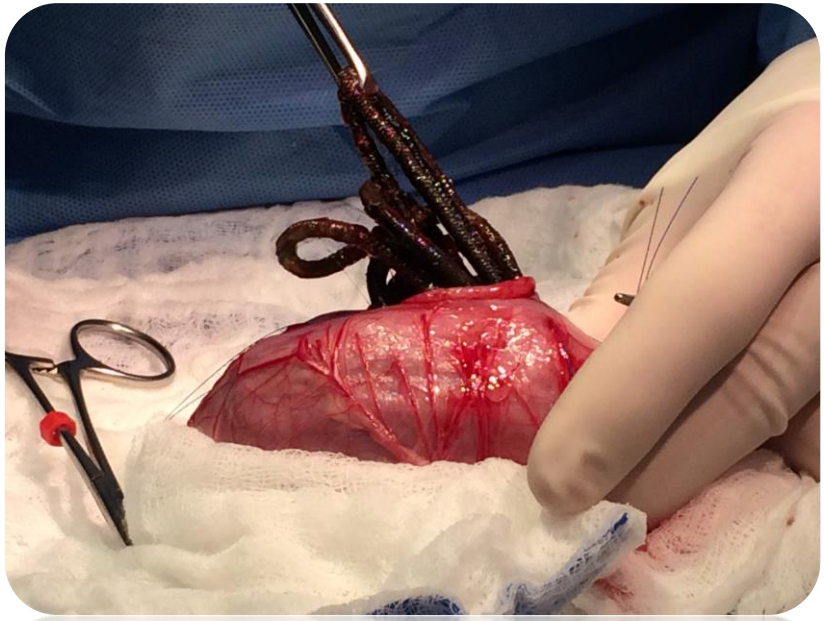
GI Anatomy



Gastrotomy technique

- Stay sutures
- Isolate area of gastrotomy
- 3-0 Polydioxanone for medium to large dogs
- 4-0 Polydioxanone for cats and toy breeds

ALWAYS TRY TO DO A GASTROTOMY IF POSSIBLE

~5% dehiscence rate!!

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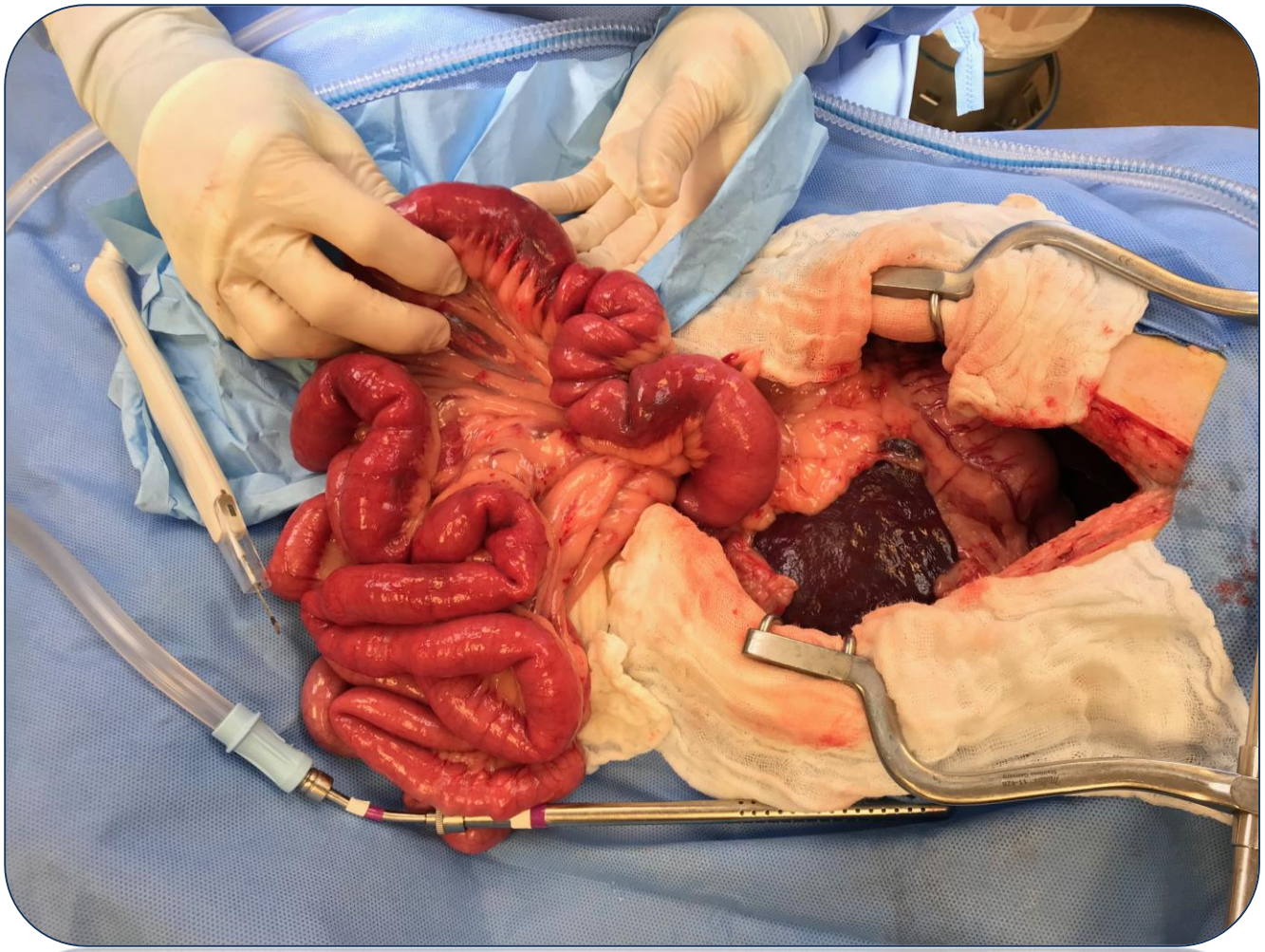
Gastrointestinal obstruction



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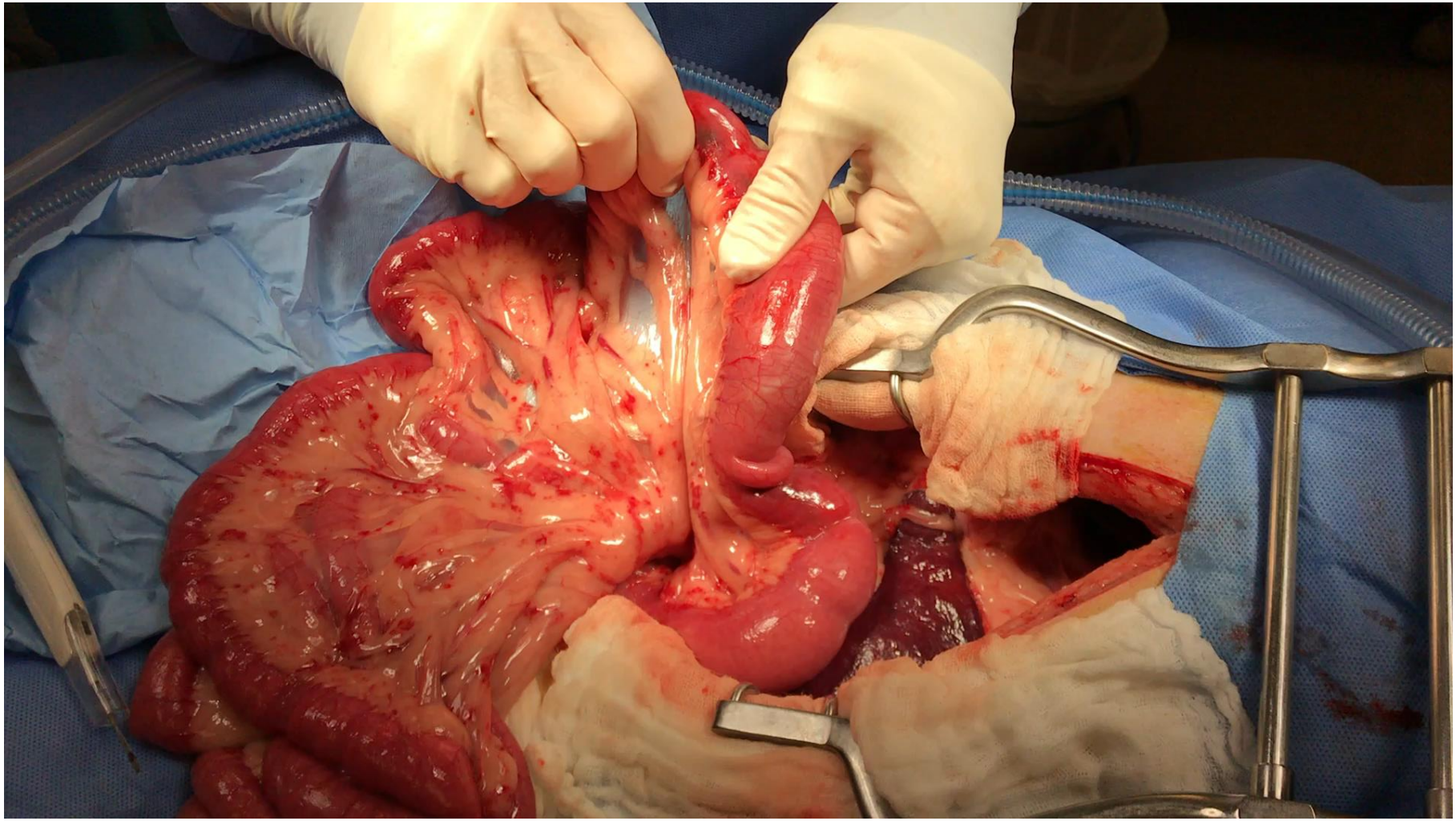

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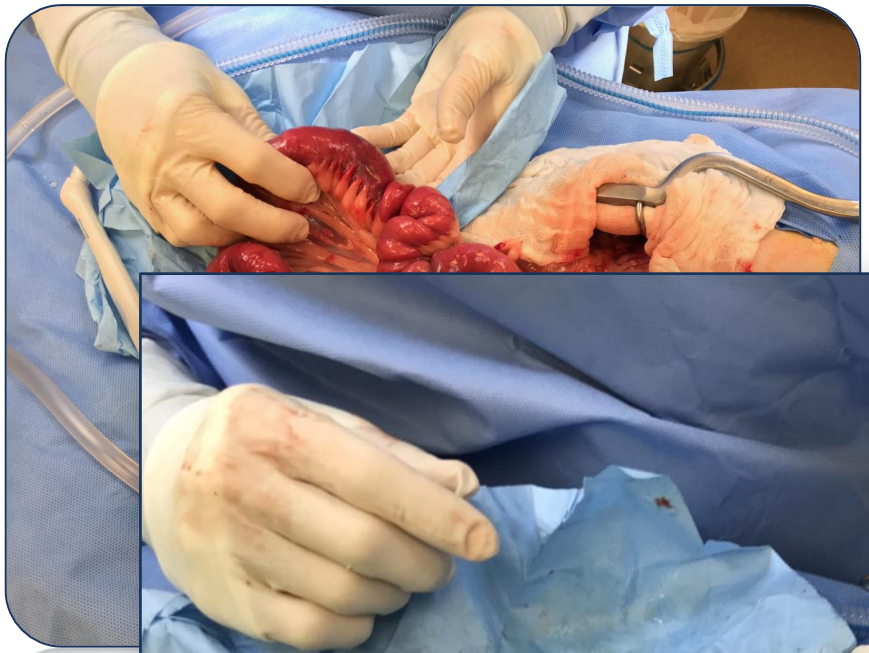

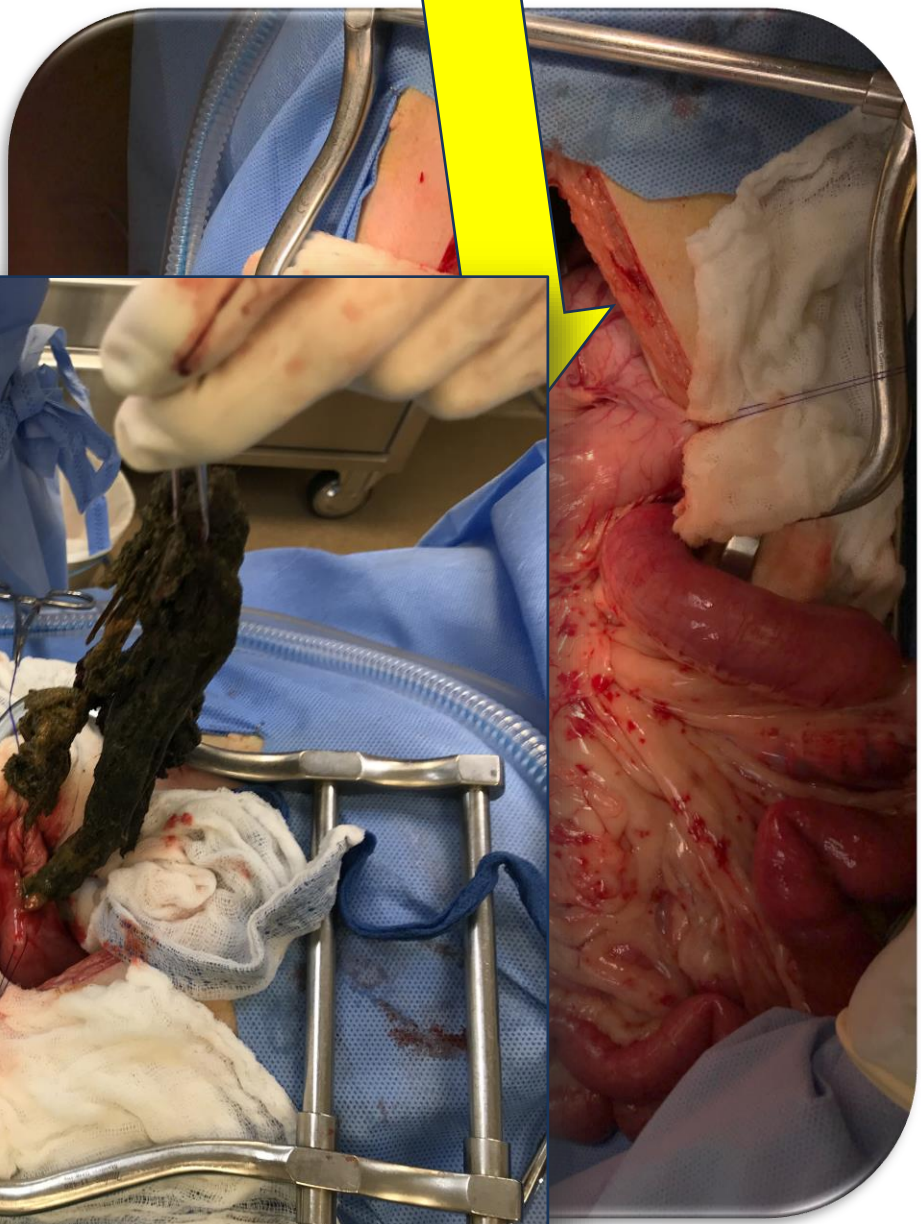

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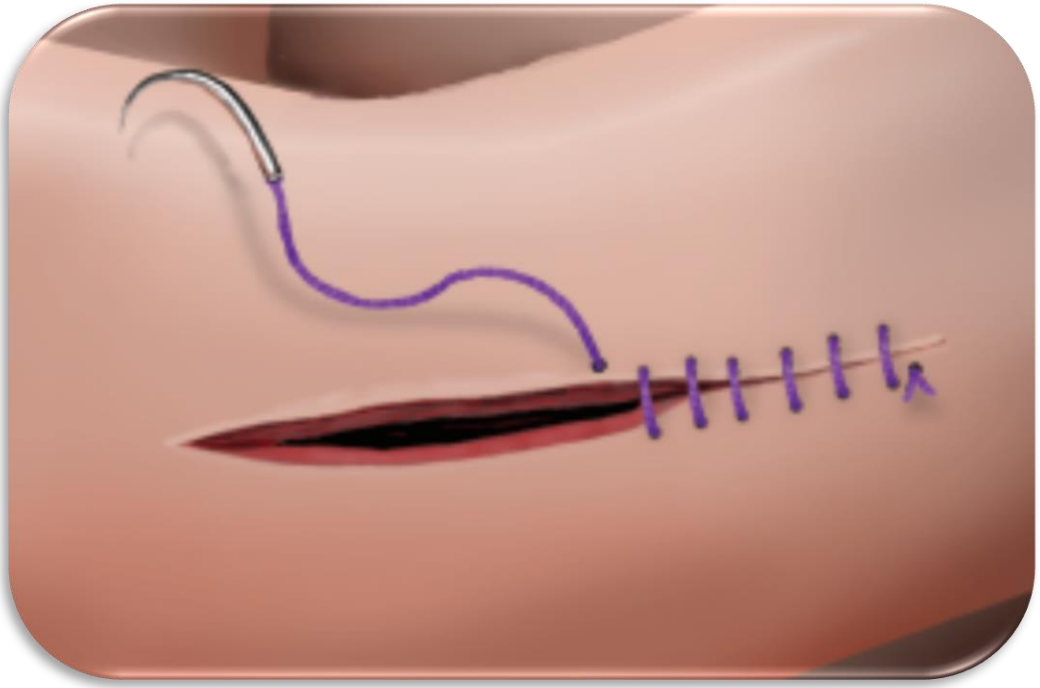
- Gastrotomy should be performed whenever possible because
  A. The stomach has less bacteria than the intestine
  B. The stomach has less pathogenic bacteria than the intestine
  C. The stomach has a lower dehiscence rate than the intestine
  D. All of the above
  E. I need more coffee

Operative Management: Enterotomy

Enterotomy



- Small Intestine is:
- More delicate
- Bidirectional vascularity
- Higher bacterial count (10^{6-7})
- Dehiscence ~10-15%

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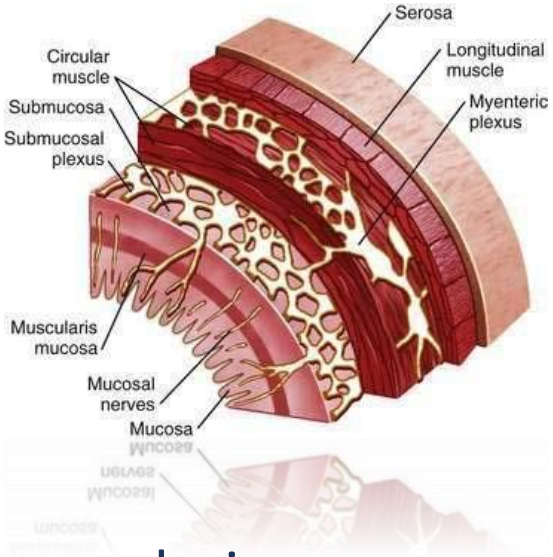
Small intestinal healing

- Fibroblast and smooth muscle collagen synthesis

- Lag phase of healing (0-3 days)
  - Decreased collagen production initially
  - Collagenase weakens submucosa
  - Takes >3 days to recover



- Intestinal dehiscence
  - 5% with gastrotomy
  - 10-15% with small intestinal wounds
  - Higher risk with colon?
  - Comorbidities? → inflammatory bowel, neoplasia, peritonitis, immunosuppression

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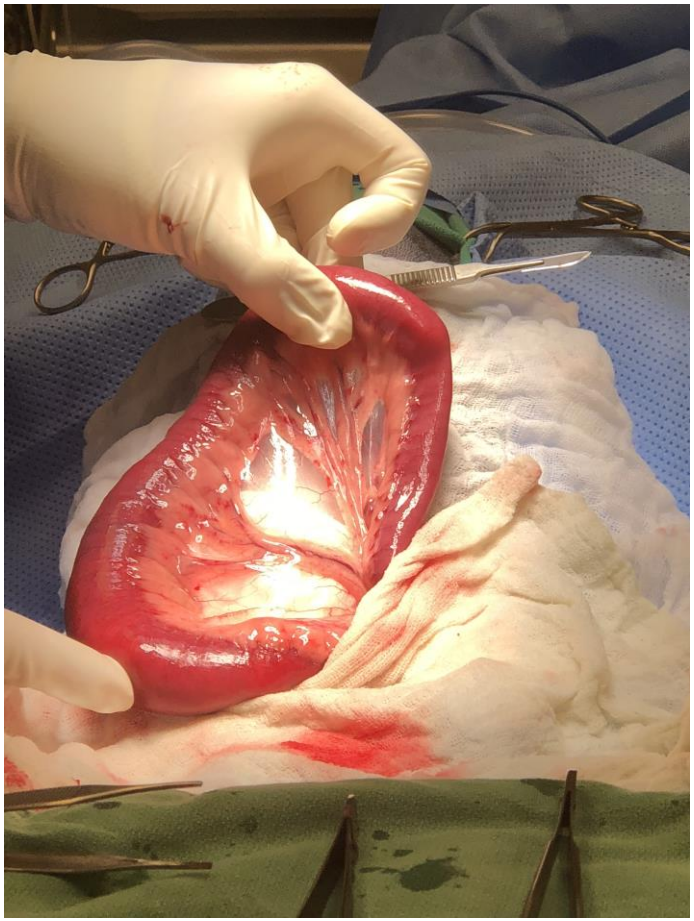
Enterotomy

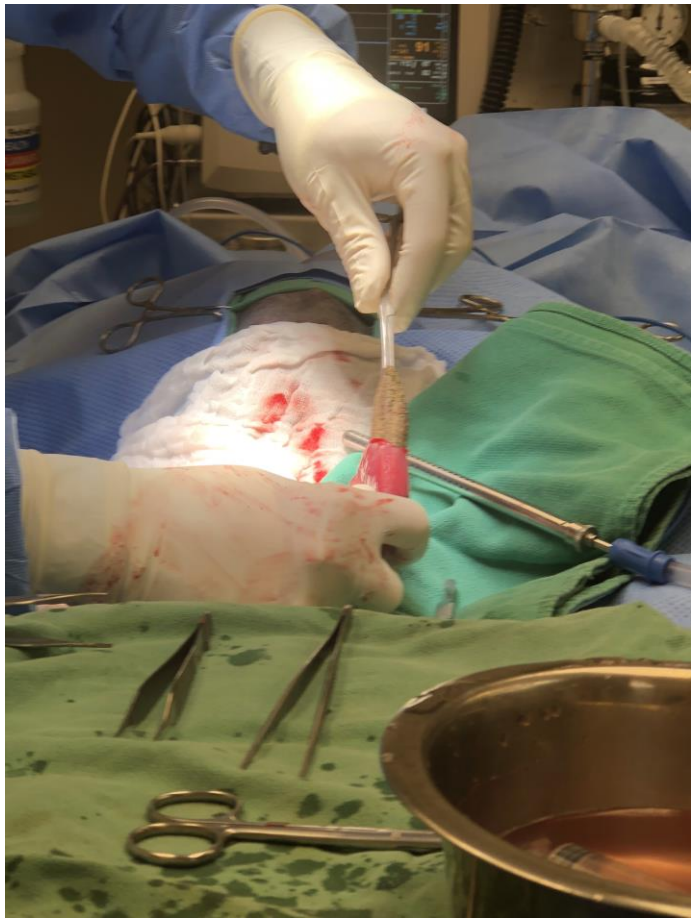
- **Enterotomy:** single layer *APPOSITIONAL* closure
- 3-0 or 4-0 Polydioxanone on RB-1 or SH-1needle
- Suture patterns:
  - Simple continuous pattern
  - Simple interrupted pattern
  - Modified Gambee
  - Disposable skin staples

GI Tips and Tricks

- Enterotomy
  - Exteriorize affected portion, pack abdomen with moistened laps and new drape with hole for affected bowel
  - “Milk” object back to the stomach if possible
  - Inject Saline aboral to obstruction and it may “float” back to the stomach
  - Test enterotomy after suturing with both probing and leak test

Enterotomy



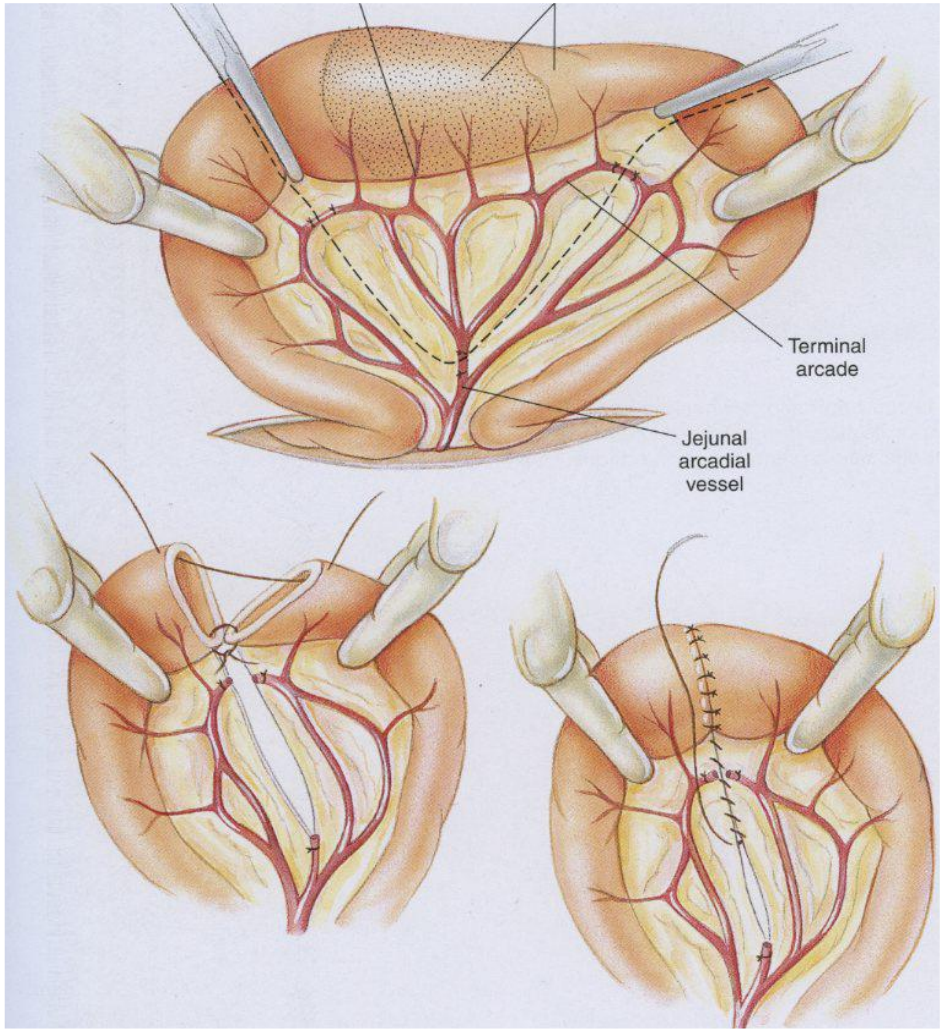


The high risk window for intestinal dehiscence is:

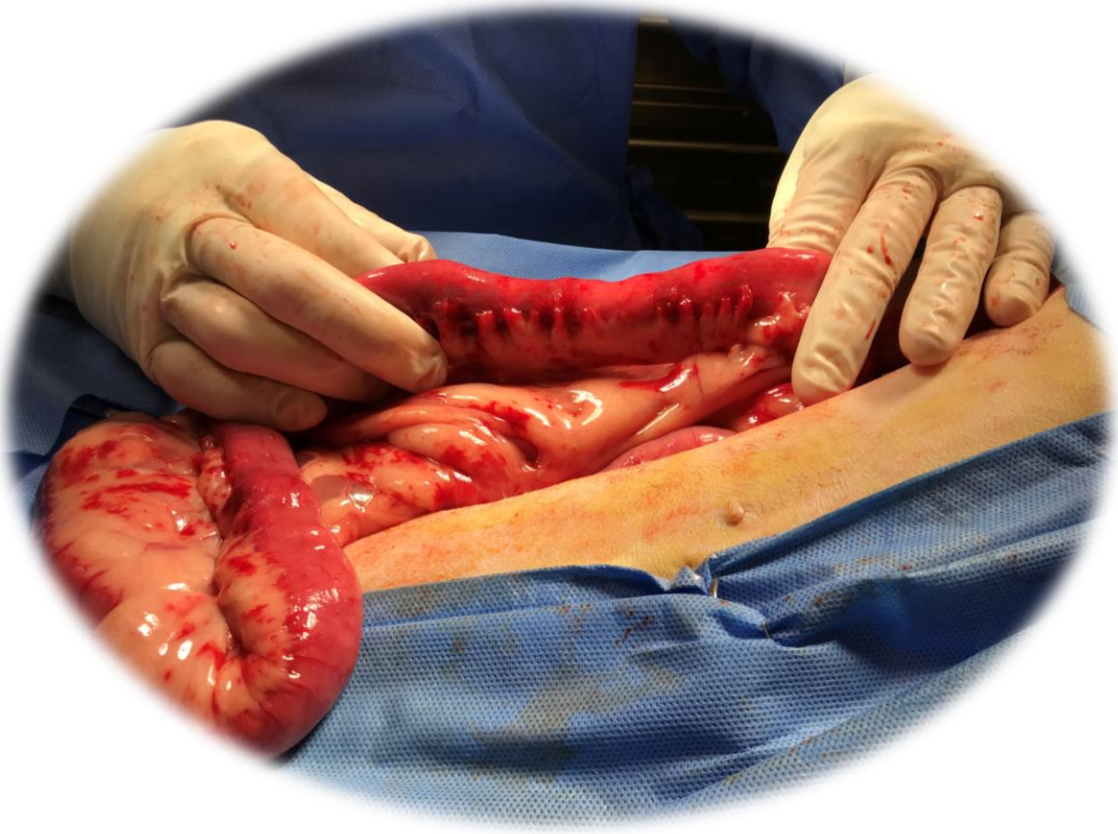
A. 0-3 days postoperatively
B. 3-5 days postoperatively
C. 5-10 days postoperatively
D. My surgeries never have complications

Operative Management: Intestinal Resection and Anastomosis

Intestinal Surgery: Resection and anastomosis



- Exteriorize!
- Milk chyme aboral and gently occlude lumen
- Address vascular supply
- Resect and anastomose



Viability – 4 P's

- Pulse
- Palor
- Peristalsis
- Perforation

Experience: bruising is recoverable in majority of cases

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GI Tips and Tricks

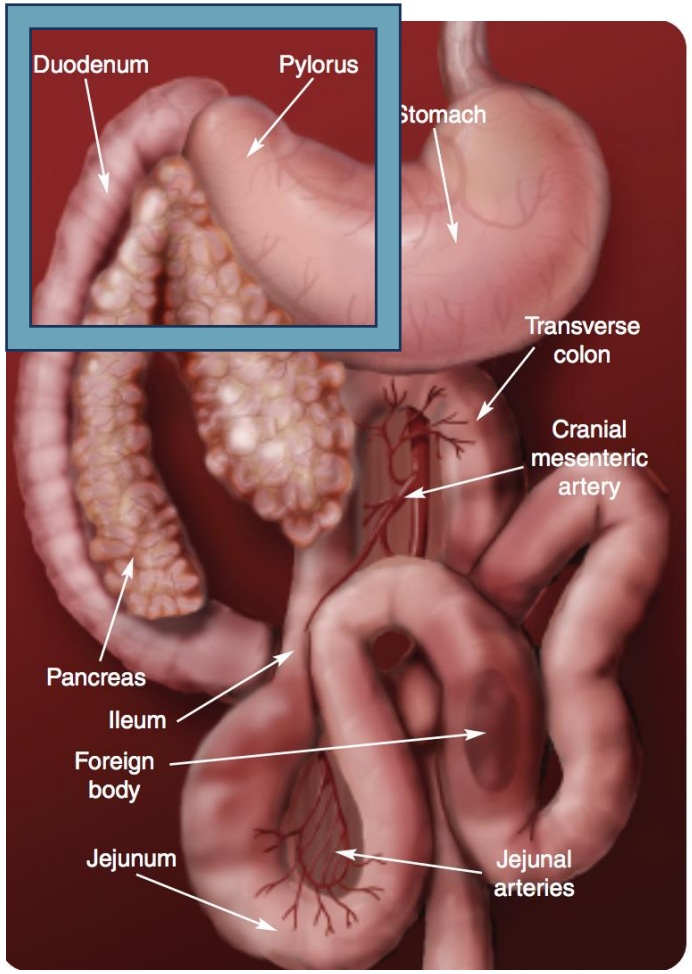
- Resection and Anastomosis
  - Resect the section +/- everted mucosa
  - Place mesenteric and anti-mesenteric sutures 1 & 2
  - Simple interrupted or simple continuous
  - Prolonged absorbable 3-0 or 4-0 suture on a taper
  - Close rent in the mesentery
    - Do not ligate arcades
    - Small enough to prevent herniation/entrappment

Small Intestinal Resection

If you find yourself doing this….

Re-evaluate your practices!!

1. Not being prepared for what you may find
2. Multiple enterotomies
3. Multiple resections
4. Descending duodenum resection or biopsy
5. Contaminating the peritoneum



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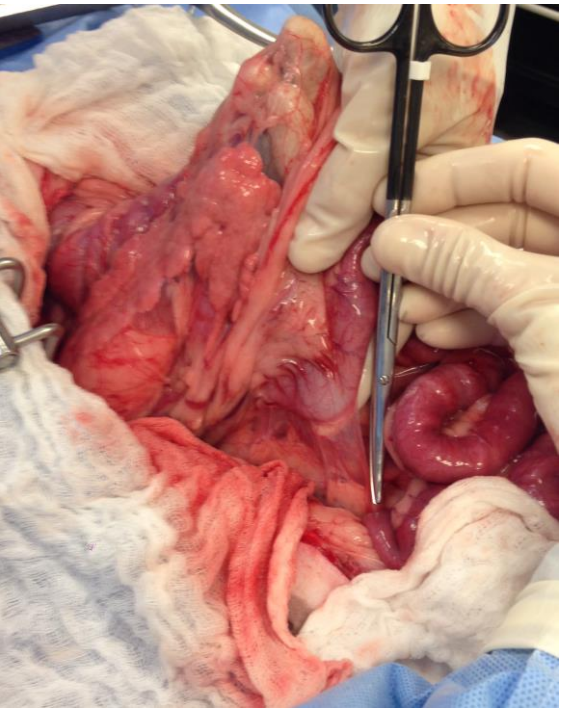
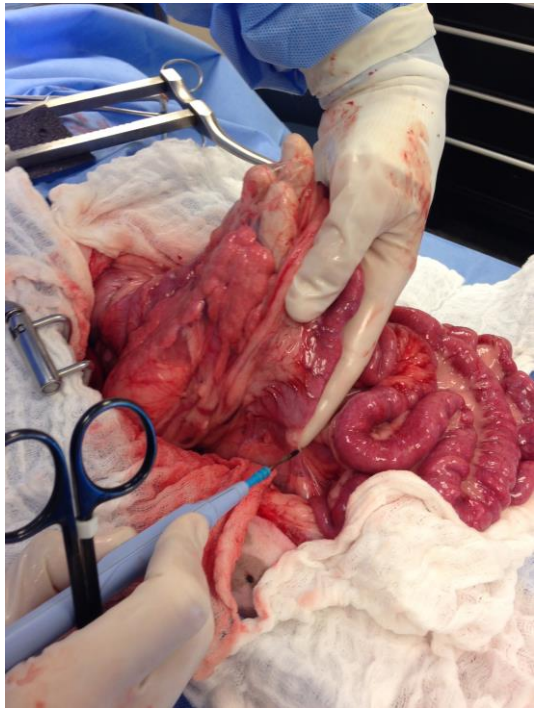
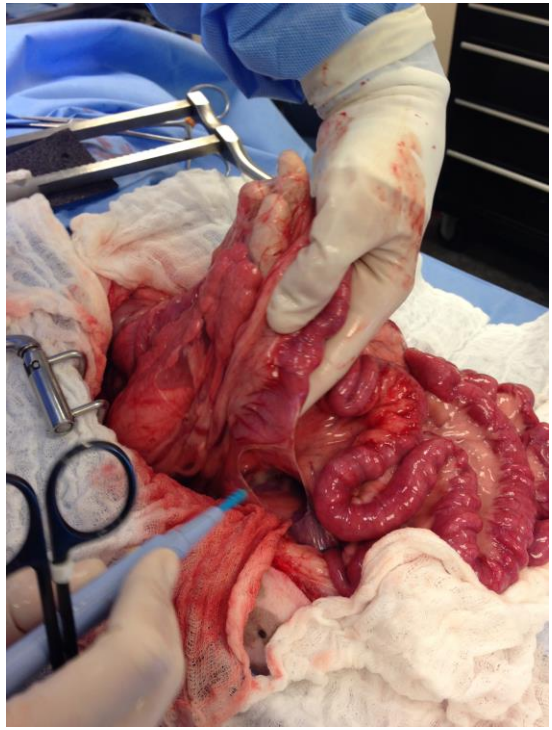
GI Tips and Tricks

- The Duodenocolic Ligament
  - Difficult area to access & understand
  - Essential to break down for exposure







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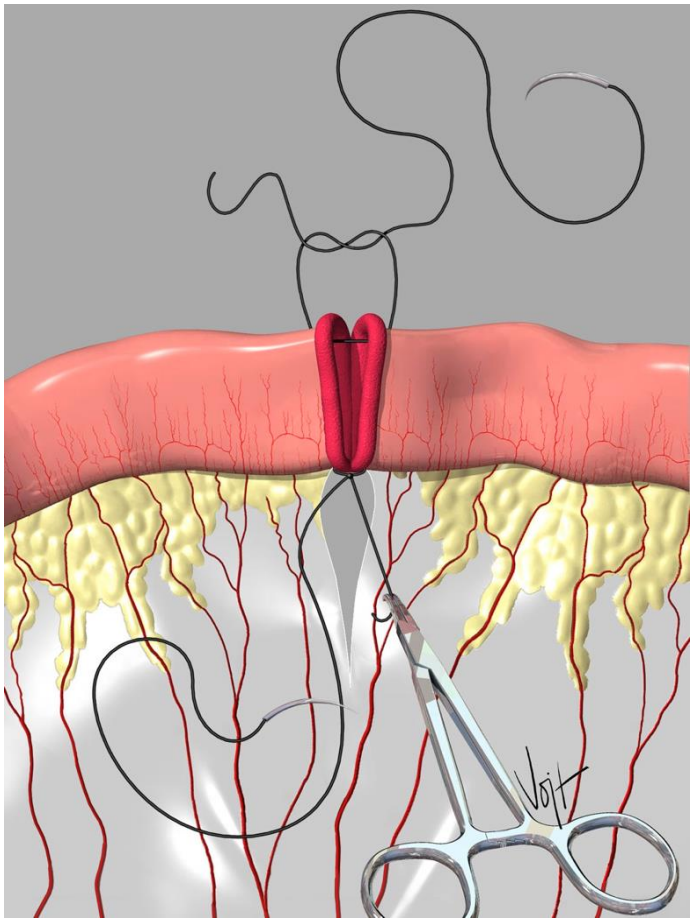
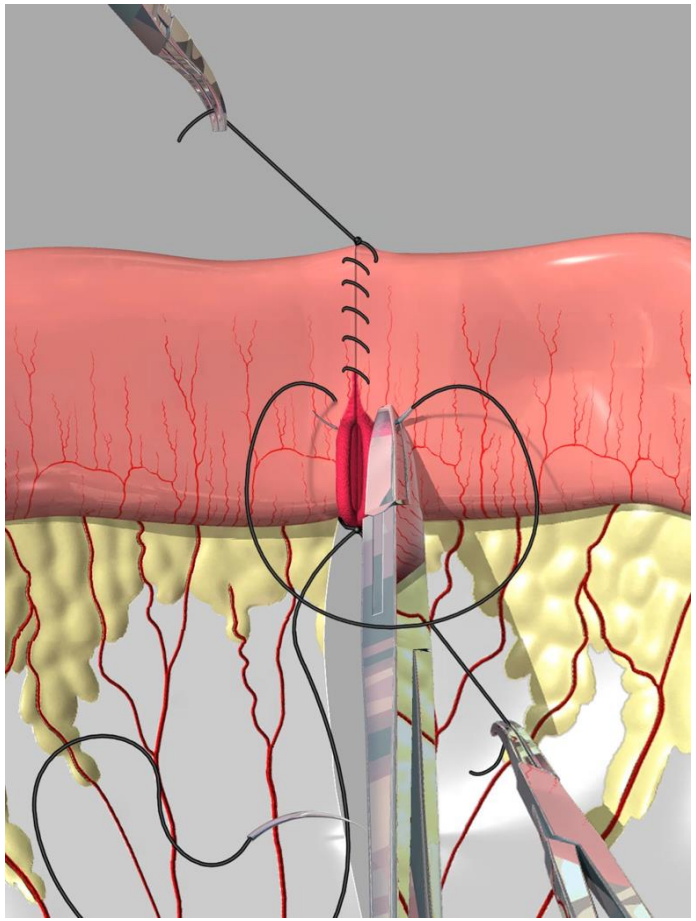
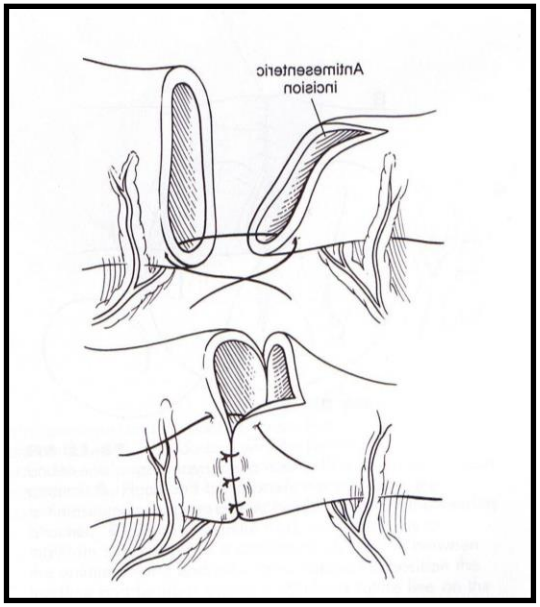




GI Tips and Tricks

- Addressing Lumen Disparity
  - 1. Make smaller side bigger (“Fish mouth”)
  - 2. Make bigger side smaller
  - 3.Place sutures on larger end further apart than sutures at smaller end
  - 4. Perform a stapled side-to-side anastomosis

https://www.researchgate.net/figure/49819610_fig1_Stapled-side-to-side-anastomosis-before-a-and-after-b-stapling



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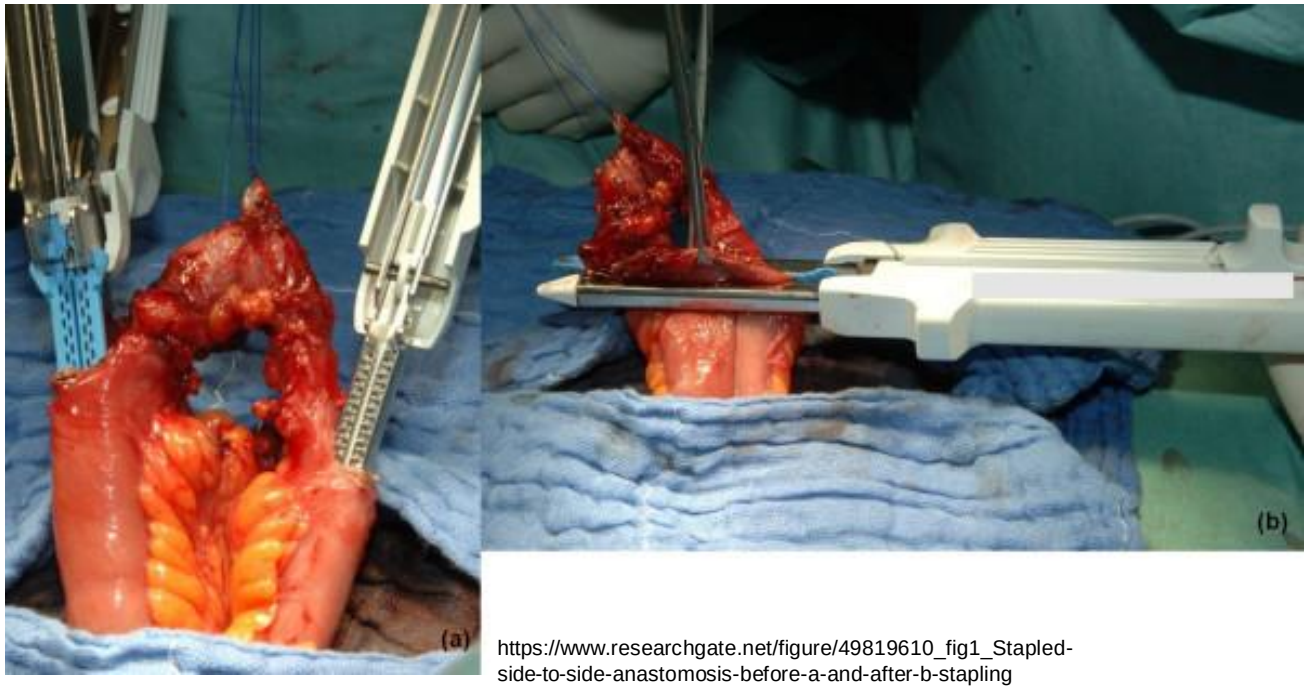

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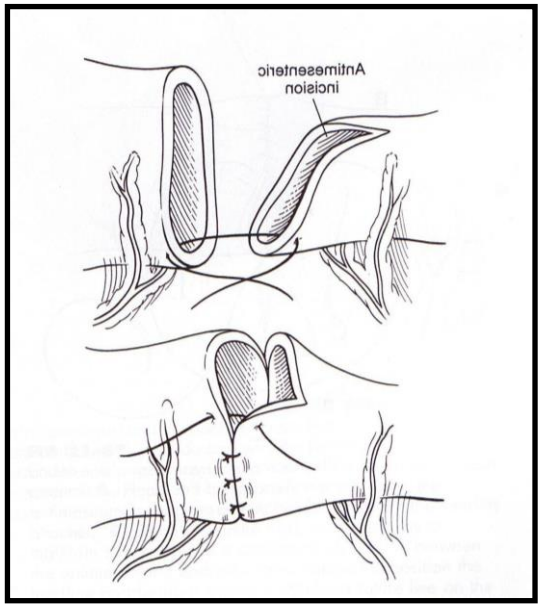

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Leak test

- Occlude 10 cm bowel (digital, bobby pin or Doyen)
- Inject 15-20 mL fluid results in 34 mmHg pressure (Normal = 25)

Stapler vs. Suture

- Stapler decreases time
- Stapler increases cost
- Stapler is not affected by luminal size
- Stapler has similar or better dehiscence rates
  - 11% vs 16% Vet Surg 2016
  - 5% vs 13% JAVMA 2018
- Stapler has decreased dehiscence in septic peritonitis patients

  9.7% vs. 28.9%

Recommend advising clients risk of dehiscence 10-15% with *ANY* small intestinal procedure

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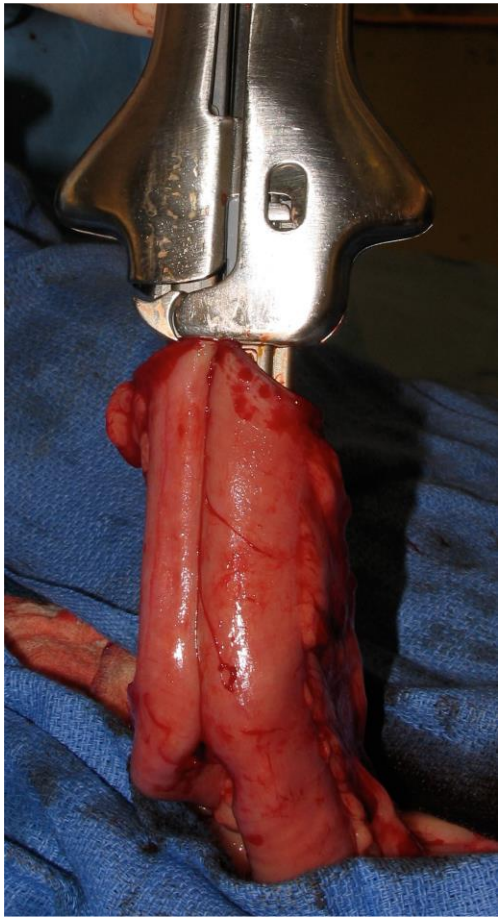
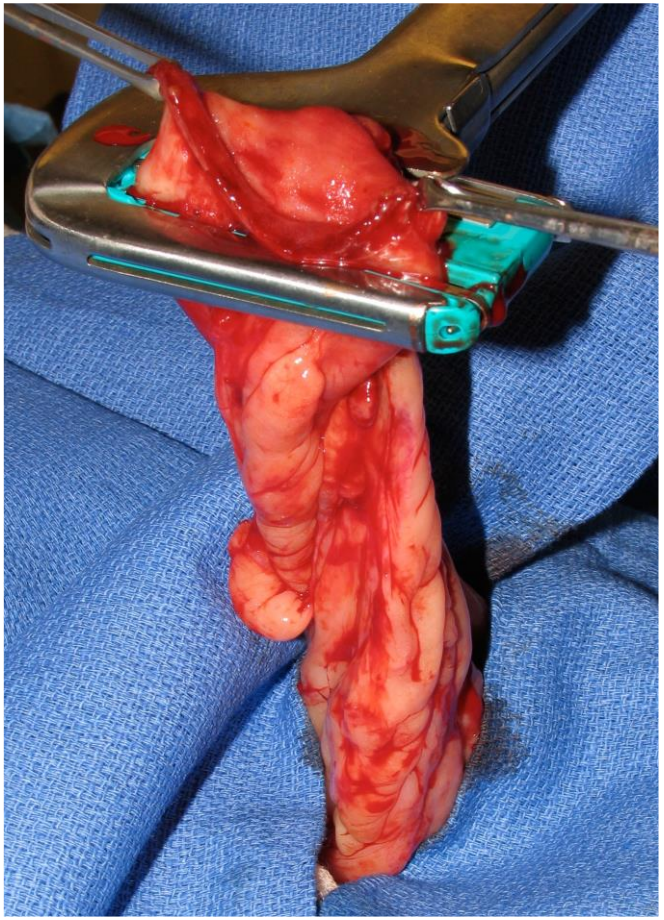
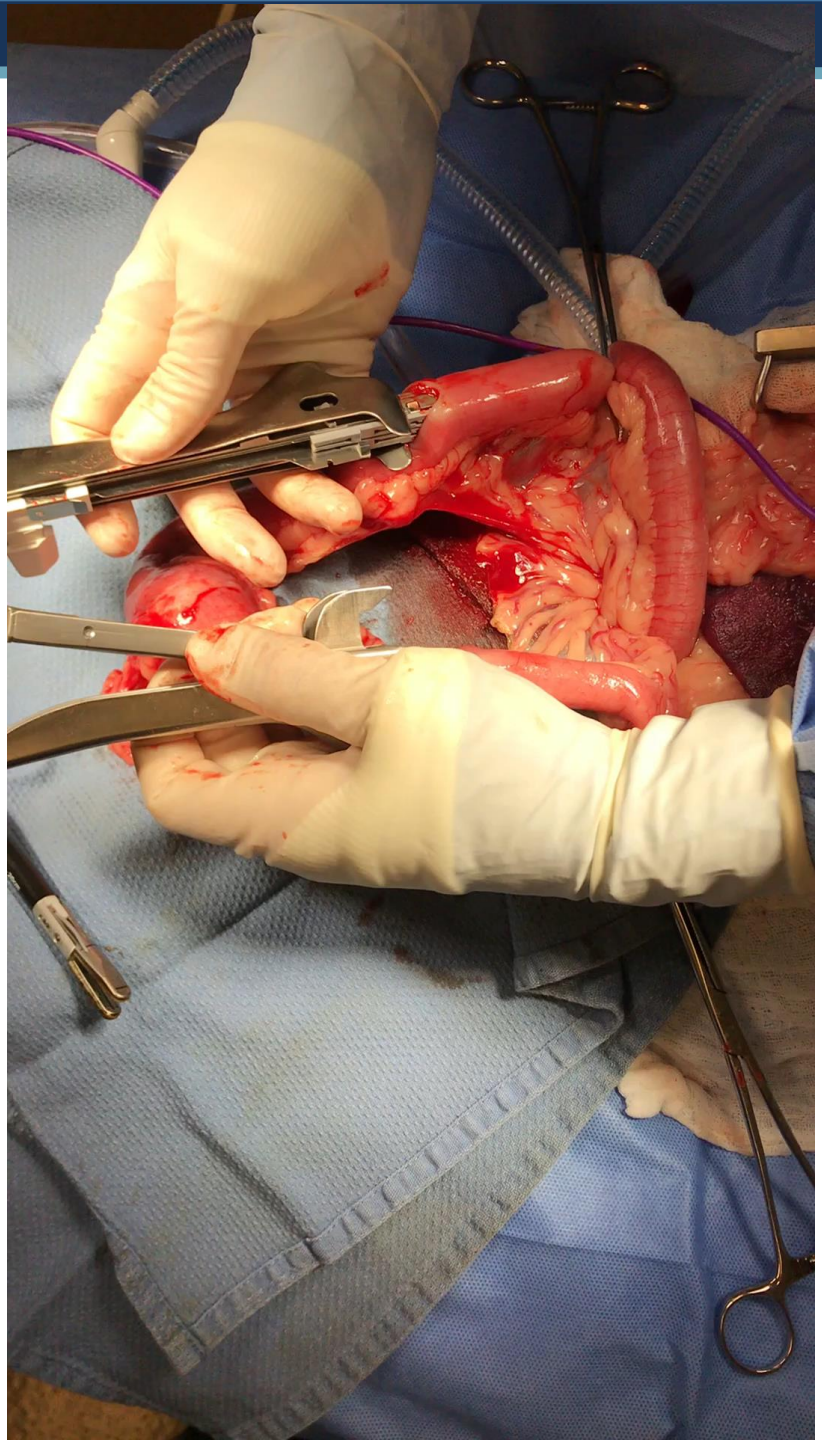
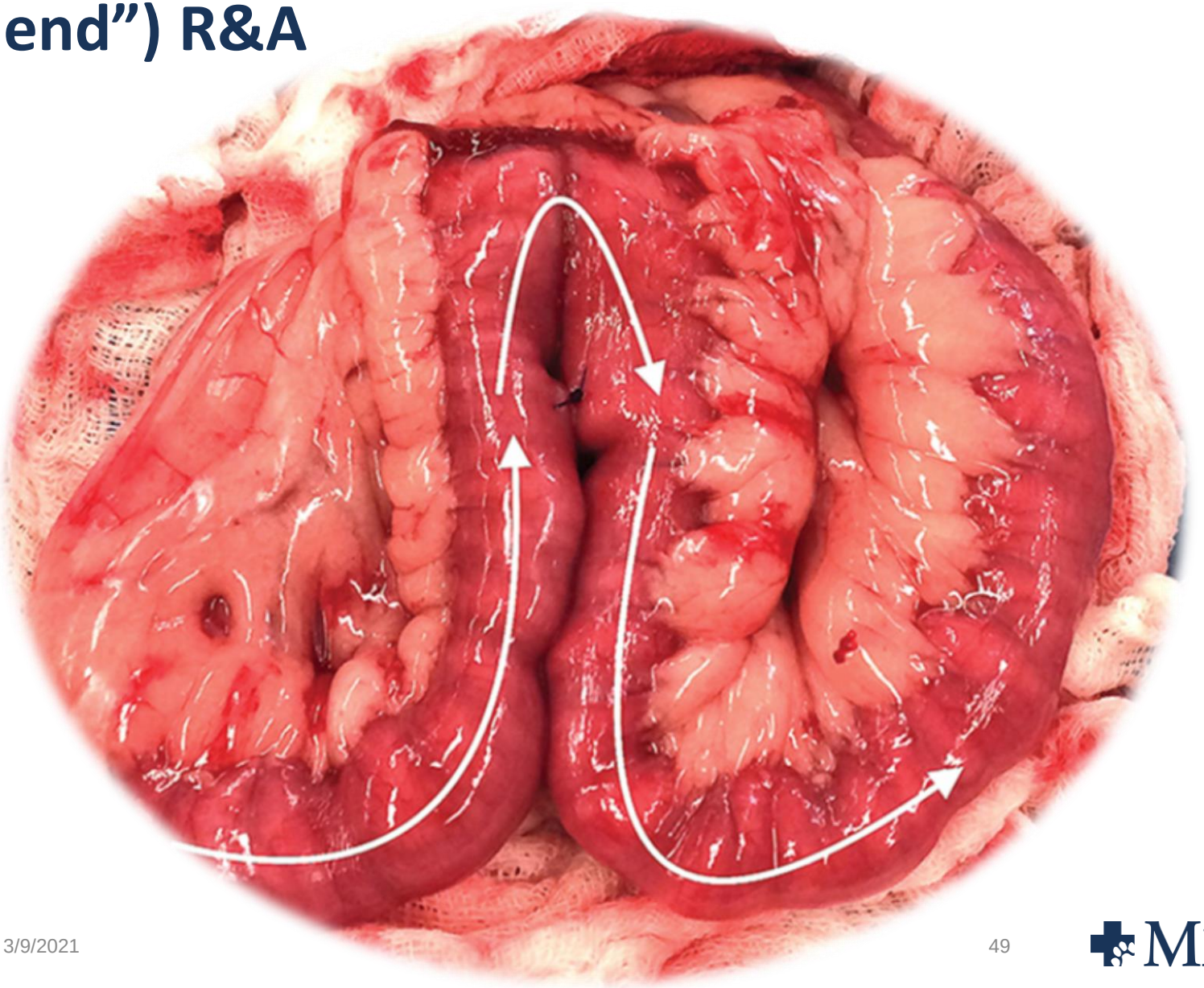
GIA Stapling: “The Pants”







Stapled Side-to-Side ("Functional end to end") R&A



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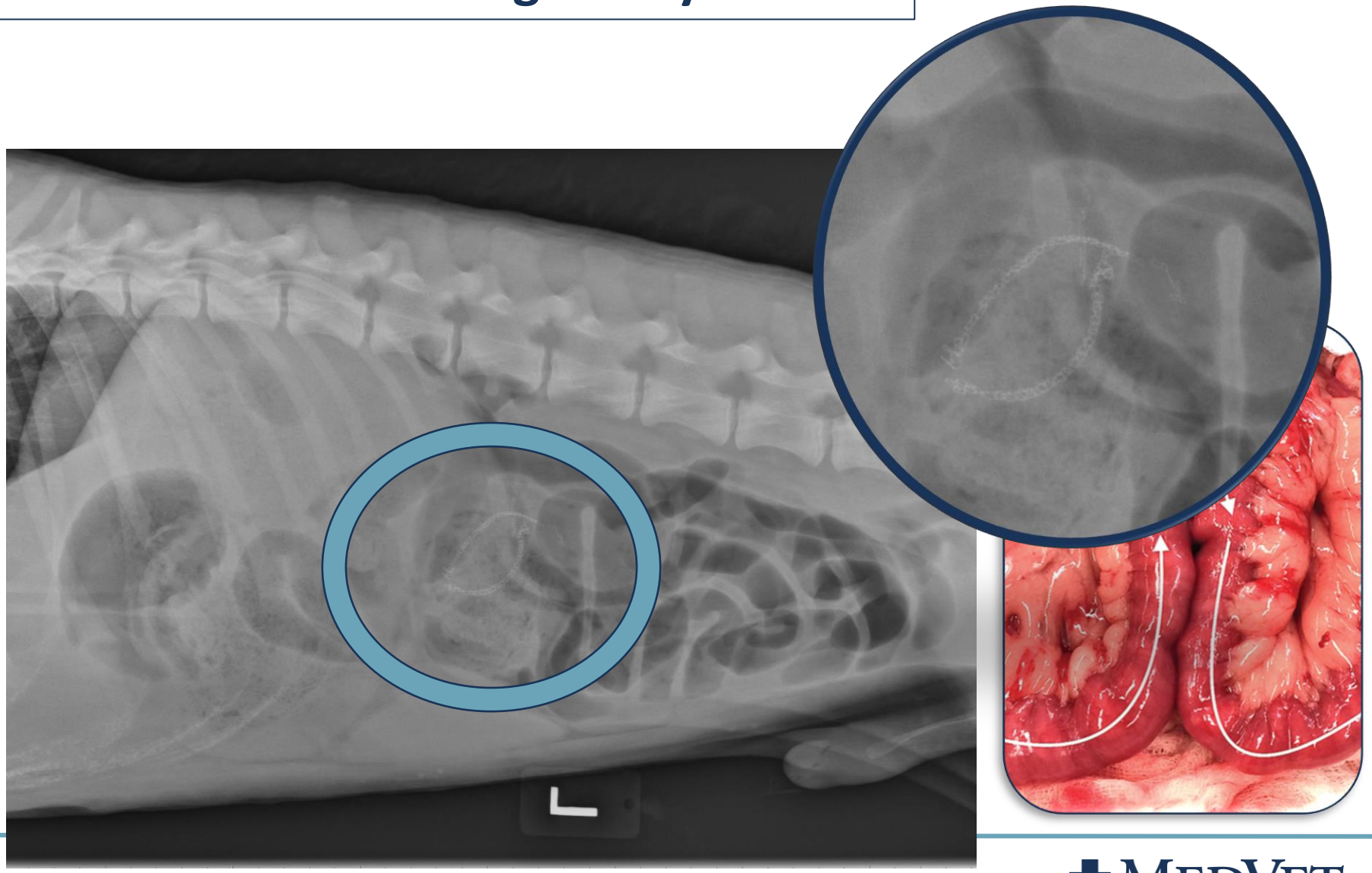
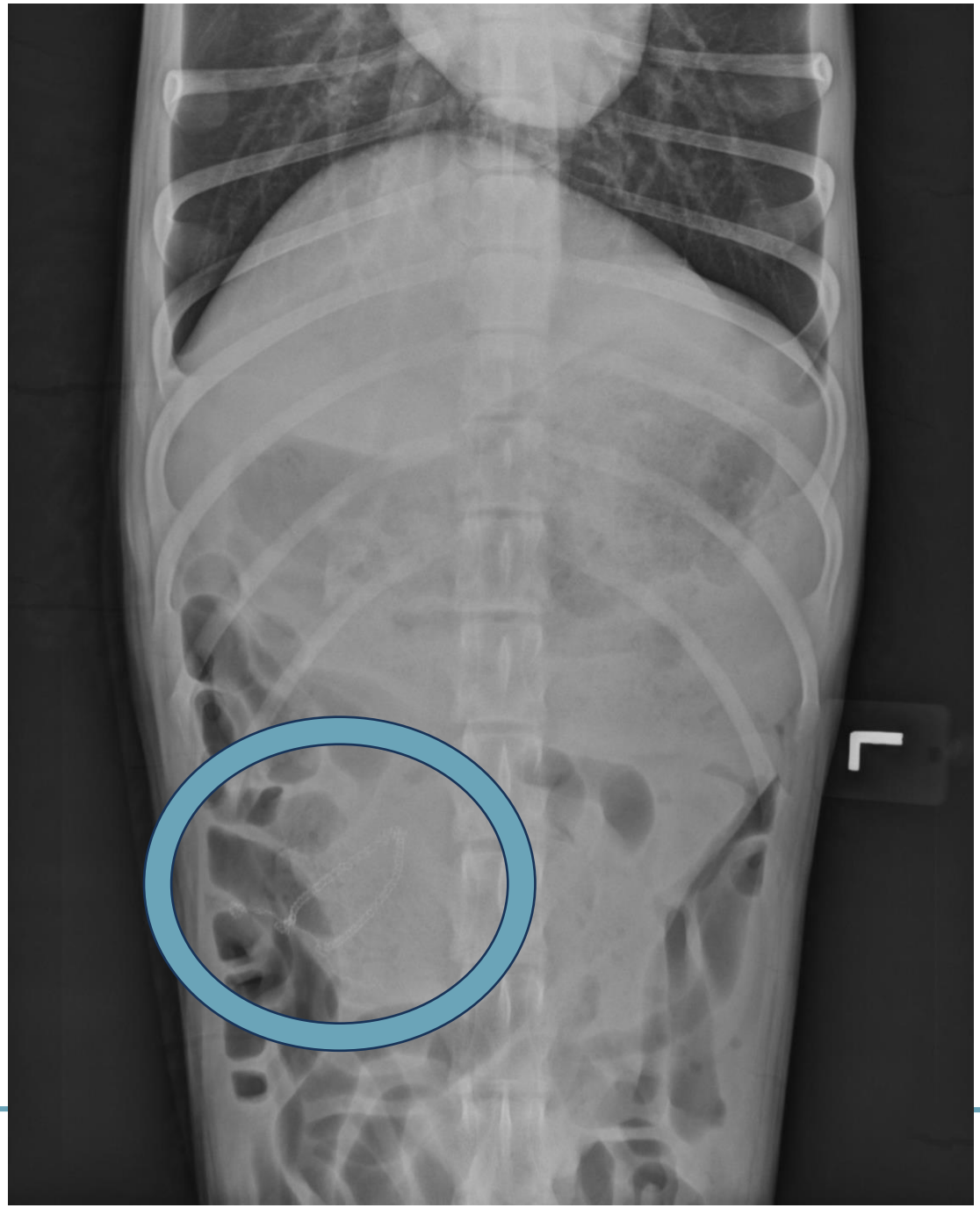
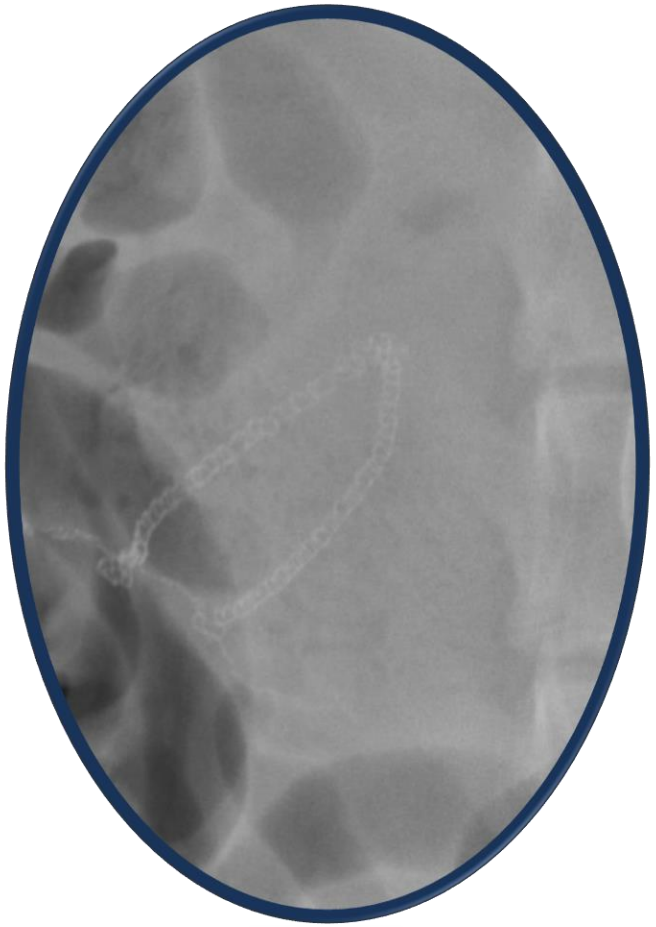
Not a necklace or foreign body….







Tips & Tricks: Bolstering the surgical site

- Omental wrap - the “abdominal policeman”
  - Seals the wound edges
  - Restores blood supply
  - Facilitates lymphatic drainage
- Serosal patch
  - Omentum unavailable or contaminated
  - Strengthens the anastomosis
    - Leak pressure increased from 28 to 82 mm Hg

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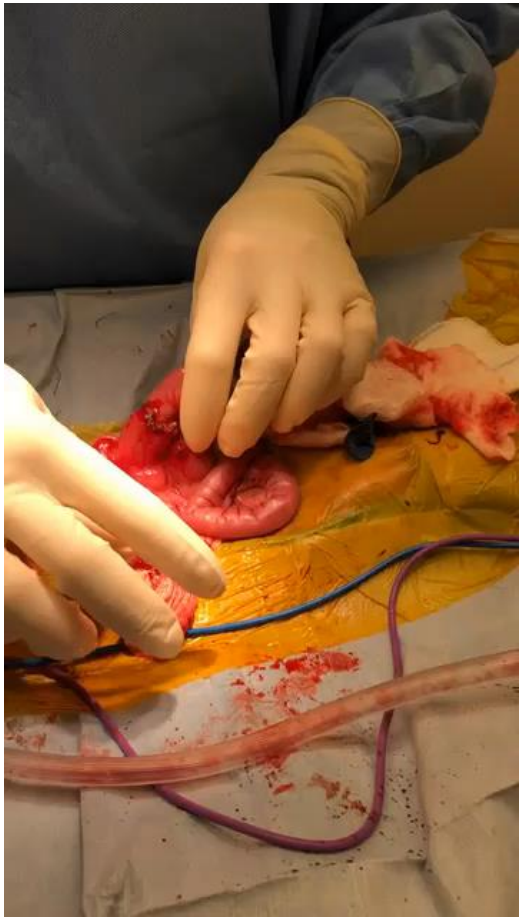


Essential Post-operative Care

Post-operative Care

- Fluid therapy
- Analgesia
- Antibiotic therapy?
- Alimentation

Post-operative Care

- When can my patient go home?
  - Eating and not vomiting
  - Comfortable with oral medications only (+/- liposomal bupivacaine)
  - Matching ins and outs
  - Attitude/demeanor

Complications and Their Mitigation

Complications

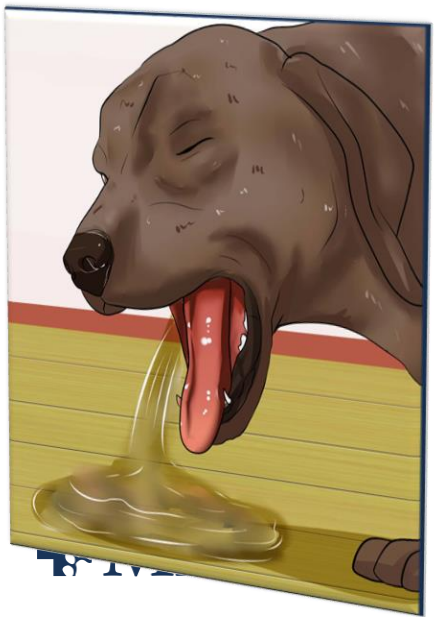
- Dehiscence – septic peritonitis
- Stricture/stenosis
  - Almost exclusive to two layer closure of small intestine
- Short Bowel Syndrome – Resection of 80% of small intestine
  - Tips & Tricks: Determining bowel length: Roughly 3.5X the length of the body

Consequence of GI Surgery Complications:

- Allen et al., 1992
  - 74% mortality with dehiscence
- Wylie and Hosgood, 1994
  - 80% mortality with dehiscence
- Ralps et al., 2003
  - Risk of dehiscence:
    - Hypoalbuminemia
    - Pre-operative peritonitis
    - Surgery for foreign body

Small intestinal healing

- **Diagnosis of dehiscence**
  - Time frame → 3-5 days, maybe longer?
    - Immediate less likely (i.e pancreatitis, esophagitis)
    - >1 week not typical unless delayed healing expected
  - Clinical signs – vomiting/regurgitation, lethargy, fever, persistent inappetence
    - Diarrhea not typical
  - Diagnostics
    - Abdominal US → *fluid cytology and analysis*
    - CBC, chemistry profile
    - Radiographs have little role in diagnosis



Septic peritonitis

Referral to 24 hour care facility and ideally one that uses GIA stapling equipment

- Prognosis = 50% survival
  - Better when diagnosed early?
- Anticipate 3-5 days in the hospital with aggressive supportive care

- Aggressive fluid therapy, intravenous antibiotics, nutritional support, blood pressure support

- Risk for dehiscence again!
  - Preoperative peritonitis 21.1% vs. 6.6% without
    - Davis et al. *Vet Surg* 2018
  - Staplers better than hand suture with septic peritonitis
    - 9.7% vs. 28.9%

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Evidence-based risk factors associated with intestinal dehiscence are:

A. Hypoalbuminemia, sepsis, surgery for foreign body
B. Hypokalemia, NSAID therapy, surgery for foreign body
C. Thrombocytopenia, neoplasia, surgery for foreign body
D. Hyponatremia, Prednisone therapy, surgery for foreign body

Discussion

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