Purpose
Practical approach to abdominal radiography of the acutely vomiting patient with emphasis on radiographic interpretation and techniques that can be performed in private practice.

Radiographs can be helpful in establishing whether an acutely vomiting patient needs medical or surgical intervention. However, imaging is only one part of the clinical picture. Radiographic findings should interpreted in light of the patient’s signalment, history, pertinent lab work, etc. Before making a radiographic diagnosis I ask myself, does the clinical picture fit with my suspected radiographic diagnosis?

Why emphasis on radiographs?
• Radiographs are ubiquitous
  o Whether analog or digital, most practices have access to radiographic equipment
  o Not always true for ultrasound
• First line of defense in human and veterinary medicine in the diagnosis of mechanical obstructions
  o Not to say that ultrasound cannot be helpful to diagnose small intestinal obstructions. However, it is not needed in most cases.
• Highly sensitive and specific for the diagnosis of small intestinal mechanical obstruction

However, radiographs are not a perfect test. Like any diagnostic test, radiographs can have false positives and false negatives.

Specific Radiographic Findings

(1) Small Intestinal Mechanical Obstruction (Mechanical Ileus)
• Complete or partial
• Lumen can be occluded by foreign objects, intussusceptions or masses (such neoplasia or less likely granulomas)
  o Masses can be luminal or extending from the wall
Radiographic Signs:

- Two populations of small intestine
  - Dilation of the loops of small intestine orad to the site of obstruction
  - One or multiple segments of small intestine are dilated compared to others
- The more complete the obstruction, and the longer it has been present, the larger the loops will be
- As more bowel becomes distended the segments assume a “stacked” appearance
- Will often not see the foreign body unless radiopaque
  - Still look for it
- Obstructed bowel will often contain both gas and fluid.
- Look hard for soft tissue opaque (fluid filled) loops.
  - Gas filled loops are easier for your eye to see because they stand out against other soft tissue opaque organs.
  - Empty or fluid filled segments of small intestine can be easy to miss because they border efface with other soft tissue opaque organs.
- Anecdotally, dogs with small intestinal mechanical obstructions often times have an empty colon. This is very non-specific finding (i.e. could be seen with a colitis as well). I would not go to surgery based solely on this finding. However, this increases my index of suspicion in a dog that I clinically suspect has a small intestinal mechanical obstruction with equivocal radiographs.
- This finding may make me more aggressive sooner (i.e. recommending an ultrasound sooner)

False negative on radiographs

- Each time a patient with a pyloric outflow, duodenal or proximal to mid jejunal obstruction vomits, the potential exists to “relieve” the signs of the obstruction (i.e. the gas and fluid dilation of the segments oral to the obstruction are not seen on the radiographs). This is a common reason an obstructive pattern may not be seen on radiographs but the patient is truly obstructed.
  - May repeat radiographs within a few hours (allowing the loops to fill with gas and ingesta) or ultrasound to look for the foreign body.

Radiographic rules to determine the presence of two populations of small intestine

Many rules have been proposed for small intestinal dilation:

1) Loop in question is 2x the size or greater compared to other (normal sized) loops***
   - Most reliable rule
2) Loop in question is 2x the size or greater compared to the height of a lumbar vertebra (on lateral projections)
3) Loop in question greater than 2x the size of two ribs
   o I do not use this rule as this falsely makes many normal loops appear enlarged
4) Cats: Loop in question is greater than 12 mm
   o As cats tend to be more uniform in body size

Partial Small Intestinal Obstruction
   • May be difficult to detect radiographically
   • Chronic partial obstructions accumulate opaque granular material in the intestine
     at the site or just orad to the obstruction from desiccated ingesta that becomes
     trapped (called a “gravel sign”)
   • A “gravel sign” has the appearance partially mineralized feces
   • Presence of material that looks like mineralized feces in the small intestine is
     indicative of a chronic partial obstruction

Pneumocolonogram
A pneumocolonogram can be used to:
1) Differentiate dilated small intestine from colon
2) Differentiate small intestinal vs colonic foreign material

Technique:
   • Red rubber (or Foley) catheter inserted into the rectum
   • Inject room air
   • Dog start with 5ml/kg
   • Cat start with 2.5 ml/kg
   • Start with a low dose (above) and can always increase based on results

Functional Ileus
   • Occurs when peristalsis ceases which causes the lumen to dilate
   • The bowel lumen remains patent
   • Non-specific finding
     o Can be seen secondary to multiple disease processes
   • One population of small intestine that are mild to moderately gas distended
   • Caution with Parvo as it can mimic a mechanical obstruction
     o For this reason, no matter how sure I am the patient has a small intestinal
       mechanical obstruction, I recommend a Parvo test, blood glucose and
       blood smear on any vomiting dog going to surgery under 1 year old
       (regardless if they are fully vaccinated).
     o This helps me ensure I am not sending a septic dog to surgery.
   • Mesenteric torsion:
     o Caused by torsion or thrombosis of the mesenteric artery
     o All small intestine (and possible part of colon) are markedly gas
       dilated
     o Typically painful on exam but do not have to be
     o Surgical disease

Linear Foreign Bodies
• Luminal linear material causes an abnormal shape and contour of the loops
• A portion becomes anchored orad
  o Cats under the tongue
  o Dogs in the pylorus or duodenum
• Bowel peristalsis causes the linear material and gas to move into pockets formed by the peristalsis giving the bowel a plicated appearance
• Forms crescent shaped luminal eccentrically located gas pattern
• Loops are typically normal in size
• Early detection key
  o Like to perforate bowel

Gastric Foreign Bodies and Pyloric Outflow Obstructions
• Some are very obvious and do not represent a diagnostic dilemma
  o Fish hooks, needles, etc.
• The stomach often radiographically contains nondescript material of questionable significance
• Feed and foreign material can be hard to differentiate
  o Impossible in many cases
• The margin of the stomach can mimic foreign material
• Excessive gastric secretions (gastric “foam”) can mimic foreign material

Importance of the Left Lateral Abdominal Radiograph
• The left lateral projection is essential for the diagnosis of pyloric and duodenal foreign material!
• In left lateral, gas is present within the non-dependent pylorus and descending duodenum that can outline the gastric foreign body
  o Acts as a natural negative contrast gastrogram
• Often times will not see the foreign body on other projections
• For this reason, I highly recommend performing a left lateral abdominal radiograph on vomiting patients.