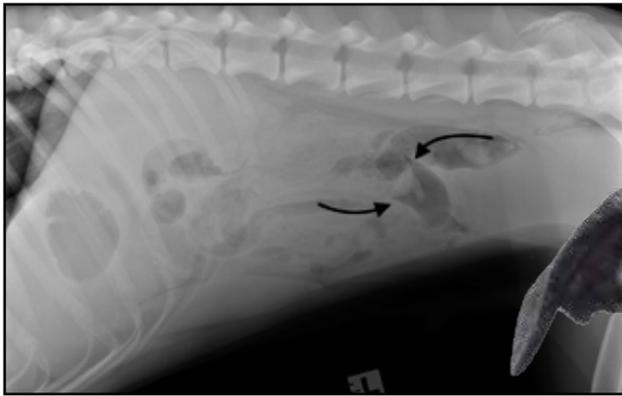


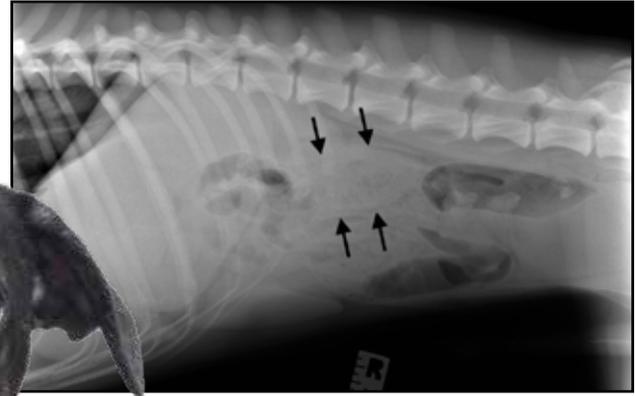
ANTECH IMAGING NEWS

Special Issue: Diagnosing Abdominal Obstructions

Focus on: Obstructive Patterns and Linear Foreign Bodies



Left Lateral View: The curved arrows point to the convex soft tissue gas interface of a foreign body in the dilated descending duodenum.



Right Lateral View: The four short straight arrows point out the same foreign body as in the left lateral. This segment is difficult to differentiate from the colon on this view, and the caudal edge is no longer defined by gas due to right lateral recumbency.

The diagnosis of foreign body obstructions can often be a challenge, especially if it is something that you don't see on a routine basis in your practice. This issue will improve your confidence and comfort level in the diagnosis of lucent and linear foreign bodies with survey radiography and ultrasound. You will learn diagnostic differences between using radiographs and ultrasound.

Let's start with why it is essential to get all three views of abdominal radiographs: VD, left lateral, and right lateral. Including both lateral views capitalizes on the movement of gas within the gastrointestinal tract to the non-dependent lumen. This will often highlight the edge of a foreign body

which may not be evident on an exam that solely includes the VD and single lateral projection. Foreign bodies within the descending duodenum are a great example of the difference in gas distribution, because this is a long segment of small intestine that is in a somewhat fixed position along the right lateral abdominal wall. When a patient

is positioned in right lateral recumbency, the edges of the foreign body are often obscured due to the fluid within the lumen. When that patient is moved into left lateral recumbency, the descending duodenum is now in the non-dependent portion of the abdomen. This means there is likely to be a shift of gas into its lumen highlighting the edge of the foreign body. The foreign body would have been missed if there was only a VD and right lateral view.

Identification of obstructive patterns

To diagnose a small intestinal obstruction, look for discrepancies in small intestinal dimensions. Two distinction "populations" are

Continued on next page

a good indication of a mechanical obstruction. Segments oral to an obstruction are typically dilated while those aboral to obstruction tend to be empty. To determine if a segment of small intestine is dilated, it is easiest to compare it to the colon. No small intestinal segment should ever have the same dimension as the colon and *there is only one colon!!* If you see two colons side by side...one is colon and the other is a dilated segment of SI. Many times a dilated segment of small intestine that contains gas speckled particulate material will fool you into thinking it is colon, but if you remember to identify the components of the gastrointestinal tract, you will often be able to differentiate between colon and small intestine. Ask yourself “Can you trace this loop into the pelvic canal, is it continuous with the ascending, transverse and descending colon?”

Identification of foreign bodies

Opaque foreign bodies are easy to identify and can be a welcome site when you have a tough client to convince. If not obvious, it is often fun to guess what the foreign body may be. I like the challenge of the so called “lucent” foreign body which is sort of a misnomer in my opinion. These are typically not lucent but the soft tissue opacity of many foreign bodies will make them hard to find when they summate with the fluid in the gastrointestinal tract lumen. In the stomach, it is key to look for a way to distinguish gas speckling that may be present within normal ingesta versus foreign body. The former tends to have a uniform distribution.

High index of suspicion for foreign material:

1. Distinct repetitive gas pattern within soft tissue opacity
2. Eccentric or focal collection of gas within soft tissue opacity
3. Gas in a well-defined crescent shape or sharp angle

Many times linear foreign body obstructions can be challenging because the obstruction may not manifest as segmental dilation. You will need to look for other findings to make the diagnosis.

1. Long segments of tubular soft tissue content +/- linear gas striations or other repetitive gas pattern. The linear material may be thick and easy to see such as with a rope toy or leash. Thin linear material such as dental floss or the backing of carpet are typically not radiographically visible.
2. Small intestinal plication, appearance is variable
 - a. Pleating of loops
 - b. “Erratic” or “punctuated” collections of gas in the small intestine
 - c. Intermittent portions of the small intestinal wall that have increased opacity corresponding to curved segments where several centimeters of intestinal wall are bunched into a shorter length gas in the small intestine (*most commonly in cats with linear foreign bodies*)
3. Gastric foreign material*
4. Abnormal course of the descending duodenum

*In dogs there is a very specific appearance of foreign material within the pylorus that can confirm a diagnosis of a linear foreign body. Based on the anatomy of the stomach and the principle of gravity, a regular foreign body that does not fill the entire lumen of the pylorus should sink or fall to the dependent lumen (the down side) and gas should rise to the non-dependent lumen (the up side).

In linear foreign bodies, the pyloric content is



Image A: This is a left lateral radiograph of a classic linear foreign body. Note the convex soft tissue gas interface in the pyloric antrum (straight arrow) and the “erratic” collections of gas (curved arrows).

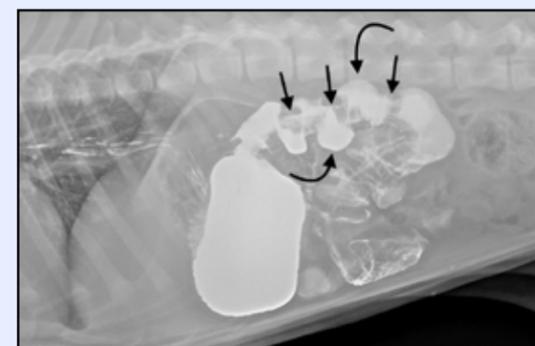


Image B: This is a right lateral radiograph post administration of barium of the same patient seen above in image A. Notice how the barium coats the linear foreign material in the duodenum (straight arrows) and the accumulation of barium in the outer lumen of the alternating folds of the plication (curved arrows). In studies without contrast, these pockets will either contain fluid or gas. When gas collects in these pockets, the “erratic” or “punctuated” pattern is diagnostic for plication (as seen in image A and C).

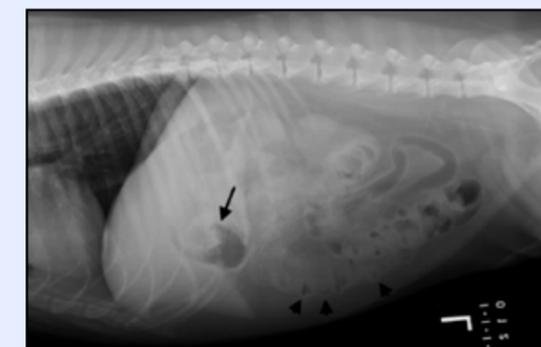


Image C: This image demonstrates the convex soft tissue gas interface in the pyloric antrum (straight arrow) and severe small intestinal plication. The punctuated gas pattern (arrow heads) aids in the recognition of the plication. In other cases, gas may not be visible which leaves you with the outline of the loops, see Image D below



Image D: This is a right lateral projection of a cat with a linear foreign body. Notice the clumps of plicated segments in the mid ventral abdomen. The loops indicated with the short straight arrow do not contain gas, but are “pleated.” The increased opacity of the two sections of small intestine marked with the curved arrows are also findings typical of linear foreign body obstructions in cats.

continuous with the material in the SI. The pull of the small intestinal plication essentially “fixes” the foreign body along the non-dependent wall of the pyloric antrum.

On the left lateral projection, this will appear as a convex soft tissue gas interface where the soft tissue opacity is confluent with the dorsal or dorsal lateral component of the antral wall. When patient is laying on their right side, fluid can mask the foreign body due to gravitational shift. **The left lateral projection is key!** This can be seen in the radiographs at the top of this page.



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Diagnosis of Foreign Bodies: Ultrasound and Survey Radiography

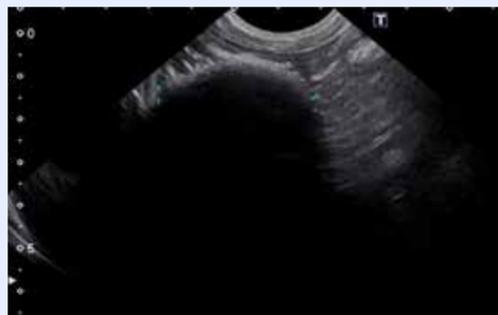


Image E: This ultrasound image is diagnostic for a simple foreign body due to the hyperechoic interface of the surface of the foreign body and the resulting strong far field shadow. Ultrasound waves tend to reflect off the surface of foreign material in the gastrointestinal tract. This leaves no ultrasound waves to be assigned to the region “below” the foreign body in the far field (shadow).



Image F: This is an ultrasound image of a plicated segment of small intestine with a thin linear foreign body. Because some linear foreign material can absorb fluid, it does not always have complete far field shadow as seen above. The hyperechoic linear foreign material (straight arrows) ‘hugs’ the mesenteric surface of the small intestine. The outer ‘folds’ (anti-mesenteric wall) of small intestine are indicated by the curved arrows. Often it is difficult to obtain a single image of the linear foreign body and plication. Cine loop capture is often necessary to demonstrate the course of the linear foreign body in plicated small intestine.

Ultrasound and radiography are complimentary imaging modalities that together often provide information that is greater than the sum of its parts. Ultrasound can be used to make the diagnosis of a linear foreign body, but on its own this can be more of a challenge. Plicated segments are harder to trace and inflamed mesentery can decrease image clarity. It can be easy to get lost in the ‘dark’ in these cases.

When radiographs are available, they can serve as a “road map” for the intestinal segments and their contents. The far field shadowing associated with colonic gas and large diameter fecal segments can often be confused with the stomach. If the stomach is empty colonic content may completely block your view of the stomach and regional small intestinal segments. On the other hand, with practice it is possible to trace a segment along its length to determine if it is small intestine or colon. The difference in the thickness and distinction of wall layering is another help differentiating SI versus colon.

With ultrasound you are more likely to see the

small diameter linear foreign material and plication is easier to recognize. Other benefits include detailed information of small intestinal wall thickness, wall layering, presence of pancreatitis, confirmation of free fluid and guided fluid collection.

The identification of free gas with ultrasound is possible but it can be easily missed. Gas can be present within mesentery adjacent to a perforated foreign body or can be in the non-dependent portion of the imaging field. If you are lucky, you can capture a cine loop of gas bubbling out of small intestinal wall perforation.

I would like to mention that some patients with foreign bodies will continue to defecate either due to partial obstruction or sufficient fecal material in the colon (feces can be present in the colon for up to 6 weeks). Don’t discount foreign body if your patient isn’t profusely vomiting (partial obstructions, some linear foreign bodies) or has suddenly stopped vomiting. Vomiting can cease even with a complete obstructions when the bowel becomes “exhausted.”

The Importance of Accurate and Up to Date Historical Information

I cannot stress the importance of having accurate and up to date history when making radiographic diagnosis, decision making and recommendations. Imagine walking into an exam room to evaluate a patient and the owner wants you to ‘guess’ why they have come to see you. An abnormality may be obvious but how important is that finding to the owner. Is that the reason they are in your exam room today?

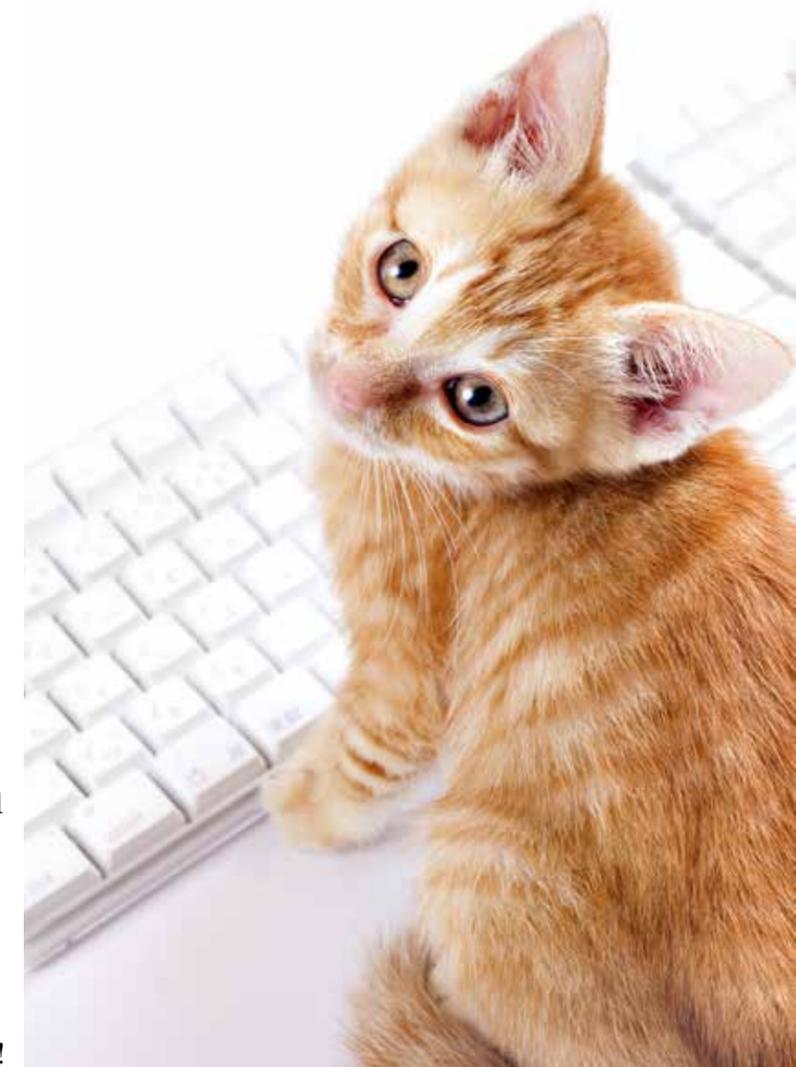
I am sure somewhere along the line, you have heard that a radiologist doesn’t want to hear the history. This is perhaps only partially true and taken out of context can really complicate what we as veterinarians we aim to accomplish for our shared veterinary patients.

My process is to I always look at a set of films before I look at a history but then I will look at the history and re-examine the radiographs in context of your primary concern. This allows me to provide you with a concise review and more tailored report. I cannot tell you how many times I have missed something on my initial review that I only saw because of that second look. Other times I will include information in my report with respect to a variant of normal or incidental finding because of a question from the history.

My differential list and recommendations for a patient with segmental dilation of small intestine with no visible foreign body will be general and perhaps not as helpful as either of us would like it to be. If I knew that patient had prior surgery and adhesions for a previous foreign body, I am going to rank obstruction due to adhesion, stricture or strangulation of bowel in a rent of omentum/mesentery. I would recommend that patient have an abdominal ultrasound prior to surgery. For that same set of radiographs, if the history indicated this was a 1 year old intact Rottweiler with questionable or no vaccine history, Parvo and Parvo testing would be at the top of my list. I would not want to send that patient to surgery!!

Likewise a dehydrated patient with a partial or early obstruction may do well with IV fluid support overnight and repeat radiographs to determine if the material is passing or is now a full obstruction.

History for follow up radiographs is just as important as that initial synopsis. It doesn’t have to be long or involved but what we do want to know is has there been any vomiting or significant change in that patient overnight? If radiographic signs are equivocal and the history states “repeat radiographs” I will struggle with my recommendation for that patient.





Diagnostic Challenge

Can you find the foreign bodies in these x-rays?



A. Battery & Bottle cap B. Tennis ball in pharynx C. Angel ornament & wire hanger D. Toy squeaker in pylorus
E. Multiple hair ties F. Deflated ball G. Toy dinosaurus foot H. Steak knife I. Golf balls

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