DCMC Emergency Department Radiology Case of the Month

These cases have been removed of identifying information. These cases are intended for peer review and educational purposes only.

Welcome to the DCMC Emergency Department Radiology Case of the Month!

In conjunction with our Pediatric Radiology specialists from ARA, we hope you enjoy these monthly radiological highlights from the case files of the Emergency Department at DCMC. These cases are meant to highlight important chief complaints, cases, and radiology findings that we all encounter every day.

If you enjoy these reviews, we invite you to check out Pediatric Emergency Medicine Fellowship Radiology rounds, which are offered quarterly and are held with the outstanding support of the Pediatric Radiology specialists at Austin Radiologic Association.

If you have any questions or feedback regarding the Case of the Month, feel free to email Robert Vezzetti, MD at rmvezzetti@ascension.org.

This Month:

Weird causes of common symptoms. We all see this every day, but this case stands out as one of the more unusual ones. Of course, imaging played a very important role in this child’s diagnosis. What caused this child’s symptoms? How did she do? Read on…
Case History

Spring has sprung in the Pediatric Emergency Department! Influenza and RSV are fading and abrasions, lacerations, contusions, and fractures are making their appearances. Quid pro quo, as the saying goes. Of course, the springtime vomiting cases are out there as well and the next child you see is no exception...or is she?

This is a 2 year old female with diffuse abdominal pain and nonbilious emesis for the past 24 hours. She was initially seen at an outside facility and had a urine test done. She was diagnosed with a urinary tract infection and Cefdinir (Omnicef) was prescribed. This all occurred roughly 12 hours ago and the child has taken one dose of this medication. She was discharged and the mother noted that over the course of the past 12 hours, the child has had periods of what is described as severe, generalized abdominal pain, coming in waves and, while never completely resolving, does seem to improve, perhaps it the pain could even be described as colicky. Because of this, the child was brought back to the outside facility, where she was noted to be ill-appearing. An IV was placed and a normal saline bolus was given (20 cc/kg); labs were obtained (CBC, CMP). The WBC was 21.8 (58 Segs 18 Bands 15 Lymphs) and the CMP was normal except for a Sodium of 127, Bicarb of 14, and a BUN of 48 (Creatinine of 0.6). A limited RLQ abdominal ultrasound was performed, which was equivocal (Appy Score of 4). She was then transferred to the DCMC ED for further evaluation for possible appendicitis.

You speak to the mother, who tells you pretty much what you already know. She does, however, throw in a few more details. The pain did indeed start 24 hours ago and has worsened over the past 12 hours. The child, as the pain worsened, has had periods of sleepiness (or at least decreased activity), along with decreased po intake and urine output. The mother felt the child had a fever, but the maximum temperature noted has been 100.4. There has been no cough, congestion, dysuria, back pain, diarrhea (in fact, the child has had 2 hard stools yesterday and no bowel movement since then), or known trauma.

On exam, the child is quite and nontoxic but ill-appearing. She is tells you “tummy better”. She is afebrile but her heart rate is 180, respiratory rate is 30, and her blood pressure is 89/67. Her exam is significant for somewhat dry mucous membranes and diffuse abdominal pain with generalized guarding with rebound. There is no hepatosplenomegaly and no signs of trauma. There are no masses.

You review the UA from earlier today; it is significant for a specific gravity of > 1.030. However, this sample is negative for nitrite and leukocyte esterase and there is trace bacteria. Is this consistent with a UTI? Does this child need imaging, given her history and symptoms? What about the original abdominal ultrasound?

April Fool’s Jokes gone badly: In 2012 Montana resident Randy Lee Tenley dressed up in a ghillie suit with the intent to scare travelers on Highway 93. He was having a blast, until he was run over by two drivers and expired from his injuries.

Findings Supportive of Appendicitis:
Aperistaltic, non-compressible dilated structure (> 6 mm outer diameter).
Echogenic prominent pericaecal and periappendiceal fat.
Periappendiceal fluid collection.
Target appearance.
Wall thickening (> 3 mm).
Loss of wall stratification (seen with necrotic appendicitis).
Periappendiceal reactive lymph node enlargement.
Appendicolith with posterior acoustic shadowing.

Ultrasound Appendicitis Scores
We have all seen appendicitis scores on right lower quadrant reports, but do you know what the numbers mean? Here’s a refresher:
1 - Normal, completely visualized appendix.
2 - Partially-visualized appendix, no signs of appendicitis.
3 - Non-visualized appendix; no signs of appendicitis.
4 - Equivocal study.
5 - Appendicitis.
This child has concerning clinical findings: she is tachycardic and her abdominal examination is not reassuring. Additionally, her WBC is high with bandemia. Is this infection? You repeat the CMP, since the child has had a NS bolus and find that it is not better: she is still hyponatremic and the bicarb is 12 (What? It got worse?).

You decide to obtain a plain radiograph, since the child has diffuse abdominal pain and emesis. Perhaps this is viral or maybe she has an ileus. More importantly, the child may have appendicitis (the ultrasound was equivocal) or a bowel obstruction. The images of the 2 view abdomen are seen to the left. In children under the age of 7 or 8 years old, a 2 view abdominal examination consists of AP and left lateral decubitus views; a left lateral decubitus view is helpful to look for obstruction from intussusception. Plain abdominal imaging is also helpful as a quick and low radiation modality to look for overall bowel gas pattern as well as suggest obstruction; free air can be detected and, in some cases, abdominal masses.

These images reveal an abnormal bowel gas pattern with prominent mid-abdominal bowel loops (red arrows). There is a paucity of air in the lower quadrants (green arrows). This suggests an ileus or even enteritis, but bowel obstruction is also a possibility. Now what?

**CT: Whirlpool Sign**

This one refers to the mesentery (as opposed to other whirlpool signs) and reflects bowel rotation around its mesentery, which results in whirls of the mesenteric vessels.

**Bowel obstruction: dilated bowel loops; note the intussusceptum (green arrow).**

**Small Bowel Obstruction: Imaging Findings**

- **Plain Radiography** - While diagnostic in about 50%-60% of cases and most sensitive for high grade obstructions, this modality is still useful. Findings include dilated loops proximal to the obstruction, 3 instances of dilation > 2.5-3cm, predominantly dilated central loops.
- **Ultrasound** - Not commonly used and operator dependent. Obstruction is probable when the lumen of the fluid-filled small bowel loops is dilated, the length of the segment is more than 10 cm, and peristalsis of the dilated segment is increased.
- **CT** - Most useful in high grade obstruction, but is a very useful modality with a sensitivity of 96% and specificity of 95%. Oral contrast is usually not needed.
You also repeat the abdominal ultrasound, looking for appendicitis – same results (Appy score of 4). While you’re there, you also look for intussusception (given the decreased activity, abdominal pain, and emesis, as well as the plain images of decreased right lower quadrant air on the plain films) and this is negative.

You re-examine the child, who now has pain again and this time is now particularly impressive in the RLQ. You speak to the Pediatric Surgery team. Time for a CT scan.

Selected images of the CT are seen to the left. There are numerous dilated fluid filled loops of bowel (red arrows). Mid-abdomen, there appears to be a point of transition between dilated and nondilated loops with a swirled appearance (yellow arrows); the appendix is normal; there is low attenuation free fluid (green arrows).

This swirling is concerning for a volvulus or internal hernia, but whatever it is, it is causing a small bowel obstruction. Why does this child have a bowel obstruction? Next steps?

**Pediatric Internal Hernias: What?**

Internal hernias are quite rare (< 1% of the population at autopsy) visceral protrusions through the peritoneum or mesentery but remain within the abdominal cavity. These hernias can be congenital (classified according to their location; paraduodenal and transmesenteric hernias are the most common in pediatric patients) or acquired.

Reports of pediatric internal hernias are rare and clinical presentation can vary; acute abdominal pain, abdominal distention, and emesis are usual symptoms, but chronic pain and emesis can also be present. In one of the largest case series (12 patients, ranging from 1 day to 12 years of age) acute abdominal pain and emesis were present in the majority of cases. Notably, the majority of younger patients did not undergo imaging and were taken to the operating room due to clinical presentation. Even more interesting (but not surprisingly) other diagnosis were entertained, such as pyloric stenosis, volvulus, malrotation, and appendicitis. In patients that underwent imaging, Upper GI with a small bowel followthrough or CT imaging were the modalities employed. The majority of patients had a congenital etiology. (Tang, et al).

**Imaging Internal Hernias**

Plain radiography has a limited role in the diagnosis of internal hernias, but can be useful to assess bowel obstruction, etc. Ultrasound is not helpful to diagnose the hernia per se, but can be useful to determine other etiologies, such as pyloric stenosis, intussusception, and appendicitis. An Upper GI series has been the traditional modality used in diagnosis and can be useful in detecting malrotation. Computed tomography has become the imaging gold standard for evaluating these patients.
Internal Hernia
A = paraduodenal
B = foramen of Winslow
C = intermesocolic
D = pericolic
E = transmesenteric, transomental, and transmesocolic
F = retroperitoneal
G = fallopian ligament
H = supramesocolic and pelvic

Case Resolution:
After the child was evaluated by the Pediatric Surgery Team, the aforementioned CT scan was obtained. This resulted in the child being taken to the operating room. During her procedure, “copious serosanguinous ascites” was encountered and there was obvious bowel necrosis, albeit a small segment. There was no malrotation but after very careful exploration by the pediatric surgeon, a small internal hernia was identified with a very well demarcated transition zone between the portion of the nonviable small bowel that passed through the hernia and the viable portion of the bowel. The nonviable bowel was resected. The child tolerated the procedure well and was admitted to the PICU post-op for close monitoring. Her post op course involved the placement of a central line and initiation of TPN. She was kept NPO due to her ileus, which had a prolonged course. She developed pulmonary edema and required Lasix and CPAP; this resulted in a good diuresis and on post-op day 3, bowel activity began and she was able to advance her diet. On post-op day 8, her TPN was discontinued, she had good pain control, and was tolerating po well; she was able to be discharged with close followup. Surgical pathology confirmed bowel ischemia with a small perforation. As of this writing, she is doing well.

Teaching Points
1. Always consider a surgical etiology in children presenting for evaluation who have abdominal pain and vomiting. Remember, though, these symptoms are more often the result of a viral process (keep an open mind).
2. Don’t underestimate the utility of plain abdominal radiography when a bowel obstruction is considered as a possible diagnosis! This modality has relatively low ionizing radiation exposure, is inexpensive, and readily available. A two view of the abdomen is recommended (AP and left lateral decubitus in younger children; supine and upright in older children).
3. Ultrasound is great for evaluation of a patient with possible appendicitis or intussusception, but has limited utility for bowel obstruction. However, there are findings (see above) that suggest obstruction.
4. Computed tomography is most commonly employed in children where the diagnosis may not be clear or there is a suspected complication, such as a perforation, abscess, or necrotic bowel. In adult patients, it is the most commonly used modality.
5. Early involvement of Pediatric Surgery is very important. If the history and/or plain imaging suggest an obstruction, obtain a Pediatric Surgery consult quickly, as this will maximize the chances for the best possible outcome.

References