DCMC Emergency Department Radiology Case of the Month

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 check out Pediatric Emergency Medicine Fellowship Radiology Rounds, which are currently 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 format, feel free to email Robert Vezzetti, MD at rmvezzetti@seton.org.

THIS MONTH: Ah February! Here are some cases to love:
The first case involves a teenager who has a most unusual cause of abdominal pain with potentially catastrophic complications if not identified and treated promptly.
The second case is a young man who is having some difficulty after his appendectomy.
These patients have some good lessons to teach us as clinicians, so read on.
Also, as a Valentine’s Day gift to you, enjoy some Valentine’s Day little known facts.

The most popular theory about Valentine’s Day origin is that Emperor Claudius II didn’t want Roman men to marry during wartime. Bishop Valentine went against his wishes and performed secret weddings. For this, Valentine was jailed and executed. While in jail he wrote a note to the jailor’s daughter signing it “from your Valentine”.

THIS MONTH:

4th 9AM-11AM Journal Club.......................Drs Yanger, Gardiner, Wilkinson
11AM-12PM DKA & Hyperglycemia..................Dr Remick

11th 9AM-10AM Small Procedures in the PED.............Drs Iyer and Ryan
10AM-11AM Simulation: Nerve Blocks...Drs Laos and Sim Faculty
11AM-12PM M&M..................................Drs Mitchell and Whitaker

18th 9AM-10AM FUO and Kawasaki Disease..................Dr Allen
10AM-11AM Biostatistics................................Dr Wilkinson
11AM-12PM Radiology: Vomiting Child.....Drs Yanger and Vezzetti

25th 9AM-10AM Acidosis, Alkalosis, Electrolytes............Dr Kienstra
10AM-12PM Board Review (Trauma II).....Drs Gregg and Whitaker
12PM-1PM ED Staff Meeting

All lectures are held in the DCMC Sig Auditorium unless otherwise noted.
Simulations are held at UMC Brackenridge in the Clinical Education Center.
All are welcome to attend!
CASE 1: In the middle of a very busy January shift in the pediatric emergency department, you are handed a chart. The nurse tells you “this girl looks like she feels terrible.” When you go into the room to examine the patient, she does indeed look terrible. Miserable is another word that comes to mind. Her mother tells you that this 17 year old began to complain of right upper quadrant abdominal pain a few days ago. Initially the pain did not seem too bad and she began to take over the counter antacids, with little relief. The pain began to worsen, then, some hours ago, began severe, so much so that she couldn’t ambulate. This was followed by 3–4 episodes of nonbilious emesis. There has been no diarrhea or fever. The pain now extends to the right lower quadrant as well. There is no history of trauma or travel. She denies being sexually active and has regular menses, then last of which was 2 weeks ago. On exam, you find an afebrile child who has a heart rate of 140 and a blood pressure of 100/60. She has diffuse abdominal tenderness with guarding; in fact it is difficult to get a really good exam because of the pain that is elicited when the abdomen is palpated. She looks pale. The rest of her exam is otherwise unremarkable.

It is obvious that this child has some significant issues. You decide to obtain IV access and begin IV fluids, along with some labwork. A differential begins to form in your mind. Surgical (appendy, ovarian issue, gallbladder issue, intestinal pathology, etc)? Medical (infectious)? Obstetrical (tubal pregnancy, PID)? You've been down this road before...imaging is needed, but which modality will be the most useful in this patient?

CASE 2: A 15 year old male is having some tummy trouble. It seems for the past couple of days, he has had progressively worsening abdominal pain, along with lack of appetite and nausea. He has not had any vomiting or diarrhea. There has been subjective fever today. He tells you that he had an appendectomy last week and seemed to be ok for the first few days, but now things are worse. On exam he is afebrile but miserable appearing. He is tachycardic (HR = 120) and slightly pale. His exam is significant for obesity (he is 110 kg) but when you palpate his abdomen he begins to tear up, saying that he really is in a lot of pain. No matter where you touch, there is tenderness, but he is most tender in the right lower quadrant and periumbilical area. He has three incision sites consistent with a laparoscopic appendectomy, one of which has a spider man band-aid on it. None of the sites have erythema, induration, or discharge. There is no crepitus. His genital exam is normal. You look back through his medical record and see that he had a laparoscopic appendectomy 12 days ago. He was perforated at the time but the procedure seemed routine. He recovered uneventfully and was sent home to continue his convalescence.

Like the previous patient, this young man will require further investigation and imaging. IV access is obtained and labs are drawn. You start fluids and provide the patient with some Morphine for pain control. What is the best imaging test for this patient with a potential post-operative complication? Should you call surgery now, or get some pictures?

In Victorian times it was considered bad luck to sign a Valentine’s Day card.

In 1537, England’s King Henry VII officially declared Feb. 14 the holiday of St. Valentine’s Day.
The oldest surviving love poem till date is written in a clay tablet from the times of the Sumerians around 3500 BC.

CASE 1

This young lady has really impressive abdominal pain. Several warning flags are present: acute onset, possible fever, lost of nausea, some vomiting. The differential is broad, but ovarian pathology seems unlikely, given the location of the pain. This patient’s history and findings are suggestive of bowel pathology. Perhaps an obstruction or perforation? Maybe an inflammatory etiology, like IBD or IBS? Initial imaging tests to consider might be a plain film (good to assess overall bowel gas pattern or the presence of free air), an ultrasound (nice way to visualize ovaries as well as the gallbladder and liver), or a CT (good for viewing inflammation, perforations, obstructions). Surgical causes of pain? What surgical cause can give a patient such acute pain? While you are thinking about that, the WBC comes back as 24,000 (70 segs 20 lymphs). Hmm....

Given this patient’s degree and extent of abdominal pain, it was decided to obtain a CT scan. While this might be more of a “big gun” approach, her history and physical exam do not suggest an ovarian torsion or cyst; pancreatitis or biliary tract pathology does not seem to be likely; the elevated white blood cell count is concerning, although stress margination may have a role in this. Overall, it was difficult to examine this patient due to the pain. A CT, in this patient, was most likely to give a good overall picture of what might be happening.

Duodenal ulcers are not uncommon in children and often go unnoticed for long periods of time. The exact incidence is debatable. This condition has been described both in infants and older children alike. Infantile presentation (very rare) may involve fussiness, emesis, GI bleeding, anorexia, and fever/sepsis. Older children can present with similar symptoms but often will complain of epigastric pain as well. They often will present with acute onset of severe abdominal pain, often accompanied by nausea and emesis.

Development of ulcers may be associated with malnutrition, NSAID use, infection with H. pylori, malnutrition, trauma, sepsis, inflammatory bowel conditions (Crohn’s, etc) and stress. Males are more likely to develop ulcers and are at higher risk for perforation. H pylori infection has, historically, a unique association with ulcer development and children are thought to acquire the infection from their mothers. Diagnosis of H pylori can be confirmed with endoscopy/biopsy, detection of antibodies in serum or stool antibody detection. Treatment of H pylori typically involves a proton pump inhibitor and a two week course of antibiotics (there are multiple regimens).

Perforated duodenal ulcers can be managed historically with open laparotomy; laparoscopy has been shown to be effective as well. In small ulcers with no evidence of active bleeding, medical management is an option.
CASE 2

We all know that patients will often experience pain following any procedure, but in this gentleman’s case, the pain is exquisite, fairly localized to his surgical sites, and is occurring a week after the procedure. Adding to the concern are the additional symptoms of fever, nausea, and anorexia. At least we know this is not appendicitis. Perhaps post-op bowel obstruction? A perforation is not likely this far out from the surgery. Renal stone? Constipation (pretty common in patients on pain controlling medication, like narcotics)? Infectious? As you ponder the possibilities, the labwork you had sent off now starts to trickle in. WBC is 26 with 86 segs and 8 lymphs. His electrolytes look ok. Urine is slightly concentrated but otherwise normal. An ultrasound may be a good idea, but this patient’s body habitus will severely limit its usefulness. Maybe time for a CT....

Oh Oh...So this contrast enhanced CT shows a fluid collection in the right lower quadrant consistent with inflammation (blue arrow) and an abscess (red arrow). No wonder he has an elevated white blood cell count and feels terrible!

This patient has a complication well-known to any surgical procedure: he has developed an abscess at the site where his former appendix resided. He will need a pediatric surgical consultation, antibiotics, and admission to the hospital. CT guided aspiration is often the treatment of choice to eliminate the abscess.

Here we see the needle introduced to the abscess site.

Here is a CT image of this patient’s treatment: CT guided needle aspiration and drainage of the abscess. This is typically done by the pediatric interventional radiologist and is a very effective way to treat this condition, in addition to antimicrobial therapy.

CT Guided Needle Aspiration: Most post-appendectomy abscesses are amenable to drainage with CT guided needle aspiration, done by interventional radiology. This is minimally invasive, effective, and produces short hospital stays in a large majority of patients. Abscess formation is more likely in patients that have a greater degree of pathology (ie the presence of a perforation, which increases risk of abscess formation by roughly 8%). Laparoscopic appendectomy vs traditional appendectomy has not been shown to increase the incidence of abscess formation in most studies.
Contrast vs Non-Contrast CT Scans

If you are considering ordering a CT scan on a patient, the question you need to answer prior to ordering the study is whether or not you need contrast. Not all CT scans need contrast; it just depends what you are trying to visualize. Here is a handy guide:

**Contrast Enhanced CT**

1. Appendicitis: You already know that in children, ultrasound is preferred. However, if CT is going to be used, then IV contrast is needed. Some centers use IV with oral and/or rectal contrast.
2. Inflammatory Bowel Disease
3. Pancreatitis: Contrast is useful when evaluating evolving pancreatitis or when evaluating a pseudocyst.
4. Pulmonary Embolism: Rare in children, but it does happen!
5. Infection/abscess evaluation

**Non-Contrast Enhanced CT**

1. Closed Head Injuries: Useful for evaluating epidural, subdural, and subarachnoid bleeding.
2. Trauma: Especially in extremity injuries or complex fractures (such as complicated ankle fractures. Remember, though, IV contrast is needed if a vascular injury is suspected.
3. Kidney Stones: Also not terribly common in children, but they do occur. Like appendicitis, US is the preferred primary imaging modality.

**Types of Contrast Agents**

IV Agents: Contrast agents for CT imaging are typically iodine-based. Intravenous contrast agents (iodine-based) can be further divided into ionic and nonionic, high osmolar and low osmolar. Rates of adverse major reactions between the various types are roughly the same, but nonionic agents have a less minor reaction rate and are most commonly used, but children overall have a low reaction rate. Osmolality (remember quantitative chemistry? I don't) is important in children, because children are more susceptible to fluid shifts; administering a high-osmolar solution could result in pulmonary edema, etc. In children with cardiac conditions that result in ventricular dysfunction, or in children with pulmonary issues, this has to be taken into consideration. (Thank a pediatric radiologist!)

Oral: There are both iodine-based and barium-based solutions, but barium-based is most commonly used in children. Oral agents can be administered, well, orally, but also by ostomy, rectally, or through a NG tube placed in the GI tract. Oral contrast agents are typically used to evaluate the GI tract; in children they are not frequently used unless there has been consultation with either a pediatric surgeon or pediatric radiologist. Barium is contraindicated in the setting of suspected bowel perforation. If a perforation is suspected and oral contrast is being used, then iodine-based contrast is used.

Shellfish allergy and contrast: Really?

Can you use contrast in patients that are allergic to shellfish? What about iodine? Well, the answer is yes! There really isn't such a thing as an iodine allergy, as this molecule is essential to life! The reaction that people experience is really due to tropomyosin (in the case of shellfish) or other portions of the contrast molecule (in the case of contrast material). Shellfish allergy is NOT a contraindication to contrast administration. Take it from the American College of Radiology: "The predictive value of specific allergies, such as those to shellfish or dairy products, previously thought to be helpful, is now recognized to be unreliable. There is no evidence to support the continuation of this practice." If necessary, and as a precaution, a steroid preparation may be given prior to the injection of IV contrast to alleviate allergic reactions from the other substances in the IV contrast.
**Case Resolutions**

**Case 1:** This patient did indeed have a perforated gastric ulcer. She was admitted, made NPO, given IV fluids and Protonix. Pediatric surgery was initially consulted in the Emergency Department and they recommended initiation of IV antibiotics (Ciprofloxacin and Flagyl), given the elevated white blood cell count and subjective fever. Surgical repair was not recommended at this time since microperforation was the case and she was otherwise hemodynamically (and clinically) stable. While she was hospitalized, Pediatric Gastroenterology was consulted. Stool cultures were sent for H. pylori. She also underwent an Upper GI, which demonstrated microperforation secondary to a gastric ulcer. Additional recommendations were serology for celiac disease and baseline inflammatory markers (ESR and CRP, which were elevated). During her hospital course her pain vastly improved and she was transitioned over to oral antibiotics, as well as eventual initiation of PO intake, which she tolerated well. Further discussions with the family revealed that her father had a long-standing history of peptic ulcer disease, and was H. pylori positive; he had multiple treatment failures, but eventually was successfully treated with a regimen of PPI, Bismuth, Tetracycline, and Flagyl. It was also revealed that the patient herself had a longstanding history of dyspeptic symptoms and bad breath (“for years” according to her parents).

This young lady was discharged after a few days in the hospital. She was sent home on antibiotics to complete a regimen for her microperforation (Augmentin and Flagyl) as well as continuation of a PPI (Protonix). Stool studies for H pylori are pending and if they return positive, then treatment will be initiated for that as well. There is also planned endoscopy once this is deemed safe by pediatric surgery.

**Case 2:** For this gentleman, IV antibiotics (Ceftriaxone and Flagyl) were started, IV fluids continued; Pediatric surgery was consulted and he was admitted to the hospital for antibiotics and drainage of the abscess. This was accomplished by Pediatric Interventional radiology using CT guided needle aspiration, which was successful. A PICC line (Peripherally Inserted Central Catheter) was placed and he was sent home on continued antibiotics (Ceftriaxone and Flagyl); his JP drain was able to be removed prior to his discharge. He and his family were given PICC care instructions and followup was arranged with Pediatric Surgery.

### Teaching Points:

1. **The sudden onset of acute abdominal pain is a red flag and consideration should be given to conditions that may require emergent imaging and possibly surgical intervention.**

2. **A change in the quality of pain is important as well; sudden escalation in pain should prompt vigorous investigation and aggressive treatment as dictated by the results of testing.**

3. **Peptic ulcer disease is not uncommon in children; beware the patient with known or suspected peptic ulcer disease that presents with acute onset of severe abdominal pain. Perforation of the ulcer should be strongly considered in these patients!**

4. **Management of a perforated ulcer involves bowel rest, antibiotics, PPI initiation, and prompt pediatric surgical and gi consultation. Microperforations can be managed typically with observation and antibiotics. Larger perforations require surgical repair.**

5. **Beware of abdominal pain in post-op patients who have undergone appendectomy. Suspect an abscess in these patients, especially with focal pain and fever. Management consists of antibiotics, pain control, and interventional radiology drainage by either CT or ultrasound.**

### REFERENCES


In the 1800s doctors commonly advised their heartbroken patients to eat chocolate, claiming it would sooth their pain.