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:

It never ceases to amaze me how we stumble on cases that appear to be one thing, only to find that something entirely different is going on with a patient. It’s always best to keep one’s options open, you know. This is good advice for our case this month, in which a child’s imaging findings are quite concerning...

PEM Fellow Conference Schedule March 2016

1st - Simulation Faculty Development
2nd - 8:00 - 11:00 - Simulation: Shock.........................Simulation Faculty
11:00 - 12:00 - Shock...........................................Drs Ryan & Vezzetti
8th - Journal Club and Literature Review......................Drs Earp & Hill
9th - 9:15 - 10:15 Med Erros/Safety Events...............Drs Iyer & Mitchell
10:15 - 11:15 Advanced Life Support................................Dr Vezzetti
11:15-12:15 Fellowship Feedback Meeting
16th - SPRING BREAK NO CONFERENCE
23rd - 9:15-11:15 Study Designs................................Dr Wilkinson
11:15 - 12:15 Grand Rounds.....................................Dr Leonard
12:15-1:15 ED Staff Meeting
30th - 9:15-10:15 M&M..........................................Drs Vezzetti & Berg
10:15-12:15 Board review........................................Dr Floyd
12:15 - 1:15 Research Update.................................Dr Wilkinson

Guest Speaker: Julie Leonard, MD
Nationwide Children’s Hospital

All conferences are held in the DCMC Command Center Rooms 3&4.
Simulations are held in the CEC and University Medical Center - Brackenridge.

Locations, times, speakers are subject to change.
All are welcome to attend!
CASE: Not much flu this year, you’ve noticed, in the Pediatric Emergency Department. But lots of abdominal complaints. Most of these patients have had viral illnesses (Enterovirus, probably, among others), and the chart you pick up seems no different than the last few you have read. This is a 2 year old female with 4 days of fever and abdominal pain. She has had one episode of emesis that was nonbilious. She also indicated to her mother that she has had dysuria for the past 3 days. She had seen her primary care provider 2 days ago and had a negative rapid strep test per her parents. She apparently has been healthy and is fully immunized. There has been no diarrhea, cough, congestion, trauma, or other symptoms.

You review her vital signs. Temperature was 102 on presentation to the ED, but this came down after she was given Motrin. Her heart rate is 110, BP is 90/60, respiratory rate is 22. On exam, the child appears healthy and is in no distress. In fact, she is dancing around the room. Her exam is unremarkable except she seems to be in pain when you palpate her right lower quadrant, her periumbilical area, and her suprapubic area. She smiles, though, at the same time she is telling you about her pain that is produced by your exam. Her genital area is normal. As you are contemplating obtaining a urine and urine culture, the parents then tell you that they feel the child’s abdomen has progressively increasing in size over the past month. (Sound familiar?) They have mentioned this to the primary care provider but were told that the child was “normal”. You admit, you don’t see anything particularly concerning on this child’s exam with regard to abdominal distention or masses, but the child does indicate that she has abdominal pain to the right lower quadrant. Could this be appendicitis? Doubtful, since by the third or fourth day one would think that there should be a much more impressive exam. Perhaps the child has a UTI...that would fit the history of fever and dysuria. The parents are looking quite concerned; in fact, the father states he had testicular cancer and is worried that there is “something in her stomach.” Certainly a urine would be a good idea but does this child need imaging?

Trends In Pediatric Imaging: ALARA

You probably have heard a lot of discussion regarding imaging and the dangers associated with it. What? Yep, imaging is NOT a risk-free procedure, just like many things in medicine today. The concern has been the association with the development of future neoplasms, especially with CT scanning. While CT and other imaging modalities have revolutionized the way we all practice medicine, there is, like most things, a time and place to use such technologies.

As Low As Reasonably Achievable was developed and promulgated to provide the best quality study while at the same time minimizing radiation and the use of radioactive materials. This benefits not only the patient, but radiology personnel as well! The idea is to use the best test the safest way for the most benefit.

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<tr>
<th>Source</th>
<th>Estimated Effective Dose (mSv)</th>
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<tr>
<td>Natural background radiation</td>
<td>3 mSv/year</td>
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<tr>
<td>Airline flight cross country</td>
<td>0.04 mSv</td>
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<tr>
<td>Radiation worker exposure limit</td>
<td>20 mSv/ year</td>
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<td>Single mammogram</td>
<td>3 mSv</td>
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<td>Radiologic Bomb</td>
<td>up to 30 mSv</td>
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<td>Chest Xray (2 view)</td>
<td>0.1 mSv</td>
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<tr>
<td>Head CT</td>
<td>4 mSv</td>
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<tr>
<td>Abdominal CT</td>
<td>5 mSv</td>
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Image, but image gently, appropriately, and responsibly!

Geisel attended Dartmouth College, graduating in 1925. At Dartmouth, he joined the Sigma Phi Epsilon fraternity and the humor magazine Dartmouth Jack-O-Lantern, eventually rising to the rank of editor-in-chief.
While at Dartmouth, he was caught drinking gin with nine friends in his room. At the time, the possession and consumption of alcohol was illegal under Prohibition laws, which remained in place between 1920 and 1933. As a result of this infraction, Dean Craven Laycock insisted that Geisel resign from all extracurricular activities, including the college humor magazine. To continue work on the Jack-O-Lantern without the administration’s knowledge, Geisel began signing his work with the pen name “Seuss.”

In May 1954, Life magazine published a report on illiteracy among school children which concluded that children were not learning to read because their books were boring. William Ellsworth Spaulding was the director of the education division at Houghton Mifflin (he later became its chairman), and he compiled a list of 348 words that he felt were important for first-graders to recognize. He asked Geisel to cut the list to 250 words and to write a book using only those words. Nine months later, Geisel completed The Cat in the Hat, using 236 of the words given to him.

So, you decide to start with the simplest test that will reveal a diagnosis. In this case, you obtain a urine and urine culture. Oddly enough, and to your surprise, the urine looks normal. That’s weird, since the child complains of dysuria (at least that’s what the parents say). You go back and do a good genital exam, which looks normal. You re-examine the abdomen and this time the child states that she is tender over the right lower quadrant and suprapubic areas more emphatically. She is no longer dancing around the room, either.

Could this be constipation? Possibly. A bowel obstruction or intussusception seems less likely. You obtain a plain film of the abdomen to get an idea of what the bowel gas pattern looks like...maybe she’s constipated. The film is seen on the right.

Ok, so the plain film was not helpful. You back in again to examine the child, who, again, states that her abdomen is tender. Now what? Treat for constipation? Obtain a CT? Obtain an ultrasound? Send her home with careful observation and await the urine culture?

The child’s abdominal pain, even though she looks pretty good, bothers you. You decide to obtain an ultrasound. The results are seen to the right and below.

Well, this film is not terribly exciting. There is some stool seen in the right lower quadrant (yellow arrow) but the bowel gas pattern looks normal and there is no evidence of obstruction. There are no obvious masses and there is no free air.

The solid organs look normal (as best you can tell on a plain film). Overall, a normal abdominal radiograph.
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This image shows the size of the mass (3.4 x 5.2 x 4.9 cm), conveniently measured by the Pediatric Radiologist. So what is this mass? We've tackled abdominal masses before (see the April 2015 issue), but this is different: this is a bladder mass. Next steps? Well, we need to define the mass better. In most instances, CT is the study of choice. CT, although it does involve radiation, is fast, requires no sedation, and can give you a good idea as to where this mass may be arising from, as well as visualizing the abdominal organs. CT it is...

These selected CT images show the mass. As on the ultrasound, it appears to be up against the bladder (red arrow), but not arising from the bladder itself (orange arrow). There appears to be necrotic enhancement as well (blue arrow) and the mass overall is rather heterogeneous.

Now what? Well, you will need to consult several specialists, namely Pediatric Urology. At some point, Pediatric Hematology-Oncology may need to be involved. In the meantime, it would be helpful to obtain labwork. A CMP, LDH, Uric Acid, CBC and Blood Culture were obtained. The CMP, LDH, and Uric Acid look normal, but the WBC on the CBC was elevated at 23, with 59 segs and 34 lymphs (no Bands or atypical cells). Why the elevated WBC?

The table above shows the most common cause of pediatric bladder tumors. The majority of malignant tumors are rhabdomyosarcomas, which show a male predominance. Is that what this child has? What about the fever and the normal urine results?
At Geisel’s alma mater of Dartmouth, more than 90-percent of incoming first-year students participate in pre-registration Dartmouth Outing Club trips into the New Hampshire wilderness. It is traditional for students returning from the trips to stay overnight at Dartmouth’s Moosilauke Ravine Lodge, where they are served green eggs and ham for breakfast in honor of Dr. Seuss.

It is very clear that this child needs admission for further workup. Pediatric Hematology-Oncology is consulted, as well as Pediatric Urology. The child is admitted to the hospital and undergoes cystoscopy the next day. This reveals significant urothelial inflammation as well as cystitis cystica and areas of hemorrhage (see picture). Urine was obtained for culture; cytology samples were sent.

The biopsy demonstrated polypoid chronic cystitis, consisting primarily of histiocytes, lymphocytes, and eosinophils. The mass itself contained inflammatory infiltrate and a necrotic area, consistent with infection. Repeat urine cultures were negative. Ultimately, this mass was thought to represent not a neoplasm, but an infected urachal remnant and eosinophilic cystitis.

The urachus is an embryonic remnant and its persistence is not common. Often, there are nonspecific symptoms and can be overlooked easily. Review your embryology if you want a detailed discussion, but urachal anomalies are more common in males than females. A patent urachus accounts for approximately half of all congenital anomalies. Many patients are asymptomatic, unless there is a patent urachus or an infection associated with a urachal remnant. If there is a communication between the umbilicus and the urachus, this can be seen as leaking urine from the umbilicus in a neonate.

The cytology from the cystoscopy did not reveal any signs of malignancy and the urine culture did not grow any bacteria. Several days later, then child developed fever. Urine was again obtained and multiple biopsies were taken of the area. This time, the urine culture grew E. coli and Ceftriaxone was started. Two days after that, the child underwent a second cystoscopy, which revealed continued inflammation and hemorrhagic conditions. Multiple biopsies were sent. This time, the biopsies revealed a chronic inflammatory cystitis but no neoplastic changes. A few days later, repeat biopsies were performed and they too revealed no evidence of neoplasm.

Vesicourachal diverticulum is associated with Eagle–Barrett Syndrome. It is very difficult to differentiate a neoplastic mass from a mass associated with a urachal remnant with imaging tests. Both benign (adenomas, fibromas, harmatomas for example) and malignant (rhabdomyosarcomas, carcinomas for example) are associated with urachal remnants. Most urachal tumors do exhibit symptoms and are typically found after metastasis. They are, though, rare.

Ultrasound can be used to look for a patent urachus or urachal remnants as well. It’s a good first choice study when evaluating a possible urachal remnant.
Teaching Points:

1. Bladder masses are not common in pediatrics; when they are malignant, the majority are rhabdomyosarcomas.
2. Urachal remnants are common in children and they may resolve on their own in some cases.
3. One of the most common urachal remnants is a patent urachus, which often manifests itself as leakage of urine from the umbilicus. This condition can be confused with umbilical granulomas; if silver nitrate does not resolve the issue, then suspect a urachal remnant.
4. Ultrasound is an excellent first imaging test in children with suspected urachal remnants. CT is also a useful study, especially if there is concern for infection. Urachal remnants can be associated with a variety of conditions as well.
5. An infected urachal remnant is typically treated with antibiotics first, followed by definitive surgical excision.
6. Eosinophilic cystitis is a rare pediatric condition but can be associated with urachal remnants and can often resemble a malignant process. Consultation with Pediatric Urology or Pediatric Surgery is essential. Cystoscopy is often needed for biopsy and cytology studies to confirm the diagnosis.
7. Listen to parents! Often this will lead you to obtaining appropriate imaging and other studies!

Follow Up:

This child was ultimately diagnosed with chronic cystitis, consistent with eosinophilic cystitis and an infected urachal remnant. The cytology and biopsies that were obtained during the child’s cystoscopies ultimately confirmed no neoplasm. The mass itself was all inflammatory with an infectious component. This was good news indeed, as chemotherapy, radiation, etc were not needed to treat this child. The cystoscopies also demonstrated an otherwise patent urinary system. Pediatric Infectious Disease was also consulted since the initial urine culture that were obtained were positive for not only E coli, but also Staph aureus (the second culture). A PICC line was inserted and the child was sent home to complete a 2 week course of antibiotics. Sensitivities from the cultures demonstrated that the organisms were both sensitive to Ancef. Additionally, followup was arranged with both Pediatric Urology (for surgical excision of the remnant) and Pediatric Infectious Disease.

References