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 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: Let’s celebrate the 4th of July with the following cases. They just go to show that not everything is what it appears to be!

Case 1: An 8 month old is here on vacation and is not having a great time. He is acting strangely ever since starting Amoxicillin for an ear infection.

Case 2: A 9 year old male cuts his leg while swimming in the lake. Some stitches and home, right?

PEM Fellow Conference Schedule July 2015

1st - Orientation for new fellows......PEM Fellowship Administration
2nd - New Fellow Welcome Party
8th - 8:15 AM Fever Without a Source.........................................................Dr Allen
9:15 AM Allergy and Anaphylaxis.................................................................Dr Gorn
14th - Mentorship........................................................................Drs Allen and Ryan
15th - 9:15 AM Clinical Research Overview.........................................Dr Wilkinson
10:15 AM TBD
11:15 AM Procedural Sedation in the Peds ED..............Drs Schwartz and Wallin
12:15 PM Research Update
22nd - 9:15 AM EMTALA and Transfer Basics..............Drs Pittman, Chu, and Yee
10:15 AM Local Transfer Process.........................................................Drs Pittman and Chu
11:15 AM Transfers: A Cased Based Discussion..Drs Pittman, Chu, Boeck
28th - Journal Club
29th - 9:15 AM M&M.................................................Drs Higginbotham and Yanger
10:15 AM Board Review: ID.................................................................Dr Iyer
11:15 AM TBD
12:00 PM 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: The parents of an 8 month old boy bring him to the Emergency department with a chief complaint of “not acting right.” Apparently, they are visiting from California and 4 days ago their son developed fever and was irritable. They sought care at an Urgent Care Facility 1 day ago, where the infant was diagnosed with otitis media and was placed on a 10 day course of Amoxicillin, which the parents state he has been taking. They tell you that the fever as persisted and they noticed that over the past 2 days, he appears to have become “cross-eyed”. He has decreased in his usual state of activity and now is more fussy. What’s more, he appears to have episodes of “staring and being out of it” per the parents.

On exam, you find a listless child who, while in no obvious distress, certainly does not seem to be at his usual mental status baseline. He has a temperature of 100.5, a heart rate of 190, respiratory rate of 24, and blood pressure of 90/50. He is not very interactive, but when you examine his ears and throat (which, aside from a dull left tympanic membrane which has no erythema, look normal), he is very irritable and prefers to be left alone being held by one of his parents. He does indeed have bilateral intermittent esotropia. He has clear lungs and an unremarkable abdomen. His grossly has normal tone and strength; you try to sit him up to see if there is any truncal ataxia, but he just screams when you do this.

This child has some concerning findings on his physical exam, not to mention a history that suggests seizures, or at least a change in mental status. This is likely infectious, but you worry that he may be having seizures as well. Of course, partially-treated meningitis is a possibility, since he is on oral antibiotics. Another more concerning question is whether or not he may have a brain abscess, hemorrhage, or other intracranial finding, given his exam. As you order labwork, you ponder what imaging test will be the most helpful in determining the diagnosis for this patient.

Case 2: Summertime is lake time! Who doesn’t enjoy swimming in one of the many bodies of water available to us lucky people in Central Texas? (Especially when it’s hotter than Hades outside). Summertime is also laceration time. Often, the two go together and then come to the Pediatric Emergency Department, which is exactly what your next case is.

A 9 year old male is enjoying a swim when he cuts his leg on an unknown object laying at the bottom of the lake. He is not sure, but he thinks it may have been a log or other piece of wood. He doesn’t think it’s too bad, though, and continues swimming in the lake without a care in the world. That is, until he gets home (several hours later) and his mother takes a really good look at his leg. She is horrified at what she finds, because the laceration he has looks way worse now that they are out of the lake and home. She decides to bring him into the Pediatric Emergency Department for sutures. Oh, by the way, his mother also noticed that he has developed a fever. She denies he has had other symptoms, such as sore throat, cough, congestion, vomiting, and diarrhea. No one else in the home is ill.

That’s where you come in. You pick up the chart and go to examine this young swimmer. He is in no distress, but does have a temperature of 101.5 (the rest of his vitals look normal, including his blood pressure). His exam is pretty nonfocal, with the exception of a 2 cm laceration to his right lower leg, on the lateral aspect. There is some surrounding erythema but no discharge or obvious foreign body that you can see. He is neurovascularly intact and is able to ambulate, but complains of pain at the laceration site. There is no other injury.

Well, looks pretty routine: a simple leg laceration. But, what’s with the fever? And why does he have some erythema around the wound already? Also, does swimming in the lake with a laceration dispose him to infection? Could there be a foreign body there? Does he need imaging? Plain films, ultrasound? CT? MRI? Maybe you could just clean and irrigate the wound very well and close it. A good visual inspection should be able to rule out a foreign body, right?
July 4th is the biggest hot dog day of the year, with Americans consuming around 155 million of them on Independence Day alone. No one really knows where the hot dog came from. Historians think that immigrants of several nationalities brought a common European sausage with them.

You obtain some basic laboratory studies on this child, including a CBC, CMP, and UA. The CBC shows a white blood cell count of 17.9 with 42 segs and 44 lymphocytes. The urine and CMP look normal. Tox screens are nегатivе. This child needs a lumbar puncture, given the history and physical examination.

The question, though, is whether or not imaging is needed prior to the LP. The biggest concern is that there may be a cerebral abscess or other space-occupying lesion. The literature in pediatrics is scarce, but well-studied in adult populations. Essentially, if there are normal clinical findings on physical examination, a CT prior to lumbar puncture is generally not warranted. Even then, a normal CT does not completely eliminate the possibility that herniation (or another rare, but known), complication of lumbar puncture may occur.

With meningitis, CT is rarely useful. Increased intracranial pressure is associated with meningitis (particularly bacterial) and is typically normal, even in cases of

"On initial consideration a cranial CT would seem to be an appropriate and potentially useful diagnostic study for confirming the diagnosis of cerebral herniation. The fallacy in this assessment has been emphasized by the finding that no clinically significant CT abnormalities are found that are not suspected on clinical assessments. Further, as previously noted, a normal CT examination may be found at about the time of a fatal herniation. Thus, the practical usefulness of a cranial CT in the majority of pediatric patients is limited to those rare patients whose increased ICP is secondary to mass lesions, not in the initial approach to acute meningitis."

A lumbar puncture is then obtained. It shows a white blood cell count of 50, red blood cell count of 308, protein of 41, and glucose of 55. Initial Gram stain is negative and cultures are sent. Antibiotics are begun, since partially treated meningitis is at the top of the list, while awaiting culture results. Vancomycin and Ceftriaxone are begun. Acyclovir is added as well.

The child is admitted to the PICU for observation and treatment. Pediatric Neurology and Pediatric Infectious Disease are consulted. He appears encephalopathic. Is this secondary to seizures? An infectious process?
John Adams believed that July 2nd was the correct date on which to celebrate the birth of American independence, and would reportedly turn down invitations to appear at July 4th events in protest. Adams and Thomas Jefferson both died on July 4, 1826—the 50th anniversary of the adoption of the Declaration of Independence.

Acute Disseminated Encephalomyelitis

This is an immune-mediated inflammatory condition which results in the demyelination of the brain and spinal cord. It is in the spectrum of other demyelinating disorders, one of the most well-known includes multiple sclerosis. MS and ADEM can be distinguished by neuroimaging and laboratory findings, however, the two conditions share very similar symptoms. Young children are most commonly affected by ADEM and the disease is usually monophasic.

ADEM usually follows an acute febrile illness (typically viral); it has been reported to follow immunization, but this is very rare. Like other forms of encephalitis, round cell inflammation is common, and patchy demyelination is seen. MS lesions are more developed, but there are theories that ADEM is one form of MS that is more easily treated and controlled.

The exact manner which demyelination occurs is not completely understood. Helper T-cells, cytokines, interleukins, and various chemokines are all involved. One particular area of interest has been in myelin oligodendrocyte glycoprotein (MOG) antibody research. While IgG antibodies to MOG are not unique to ADEM, their presence in one study indicated a favorable prognosis.

Epidemiology: ADEM

Rates have been reported from 0.2-0.4/100,000. Curiously, ADEM rates increase closer to the equator. A seasonal incidence (Winter and Spring). Mortality is approx 2%. Morbidity includes visual, motor, and autonomic deficits. Recovery, though, is complete in up to 90% of patients. In general, the younger the child, the more severe the disease.
YOU DECIDE TO OBTAIN A PLAIN FILM OF THE INJURED EXTREMITY. WHY? WELL, THIS CHILD WAS SWIMMING IN A LAKE, WHERE VISIBILITY IS NOT VERY GOOD, SUSTAINING AN INJURY ON AN UNKNOWN OBJECT. HE DID TELL THE PEDIATRIC EMERGENCY DEPARTMENT PHYSICIAN THAT PERHAPS HE CUT HIS LEG ON A ROCK, BUT NONETHELESS THE EXACT OBJECT REMAINS UNCLEAR. A RETAINED FOREIGN BODY IS A POSSIBILITY, SO A PLAIN RADIOGRAPH IS NOT A BAD IDEA.

ALSO, HE NOW HAS A FEVER. IS THIS COINCIDENCE, OR DID SWIMMING WITH AN OPEN LACERATION IN A LAKE PLACE HIM AT RISK FOR INFECTION. BUT THIS SEEMS TO BE A PRETTY RAPID COURSE; HE WAS FINE A FEW HOURS AGO!

OK, HERE IS THE FILM. THE RED ARROW SHOWS THE LOCATION OF THE LACERATION, WHICH, IF YOU LOOK HARD ENOUGH, YOU CAN MAKE OUT THE SKIN DISRUPTION ON THE FILM. THERE ARE NO FRACTURES OR RADIO-Opaque FOREIGN BODIES. BUT THERE IS A VERY SUBTLE FINDING ON THIS FILM. IF ONE LOOKS VERY CAREFULLY, AIR IS VISIBLE, CONSISTENT WITH SOFT TISSUE GAS (GREEN ARROW). WHILE IT IS NOT UNUSUAL TO HAVE AIR ASSOCIATED WITH A LACERATION, IN THIS CASE, THERE ARE TWO CONCERNS:

1. THE AMOUNT OF AIR SEEMS OUT OF PROPORTION TO THE DIMENSIONS OF THE LACERATION (SMALL CUT, LOTS OF AIR).

2. THIS CHILD WAS SWIMMING IN A LAKE AND NOW HAS FEVER. LOTS OF AGGRESSIVE BACTERIA LIVE IN LAKES AND CAN CAUSE SYMPTOMS OF INFECTION EXTREMELY RAPIDLY.

Given the clinical picture, this child is at risk for Aeromonas hydrophila, which typically resides in fresh (and brackish) water. It has been associated with gastroenteritis, but also cellulitis, and, in severe cases, necrotizing fasciitis. Aeromonas hydrophila is very toxic to many organisms (especially fish). Its toxin binds to cell receptors and results in increased permeability of the cell membrane. This leads to cell death and tissue destruction. Great. Now what?
Case Resolutions

Case 1: Well, ADEM is diagnosed and treatment is begun with IVIG. He receives a total of 2 doses of IVIG, which he tolerates very well. After a few days, he is transitioned out of the Pediatric Intensive Care Unit to a Floor bed. Per consultant recommendations, he is started on oral steroids (after receiving an IV dose of 20 mg/kg of Solu-Medrol). He is continued on pulse doses of oral steroids of 10 mg/kg. During his hospitalization, he develops ataxia and a right cranial nerve VI palsy, both of which improve while he is on the steroids. Also improved is his oral intake, as initially he did not want to take anything by mouth and had progressively gotten weaker as his mental status declined. At the time of discharge, he regained purposeful movements and the ataxia had resolved. Pediatric Neurology recommended continuing oral steroids in a taper. Pediatric Infectious Disease was consulted for antibiotic recommendations and Zosyn was started, pending culture result. Which was obtained from the wound prior to beginning antibiotics. Pediatric Surgery was consulted as well and the child was admitted to their service for observation and delayed wound closure in the operating room. The next day, then wound looked more erythematous and the child was taken to the OR where the wound was explored, irrigated/cleaned again, and a wound vac was placed. Three days later, the wound was closed, again in the operating room. Cultures came back as positive for Aeromonas and strep. The child was discharged on Bactrim, since the organism was sensitive to not only Zosyn, but Bactrim as well. At discharge he was afebrile and was not sent home on any oral antibiotic regimen.

NOTE: I did receive followup news on this patient and I am very happy to report he is completely back to baseline. He is being followed by a pediatric neurologist in his hometown and doing quite well.

Case 2: With the laceration, the amount of air present and the fever, there was concern that this child did indeed have an infection, specifically Aeromonas. The wound was thoroughly irrigated but not closed in the Emergency Department. Pediatric Infectious Disease was consulted for antibiotic recommendations and Zosyn was started, pending culture result, which was obtained from the wound prior to beginning antibiotics. Pediatric Surgery was consulted as well and the child was admitted to their service for observation and delayed wound closure in the operating room. The next day, then wound looked more erythematous and the child was taken to the OR where the wound was explored, irrigated/cleaned again, and a wound vac was placed. Three days later, the wound was closed, again in the operating room. Cultures came back as positive for Aeromonas and strep. The child was discharged on Bactrim, since the organism was sensitive to not only Zosyn, but Bactrim as well, to complete an outpatient course. (Thanks to Dr. Andy Kienstra for sharing this case).

Teaching Points:

Case 1:
1. Mental status changes in the setting of fever are always concerning. This concern is augmented when these changes occur in the context of an presumed or known infection, especially when being treated with antibiotics.
2. The differential diagnosis is broad in children with mental status changes: Ingestion, Trauma, Seizures, Intracranial masses, intracranial hemorrhage, Intussusception, Psychiatric pathology. In the context of fever, meningitis (partially treated, viral, bacterial, etc), cerebral abscess, or a demyelinating disorder should be considered.
3. ADEM is one of many demyelinating disorders in children. Multiple sclerosis is another example of a disease associated with demyelinating pathology.
4. ADEM is associated with viral illness and can present with a variety of symptoms, including ataxia, weakness, suspected partial seizures, weakness, and mental status changes. It is typically treated with IVIG and steroids and typically is not recurrent. Most children recover uneventfully, but morbidity (including visual, motor, and anatomic deficits) has been reported, particularly in younger children.

Case 2:
1. Most lacerations heal well and have little associated complications with proper care.
2. Always consider x-rays in wounds that are deep or at risk for foreign body or contamination. In cases where a suspected foreign body can’t be found, consider ultrasound, CT, or pediatric surgical or orthopedic consultation.
3. Wounds at high risk for infection or which are already infected should not be immediately closed. After antibiotics and good wound care, delayed closure can be performed.
4. Beware of lakes and lacerations! This is a perfect combination for infection.

References

Congratulations on Your Graduation From the Fellowship!

We wish you the absolute best of luck!