Abstract:
A 3-year-old male presented to the emergency department with two episodes of abdominal pain, 1 week apart. His evaluation was unrevealing, but he was admitted for continued bouts of severe, intermittent abdominal pain. Further history obtained the day after admission revealed the cause of his symptoms and the ultimate diagnosis.

Keywords:
Acute abdominal pain; recurrent abdominal pain; facial edema; toxicology; black widow envenomation

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Right in Our Own Backyard

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A previously healthy 3-year-old male was brought to the emergency department (ED) by his parents for severe acute onset abdominal pain. Forty-five minutes prior to presentation, he had been playing outside with his sister when he suddenly began to cry out in pain, clutch his stomach, and pulling his legs up to his belly. Earlier that morning, the patient had fallen from a standing position and struck his upper lip on the edge of a suitcase. There was no loss of consciousness, no loose teeth, or mouth pain. The family noticed a small cut on the lower lip that bled briefly then stopped. No additional trauma was noted. There was no fever and no associated vomiting or diarrhea. Urine and stool output had been normal prior to the onset of his pain. The patient asked his parents repeatedly to take him to see the doctor and was inconsolable during the ride to the ED.

The patient was seen in the ED 1 week prior for a similar presentation of acute onset abdominal pain that had developed 1 hour prior to presentation. At that time, he seemed to localize pain to the periumbilical region and there were no associated symptoms. He required morphine for pain relief. His work up included ultrasound exams for appendicitis, intussusception, and hepatic or renal pathology, all of which were unremarkable. His complete blood count (CBC), comprehensive metabolic panel (CMP), lipase, and urinalysis values were all within normal limits. The surgical service was consulted and requested a computed tomography (CT) scan of the abdomen, which was also unremarkable. His abdominal x-ray demonstrated copious stool and his pain improved while in the ED. He was given a prescription for polyethylene glycol and discharged with a presumptive diagnosis of constipation. He did not have any episodes of abdominal pain between the initial visit and the current visit to the ED.

The patient was otherwise healthy with no allergies and was up-to-date on all immunizations. There was no history of urinary tract infection, no recent travel, nor current medication use. He

lives with his mother, father, and one sister. Family history is notable for father with environmental allergies, sister with eczema, and grandparents with hypertension.

On arrival to the ED, the patient's vital signs were: temperature, 36.9°C; heart rate, 136 beat/min; respiratory rate, 32 breaths per minute; blood pressure 109/63 mmHg; oxygen saturation, 96% on room air; and his weight was 15 kg. On general appearance, the patient was well developed and well nourished, but tearful and was lying in the fetal position complaining of abdominal pain. His HEENT exam was notable for mild edema of the left upper lip with a 0.5 cm laceration to the upper frenulum, but no additional signs of trauma. Mucous membranes were moist. Pupils were equal, round, and reactive to light, and extra-ocular movements were intact with no periorbital edema. His neck was supple and without lymphadenopathy. The chest exam demonstrated clear lungs bilaterally. His heart had a regular rate and rhythm, normal heart sounds, and no murmurs. The abdomen had normal bowel sounds and no distention but was tense and diffusely tender. The patient was pointing to the umbilicus as the site of pain, but no masses or organomegaly were appreciated. His genitourinary exam revealed a normal penis, no hernias, and a normal testicular exam. He was able to move all extremities and had no peripheral edema or signs of injury. His neurologic exam demonstrated an appropriate response to questions and no focal deficits. His skin was warm and moist with capillary refill time of less than 3 seconds with no diaphoresis.

Based on this presentation of severe, acute abdominal pain in a young child, the initial work up was focused on diagnosis and management of a potential surgical cause. A peripheral IV was placed and the patient's discomfort was treated with morphine, as well as diphenhydramine and ondansetron, which provided incomplete relief. A CBC, CMP, lipase, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), creatine kinase, lead level, and urinalysis were ordered. An ultrasound examination of the abdomen to evaluate for appendicitis and intussusception were performed. The CBC demonstrated a white blood cell count of 12 000/mL, hemoglobin of 12.5 g/dL, and platelet count of 554 000/mL. White blood cell differential showed 78% neutrophils without bands. The CMP demonstrated the following: sodium 135 mmol/L, potassium 3.7 mmol/L, chloride 98 mmol/L, bicarbonate 21 mmol/L, blood urea nitrogen (BUN) 28 mg/dL, creatinine 0.23 mg/dL, and glucose of 164 mg/dL. Liver enzymes were all within normal limits, as was his lipase. Urinalysis was negative for any blood, leukocyte esterase, ketones, glucose, or nitrites. ESR was 12 mm and CRP was <0.50 mg/dL. Creatine kinase was 181 U/L. Ultrasound showed no evidence of intussusception, and while the appendix was not visualized, there were no secondary signs of appendicitis. His abdominal x-rays revealed a non-obstructive bowel gas pattern with a moderate stool burden.

On repeat exam, the patient was diaphoretic, moaning, and continued to have intermittent severe abdominal pain. At this time, he was given an enema with little noted benefit. Given his persistent pain and inability to tolerate oral intake, he was admitted to the hospitalist service for further management. The patient underwent continued monitoring and continued pain management by the hospitalist team until the next morning when the diagnosis revealed itself.

DIFFERENTIAL DIAGNOSIS

The differential for acute abdominal pain in the young child is extremely broad and requires consideration of both the unusual presentation of common causes and consideration of more rare diagnoses based on key details in the history and exam. In this case, despite a previously normal CT scan of the abdomen, common diagnoses such as appendicitis or intussusception have not been ruled out; thus, the initial work up focused on repeating high-yield ultrasound imaging and laboratory diagnostics. Though the sensitivity of ultrasound for both intussusception and appendicitis is not 100%, in the context of a normal white blood cell count and normal CRP without focal findings on exam, the overall negative predictive value is considered good, especially when combining ultrasound results with other clinical predictors such as the Pediatric Appendicitis Score.[1-3]

Constipation is estimated to account for close to 20% of all ED visits for abdominal pain.[3,4] This patient had been previously seen and discharged with a presumed diagnosis of constipation and a prescription for polyethylene glycol after an abdominal radiograph demonstrated copious stool burden. The family did not report any ongoing symptoms of constipation such as hard stools or difficulty stooling, and the patient had a normal stool pattern leading up the current visit. Use of abdominal radiographs in the evaluation of constipation has demonstrated poor reliability in predicting fecal loading and may lead to an incorrect diagnosis.[5, 6] Despite a moderate stool burden on the current abdominal x-ray, his pain seemed out of proportion

in the context of lacking any symptoms of constipation.

Taking into account the normal abdominal laboratory results, several other causes of intraabdominal pathology are less likely including hepatitis, pancreatitis, diabetic ketoacidosis, and renal disease. In this case, a prior urine sample and CT were obtained that were normal, though the child was unable to provide a urine sample at the current visit while he was in the ED.

Abdominal CT has shown good sensitivity for evaluating the anatomic relationships among the superior mesenteric artery, superior mesenteric vein, and the duodenal-jejunal junction for diagnosis of malrotation.[7] Other anatomic variants such as duplication cysts or arteriovenous malformations would also be less likely given the normal imaging.

With the recurrence and colicky nature of his pain, Henoch-Schönlein Purpura (HSP) was considered. Abdominal pain in HSP is typically generalized and can precede the typical rash, which this patient did not have. Tenderness is usually more diffuse (as in this patient's case) and not associated with guarding. Patients may have associated hematochezia and are at risk for intussusception. Recurrence of HSP presenting with abdominal pain is also common.[8] In this case, the patient did not have any additional symptoms or lab findings to support a diagnosis of HSP, but early HSP could not be eliminated as a potential diagnosis.

In the presentation of acute abdominal pain with normal labs and imaging studies, toxicologic causes must be considered. Lead poisoning can present with vague abdominal pain, anorexia, constipation, or vomiting. Hypochromic, microcytic anemia can be seen on the CBC, but basophilic stippling (which is pathognomonic) is not frequently seen in children. In acute ingestions, radiopaque foreign bodies can sometimes be visualized on abdominal radiographs.[9] Lead toxicity also affect other systems including neurologic, hematologic, skeletal, and renal. Our patient did not demonstrate any of these abnormalities on exam. A serum lead level was sent in the ED but had not yet resulted by the time the patient was admitted.

Acute iron toxicity can also present with abdominal pain, nausea, and vomiting. Similar to lead, in an acute ingestion, radiopaque pill fragments can often be seen on abdominal films. In the initial stages of iron toxicity, liver enzymes may be measured as normal. Iron levels must be measured serially as they may continue to rise as additional iron is absorbed from the gastrointestinal tract. Blood gases, liver enzymes, and coagulation factors should be routinely measured in symptomatic patients.[10] Because of the acuity of onset, lack of vomiting, and lack of any radiopaque fragments on this patient's abdominal x-ray, severe acute iron toxicity was less likely.

Our patient was playing outdoors just prior to the onset of his symptoms, thus, toxic plant ingestions are also on the differential. There are several toxic plants that can be commonly found in outdoor environments in North America. Many of these plants cause more systemic symptoms, including anticholinergic effects or central nervous system changes, which this patient did not have on presentation. Certain plants, such as holly berries and mistletoe can cause gastrointestinal distress. Similarly, amatoxin-containing mushrooms can cause nausea, vomiting, and diarrhea, though onset is usually delayed (up to 6 hours) after ingestion. Good history taking and photographic evidence of plants the patient may have been exposed to, along with communication with the Poison Control Center, is essential to identifying these types of ingestions.[11] The discomfort experienced by our patient could be explained by this, and he may go on to develop more gastrointestinal symptoms.

Envenomation by snake, spider, scorpion, or Hymenoptera can also manifest with acute abdominal pain. Snake and scorpion bites typically cause localized pain. In smaller children, scorpion bites can cause jerking movements, fasciculations, and abnormal eye movements secondary to systemic nervous system effects. Scorpion bites usually lack regional edema or erythema as opposed to snake bites. Brown recluse spider bites typically present with localized erythema, pruritis, and pain. Black widow bites may demonstrate a target lesion near the bite site. Patients with black widow envenomation may also develop proximal muscle cramping, facial grimacing, regional or diffuse diaphoresis, hypertension, and tachycardia.[12] Hymenoptera stings typically also cause localized effects at the sting site, but can also cause symptoms of anaphylaxis, including nausea, abdominal pain, and vomiting. Our patient did not have any findings to suggest a site of a bite or sting and had no additional signs of anaphylaxis.[13]

Other diagnoses of exclusion remain on the differential, including abdominal migraine and functional abdominal pain. Pain associated with abdominal migraines present primarily in children age three to 10 years and is poorly localized but can be severe in intensity. Our patient's pain quality would fit these descriptors. To meet criteria for diagnosis, the patient must have at least five separate attacks of abdominal pain and have at

least two of the following associated symptoms: anorexia, nausea, vomiting, or pallor, which this patient currently did not have.[14,15] Functional abdominal pain should be considered when other possibilities have been ruled out, which was not yet the case in this patient.

CASE PROGRESSION AND DIAGNOSIS

By day 2 of admission, the patient continued to have diaphoresis, hypertension, moaning, and intermittent, severe abdominal pain. He then developed periorbital edema bilaterally with flushing of the cheeks. His family mentioned to the hospitalist team that the patient had started to have flushing, sweating, and facial edema in the ED with some pruritis around his eyelids but they had not relayed this to the ED team. His lead level and urinalysis both returned as normal.

That same day, the patient's father remembered that the patient's symptoms all started after he saw the patient try to put a boot onto his right foot and then exclaimed, "Itchy! Itchy!" This was his father's boot that the patient found in the family's backyard. The patient started to complain of severe abdominal pain immediately after this incident. The patient's father went home, found the boot in the family's backyard, and shook some spiders out of it. He brought in a photo of a spider to show the hospital team (Figure 1).

On repeat skin exam, the patient was found to have a small puncture wound with surrounding erythema over the right ankle (Figure 2) that had not been noted previously. The presentation, history, and new evidence were consistent with black widow envenomation. The toxicology service was consulted and recommended supportive care, including pain control and benzodiazepines as needed for symptoms of muscle spasm. The patient was admitted for a total of two days, upon which his pain had resolved, and he was no longer requiring medication.

He was seen for follow up one day later by his primary care physician for bilateral lower leg pain and a pruritic, papular rash that had developed over his legs. He was prescribed loratadine and diphenhydramine. He returned two days later for follow up and the rash was noted to have spread to his torso and upper extremities, but his pain had resolved. He was given a prescription for triamcinolone cream and the rash resolved. He had no further symptoms or sequelae.

DISCUSSION

The acute response to black widow envenomation, or latrodectism, can include severe pain, diaphoresis, and muscle spasms. Black widows/*Latrodectus* species can be found on all continents (except Antarctica) typically favoring warmer areas.

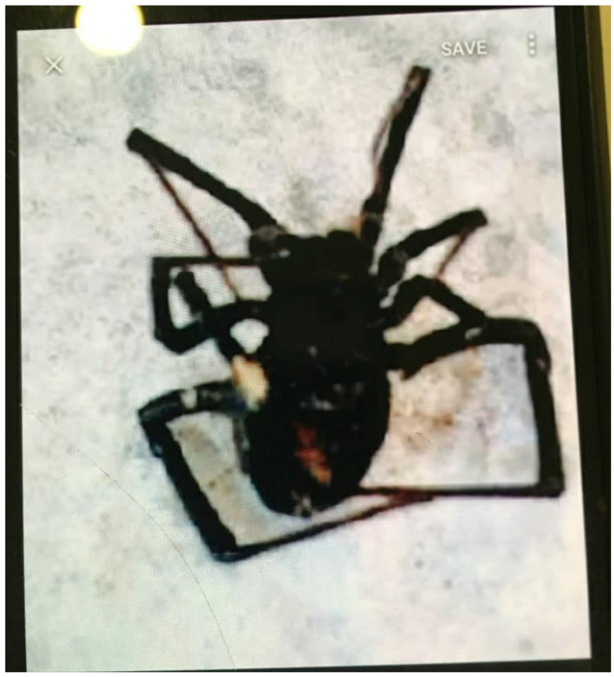

Figure 1. Photo of spider found by the patient's father.

Figure 2. Small skin lesion and surrounding erythema over patient's right medial malleolus.

[16,17] Latrodectism can mimic various causes of acute abdominal pain. There are no laboratory or imaging studies that aid in specific diagnosis, so a high degree of suspicion is necessary.[18-20]

Five species of black widows can be found in the United States with at least one present in every state in the US, except for Alaska. Envenomation by North American species primarily causes severe back and abdominal pain. Regional or asymmetrical diaphoresis can occur, and if seen, is pathognomonic. Up to one third of cases involve other systemic effects such as hypertension, fever, and agitation, with hypertension being more common in children. This patient did have persistent relative hypertension for age during the course of his ED and hospital stay. Facial edema can also be seen more commonly in children, which this patient began to demonstrate more prominently after admission. Diaphoresis is also common, and localized diaphoresis near the site of the bite is pathognomonic. The site of the bite may be painful with a target lesion and small central fang marks, or can be painless with only faint erythema, as in this patient's presentation.[18-20]

Alpha-latrotoxin, the primary toxin that causes effects in mammals, leads to neurotransmitter release, including acetylcholine, via binding to the pre-synaptic nerve terminals. If untreated, symptoms from latrotoxin may last several days and are managed symptomatically with pain medication and benzodiazepines for muscle spasms. An equine-derived antivenom is available and has demonstrated good relief of symptoms; however, its use remains controversial in the United States as there have been associated cases of severe anaphylaxis. It is now more difficult to obtain as it is no longer being routinely manufactured. Envenomation alone has not been known to cause any deaths in the current era of medicine.[17, 21]

Black widows prefer protected environments where they can hide during the day and emerge at night to seek prey. Outdoor areas surrounding human homes and structures provide an ideal habitat. The poisonous mature females are easy to spot with their shiny black abdomen with its characteristic red hourglass marking. While juvenile female black widows are also venomous, they are more difficult to recognize as they have a completely different appearance from their adult counterparts with tan colored legs and abdomen with white and black markings.[16]

Some of the symptoms of latrodectism may overlap with those of scorpion stings as these can cause jerking movements, fasciculations, and abnormal eye movements remote to the sting site secondary to toxic nervous system effects. Hymenoptera stings may present with anaphylaxis, including vomiting and abdominal pain, but uncomplicated stings will have only localized pain and edema. While the brown recluse spider can be found in similar environments to the black widow, their bites typically present with tissue necrosis, pain, and edema at the site of envenomation, and not with systemic symptoms.[12]

SUMMARY

Though black widow spiders primarily prefer warm and dry climates, they can be found throughout the US, including at high altitude, mountainous regions where temperatures reach below-freezing. Black widow envenomation should be included in the differential diagnosis for children who present with severe abdominal pain after possible exposure.

Symptomatic relief is the cornerstone of latrodectism treatment. ✚

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