A 6-week-old Girl with Constipation, Fussiness

Robert Listernick, MD

This 6-week-old girl was seen in the emergency room due to constipation and increased fussiness. She had tactile fever the night before admission, but her mother hadn’t taken her temperature. She had no bowel movements for the previous 2 days. Normally, she had three to five formed bowel movements each day. She had been eating normally but was fussier over the past several days. In addition, she had several episodes of non-bloody, nonbilious “spitting up.”

She was a 6-lb product of a full-term pregnancy to a 30-year-old gravida 2 para 2 woman. There were no perinatal complications. Family history was unremarkable. She had been taking cow’s milk-based formula well, 3 to 4 oz every 3 to 4 hours. On exam, she was alert and fussy but easily consoled. Her temperature was 38.9°C, but other vital signs were normal. Her weight, length, and head circumference were in the 20th percentile. HEENT exam was unremarkable. Lungs were clear. Cardiac exam was normal. Abdomen was soft and nontender without masses or organomegaly. Genitalia were normal.

On admission, her complete blood count, serum chemistries, and urinalysis were normal. Lumbar puncture revealed 178,000 red blood cells/mm³ and 20 white blood cells/mm³; there were 15% neutrophils; 35% bands; and 42% lymphocytes. CSF glucose was 55 mg/dL, and CSF protein 233 mg/dL. Gran’s stain showed gram-positive cocci in short chains and pairs.

Robert Listernick, MD, moderator: What about the Gram’s stain results?

Julie Stamos, MD, pediatric infectious disease physician: In the pre-Haemophilus vaccine era, we occasionally saw children with overwhelming meningitis who had a lot of bacteria in the CSF but few white blood cells. The lead physician did just that; the repeat Gran’s stain was negative. She was given intravenous antibiotics because of the fever. She remained well for 6 hours, after which she developed increasing abdominal distention and tachycardia. She received several infusions of intravenous saline, which didn’t correct the tachycardia, and she had several brief episodes of oxygen desaturation. Due to increasing ab-
dominal distention, an abdominal X-ray was obtained.

**Bryan Mitchell, MD, pediatric radiologist:** There were multiple dilated loops of small intestine without evidence of free air or pneumatisos intestinalis. This was felt to represent either enterocolitis or distal bowel obstruction. In an older child, you might think of intussusception, although there’s no evidence of a right lower quadrant soft tissue mass.

**Katie Donnelly, MD, pediatric resident:** Several hours after admission, she looked well and was eating normally. When we saw her 5 hours later, her abdomen was significantly distended, and she was having repeated oxygen desaturations, prompting X-rays, laboratory testing, and a surgical consult.

**Dr. Listernick:** There was a remarkable change in the laboratory values: hemoglobin 7.1 g/dL, 4 g/dL lower than its value 12 hours earlier; white blood cell count 1,800/mm³, with 83% lymphocytes, 2% metamyelocytes, and 2% myelocytes; and platelet count 255,000 mm³. Prothrombin time was 32 seconds; PTT 67 seconds; pH 7.12.

**Katherine Barsness, MD, pediatric surgeon:** Early in the course, she had a rectal exam, which revealed normal formed stool, and a nasogastric tube was inserted, which had no bilious drainage. Over the next 3 hours from when the surgical resident saw her until I saw her, her abdomen transformed from “soft and moderately distended” to marked distention and tenderness with a concern for the development of abdominal compartment syndrome. By the time she came to the operating room shortly after I arrived, her feet were cold, blue and mottled, and she had produced minimal urine.

**Dr. Listernick:** What is abdominal compartment syndrome?

**Dr. Barsness:** Massive abdominal distention from either intraluminal or intraperitoneal fluid leads to increased intraabdominal pressure and decreased perfusion and ischemia of intraabdominal organs and the lower extremities. In addition, the massive distention may lead to decreased ventilation and hypoxia. This can be seen in a variety of intraabdominal catastrophes, including abdominal trauma or pancreatitis, or in situations where there has been massive fluid resuscitation and pooling of the fluid in the abdominal cavity or intestinal lumen. At times, we leave an abdominal incision open to prevent development of compartment syndrome.

**Dr. Listernick:** What happened in the operating room?

**Dr. Barsness:** When we made the initial incision, the bowel popped out under pressure. We did nothing until the anesthesiologists provided her with fluid resuscitation and better ventilatory support. The small intestines appeared grossly viable but were markedly distended and “thinned out.” The colon was even more distended. There was no transition zone, which might have suggested an area of obstruction or compromise. The presence of thickened or ischemic bowel would have suggested an obstructive process, such as a band or internal hernia. We opened the distal end of the ileum to decompress it; the bowel contents were extremely foul-smelling, suggesting an infectious colitis.

**Dr. Listernick:** How do you prevent the process from recurring?

**Dr. Barsness:** We created an ileostomy using the proximal small bowel and a mucous fistula using the distal part so as to totally decompress all segments of the intestine.

**Dr. Listernick:** What were you thinking at the time as to etiology?

**Dr. Donnelly:** We discussed with the surgeons the possibility of Hirschsprung disease (HD), although we were puzzled by the history of normal stooling up to 3 days before presentation. Infectious enterocolitis was also a possibility, except she had no history of diarrhea.

**Dr. Barsness:** HD was clearly a consideration. Digging a little deeper, the mother had been breastfeeding but had recently converted to formula feeding. Although we were puzzled by the history of normal stooling up to 3 days before presentation. Infectious enterocolitis was also a possibility, except she had no history of diarrhea.

**Erin Rowell, MD, pediatric surgeon:** Enterocolitis is a major source of morbidity and mortality in children who have either...
uncorrected or corrected HD. It’s a process we don’t completely understand because the risk of enterocolitis remains after we remove the segment of aganglionic bowel. Rectal irrigations leading to “decompression” can be life-saving in these children.

Tony Chin, MD, pediatric surgeon: The rectal exam is crucial. Explosive diarrhea in this situation following rectal examination is highly suspicious of enterocolitis and HD. HD affects the internal sphincter, preventing relaxation and preventing stool from being evacuated.

Dr. Listernick: How reliable is the barium enema for detecting HD?

Dr. Mitchell: Barium enema has a high sensitivity for the diagnosis of HD. The first important point for the pediatrician is that the exam should be performed in an “untreated” colon. If suppositories or laxatives are given to relieve the constipation before the X-ray is performed, it may be difficult to identify the aganglionic transition zone. The surgeons even prefer to have the barium enema performed before a rectal examination for the same reason.

Dr. Listernick: Any tricks to performing a more sensitive barium enema?

Dr. Mitchell: The radiologist wants to get as much distension of the rectum and the sigmoid colon as possible in order to identify the transition zone. In her initial study, I don’t see a definite transition zone. However, the sigmoid colon is definitely abnormally distended compared with the rectum, and the proximal colon appears to have thickened walls. This is highly suspicious for HD.

Key Learning Points

1. Massive abdominal distention from either intraluminal or intraperitoneal fluid may lead to abdominal compartment syndrome, which includes decreased perfusion and ischemia of intrabdominal organs and the lower extremities.
2. Children with low-segment Hirschsprung disease (HD) uncommonly present with full-blown enterocolitis; patients who are breastfeeding tend to present later, particularly when they transition to formula or solid food.
3. Barium enema has a high sensitivity for the diagnosis of HD. The examination should be performed in an “untreated” colon before the use of suppositories or laxatives.
4. The gold standard for the diagnosis of HD is to document three findings on rectal biopsy: the absence of ganglion cells; the presence of hypertrophic nerves; and an abnormal acetylcholinesterase stain.
5. HD is associated with a number of genetic syndromes and single-gene disorders, such as Down syndrome, Waardenburg syndrome, and Mowat-Wilson syndrome (macrocephaly, mental retardation, and HD). In addition, mutations of the RET protooncogene account for as many as 50% of the familial cases and 20% of the sporadic cases.

Dr. Listernick: How do we begin to confirm the diagnosis of HD?

Reema Jaffar, MD, pediatric pathologist: There are multiple collaborations that occur between the pathologist and the surgeon in the diagnosis and management of HD. The initial biopsy is performed to confirm the diagnosis. A suction rectal biopsy can be performed easily until approximately 6 weeks of age; after that, full-thickness biopsy is generally performed. We look at a frozen section while the child is in the operating room to assess the adequacy of the specimen. Following this, we meticulously examine the permanent sections for the presence or absence of ganglion cells and hypertrophic nerves.

Dr. Listernick: What are the pathologic criteria by which you diagnose HD?

Dr. Jaffar: The gold standard is to document three findings: the absence of ganglion cells, the presence of hypertrophic nerves, and an abnormal acetylcholinesterase staining pattern. Normal nerves stain positive for acetylcholinesterase; abnormal acetylcholinesterase expression is seen in the increased number of coarse fibers in the lamina propria and muscularis mucosae due to aberrant innervation of the aganglionic segment. Inflammation can cause an abnormal ACE staining pattern. The diagnosis was very difficult to make in this child, who had colitis and abnormal mucosa. Ultimately, on the third biopsy attempt, we were able to make the diagnosis of HD.

Dr. Listernick: What’s the next step?

Dr. Barsness: The second collaboration between the surgeon
and the pathologist involves establishing the level of the aganglionic segment once the diagnosis of HD has been confirmed. Traditionally, the surgeon starts biopsying from the peritoneal reflection around the rectosigmoid colon working her way proximally, attempting to identify where the aganglionic segment ends. The pathologist, in real time, is looking at the frozen section for the presence of ganglion cells. This patient has very low-segment HD. However, her colonic mucosa looked very abnormal, and I did not feel she was ready for the definitive surgical repair.

**Dr. Listerick:** What would be the typical “definitive” surgery?

**Dr. Barsness:** Most of us have been trained to perform a laparoscopic pullthrough operation. First, we remove the blood supply to the aganglionic section of the distal colon laparoscopically. We then resect this segment transanally, either performing a full-thickness removal of the abnormal tissue (the Swensen procedure) or by just removing the mucus layer and leaving in the muscularis (the Soave procedure). Both procedures are equally effective in well-trained hands. Finally, we take the segment with normal nerves and pull that down to create an anal anastomosis.

**Dr. Listerick:** What’s the functional outcome?

**Dr. Barsness:** Most patients have excellent quality of life, but chronic constipation requiring laxatives, such as polyethylene glycol solutions, is common. Some patients require daily retrograde enemas; as they get older, if they aren’t compliant with these enemas, we may place a percutaneous cecal tube for delivery of colonic irrigation.

**Dr. Listerick:** Although it most likely doesn’t apply to our patient, HD is associated with a number of genetic syndromes and single-gene disorders, such as Down syndrome, Waardenburg syndrome, and Mowat-Wilson syndrome (macrocephaly, mental retardation, and HD). In addition, mutations of the RET proto-oncogene account for as many as 50% of the familial cases and 20% of the sporadic cases. This association is particularly true if the patient has a long aganglionic segment.

Thank you, everybody.