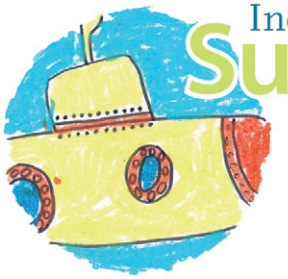

Index of Suspicion

5 Right Upper Quadrant Abdominal Pain in an Otherwise Healthy 8-year-old Girl

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PRESENTATION

A previously healthy 8-year-old girl presents to the emergency department with an 8-day history of intermittent high fevers, vomiting, and right upper quadrant (RUQ) abdominal pain. She was seen on day 2 of illness, diagnosed as having presumptive urinary tract infection due to pyuria, and was prescribed a course of trimethoprim-sulfamethoxazole. After 3 days of continued fevers (102.2°F–104.9°F [39.0°C–40.5°C]) and intermittent RUQ pain, the antibiotic drug course was switched to cefdinir. Her clinical course worsened, with ongoing fever, RUQ pain, vomiting, and development of dehydration, prompting presentation to the emergency department. Her travel history and animal exposure history are unremarkable.

On presentation, her vital signs are significant for a heart rate of 142 beats/min and a temperature of 103.5°F (39.7°C). Her blood pressure and respiratory rate are within the reference ranges for her age. On physical examination, she is noted to have dry mucous membranes and adequate capillary refill. Her abdomen is soft, with normal bowel sounds and mild tenderness to palpation mostly in the RUQ. She does not have any rebound or guarding and has no tenderness over the McBurney point. Murphy, Rovsing, obturator, and psoas signs are all negative. Rectal examination is deferred. Findings from the remainder of the physical examination are normal.

Initial laboratory test results are as follows: white blood cell count, 30,660/μL (30.6×10^9/L), with 79% neutrophils, 8% lymphocytes, 12% monocytes, and 1% basophils; hemoglobin level, 10 g/dL (100 g/L), with a mean corpuscular volume of 72.6 μm^3 (72.6 fL), mean corpuscular hemoglobin level of 25.1 pg/cell, mean corpuscular hemoglobin concentration of 34.6 g/dL (346.0 g/L), and red blood cell distribution width of 37.3 fL; and platelet count, $420\times10^3/\mu$L (420×10^9/L). Serum electrolyte levels are normal. Erythrocyte sedimentation rate is 81 mm/hour, and the C-reactive protein level is 168.0 mg/L (1,600.0 nmol/L). Liver function tests reveal an albumin level of 1.9 g/dL (19.0 g/L); total bilirubin level, 1.0 mg/dL (17.1 μmol/L); aspartate aminotransferase level, 39 U/L (0.7 μkat/L); and alanine aminotransferase level, 83 U/L (1.4 μkat/L). Urinalysis reveals 1+ ketones, trace leukocyte esterase, a white blood cell count of 14 per high-power field, and is otherwise normal. A blood culture sample is sent to the laboratory.

Initial imaging is pursued in the emergency department. A chest radiograph reveals a small right-sided pleural effusion. Initial limited right lower quadrant

abdominal ultrasonography did not visualize the appendix, but there were no secondary signs consistent with appendicitis. She is hospitalized for dehydration and is evaluated for fever of unknown origin. She is started on intravenous ceftriaxone with concern for right lower lobe pneumonia based on chest radiographic findings, and despite antibiotic drug therapy, she continues to have fevers, emesis, and abdominal pain. Additional imaging studies elucidate the diagnosis.

The Case Discussion and Suggested Readings appear with the online version of this article at http://pedsinreview.aappublications.org/content/38/4/187.

DISCUSSION

The Differential Diagnosis

Differential diagnosis comprises occult bacterial infection, including developing right lower lobe pneumonia, urinary tract infection, abdominal or retroperitoneal abscess, and viral infection (including those due to Epstein-Barr virus or cytomegalovirus).

The laboratory evaluation was not diagnostic for cytomegalovirus and Epstein-Barr virus infections by serology. Blood, urine, and stool culture results remained negative throughout the illness.

Owing to persistent fevers, there was concern for abdominal or retroperitoneal abscess, and antibiotics were empirically broadened to vancomycin and piperacillin/tazobactam. Complete abdominal ultrasonography showed a heterogeneous fluid-containing lesion centered in the right hepatic lobe suggestive of hepatic abscess. Abdominal computed tomography (CT) with oral and intravenous contrast confirmed this finding. An interventional radiologist placed a drain and sent a fluid specimen for culture. On hospital day 9, *Streptococcus intermedius* was identified from the drained abscess fluid, but susceptibilities were unable to be obtained. Due to a high vancomycin trough level and an increased creatinine concentration concerning for acute kidney injury, the patient was switched back to a prolonged monotherapy course with ceftriaxone.

The Condition

Hepatic abscesses are uncommon in children, with pyogenic liver abscesses (PLAs) accounting for most cases of hepatic abscess. The incidence of PLA has been estimated in some studies to account for 3 to 25 per 100,000 hospital admissions in developed countries. The incidence is generally higher in developing countries. Studies have typically shown an equal incidence between boys and girls. Age stratification varies by case series, with one demonstrating a predominance of cases in children aged 0 to 1 years and another with a predominance of cases in older school-aged children and early adolescents.

In the infant population, common risk factors include sepsis, umbilical infection, or the presence of an indwelling umbilical line. In all children, certain chronic conditions, including diabetes and sickle cell disease, and conditions leading to impaired immune function, either inherited or acquired, including chronic granulomatous disease, protein calorie malnutrition, and human immunodeficiency virus infection, have been associated with predisposition to PLAs. Of note, *Staphylococcus aureus* is the most common pathogen isolated from hepatic abscesses in children, unlike in this case.

Pathogenesis

Streptococcus intermedius infection is typically associated with liver and brain abscess formation and rarely with endocarditis. It is 1 of 3 *Streptococcus* species that makes up the *Streptococcus milleri* group. Together with *Streptococcus constellatus* and *Streptococcus anginosus,* these 3 species are typical mouth, gastrointestinal, and genitourinary flora. They are often the cause of purulent infections.

Bacterial infection may seed the liver if the patient has portal, biliary, or systemic sepsis. Intra-abdominal trauma is another underlying mechanism that may contribute to the formation of liver abscess. Other organisms causing hepatic abscess include parasitic or cryptogenic pathogens.

Diagnosis

History and physical examination findings are often nonspecific for pediatric PLAs. Typical symptoms include fever and abdominal pain, often localized to the RUQ. In one case series of children diagnosed as having PLA at a major hospital in the United Kingdom over a 10-year period, Muorah et al, reported that 100% of patients presented with fever, whereas only 47% had abdominal pain. Clinical presentation can be insidious. As was seen in our patient, RUQ inflammation and irritation can occasionally lead to diaphragmatic irritation and the development of pleural effusions.

Laboratory data are also often nonspecific in children with PLA. Commonly, leukocytosis and elevated inflammatory markers are seen. Alterations in liver function test results, including hypoalbuminemia and elevated liver enzyme, bilirubin, or alkaline phosphatase levels may be seen, although no consistent patterns have been observed across studies.

Imaging is the method of choice for the diagnosis of hepatic abscess. Ultrasonography is commonly the first imaging study conducted, followed by abdominal CT as a confirmatory imaging study. Abdominal ultrasonography may miss domal hepatic abscesses but otherwise is useful as a screening tool. Abdominal CT is highly sensitive in detecting hepatic abscess and is also helpful in surgical planning.

Management and Prognosis

Percutaneous drainage in conjunction with antimicrobial drug therapy is typically the most effective management choice for hepatic abscess. Some studies suggest 4 to 6 weeks of antimicrobial drug therapy to ensure a good outcome.

Without treatment, a PLA is almost universally fatal, with eventual abscess expansion, rupture, or systemic spread of infection. In reviewing the literature, for which prognostic

data are mainly derived from case series in developing countries, Mishra et al noted that with improvements in antibiotic drug and surgical management, mortality has been reduced to less than 15%.

Lessons for the Clinician

- Although more common in the developing world and in children with chronic disease or those who are immunocompromised, liver abscesses do occur in immunocompetent children.
- It is important to consider hepatic abscess as an underlying cause of infection in a child presenting with nonspecific symptoms, such as fever and abdominal pain.
- Remember that *Staphylococcus aureus* is the most common pathogen in liver abscesses but other microbes, including *Streptococcus intermedius,* and anaerobes are also associated with abscesses and should be considered when selecting antimicrobial drug therapy.
- Early diagnosis, drainage, and antimicrobial drug therapy can decrease mortality significantly in children found to have hepatic abscess.

Suggested Readings

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Whiley RA, Beighton D, Winstanley TG, Fraser HY, Hardie JM. *Streptococcus intermedius, Streptococcus constellatus,* and *Streptococcus anginosus* (the *Streptococcus milleri* group): association with different body sites and clinical infections. *J Clin Microbiol.* 1992;30(1):243–244

Additional Resources for Pediatricians

AAP Textbook of Pediatric Care, 2nd Edition

- Chapter 125: Abdominal Pain - https://pediatriccare.solutions.aap.org/chapter.aspx?sectionId=107997824&bookId=1626

Point-of-Care Quick Reference

- Abdominal Pain - https://pediatriccare.solutions.aap.org/content.aspx?gbosid=165407

Parent Resources from the AAP at HealthyChildren.org

- **Abdominal Pain in Children:** https://www.healthychildren.org/English/health-issues/conditions/abdominal/Pages/Abdominal-Pain-in-Children.aspx
- **Boils, Abscess & Cellulitis:** https://www.healthychildren.org/English/health-issues/conditions/infections/Pages/Boils-Abscess-and-Cellulitis.aspx

For a comprehensive library of AAP parent handouts, please go to the *Pediatric Patient Education* site at http://patiented.aap.org.

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