

MORNING REPORT

A BEWILDERING BACTEREMIA: AN EXERCISE IN CLINICAL REASONING WITH COGNITIVE AUTOPSY

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(*Discussant in italics)

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A 60-year-old Hispanic man with a history of insulin-dependent diabetes mellitus presented for six days of abdominal pain, nausea, and vomiting.

Broadly, his symptoms can be categorized into two initial diagnostic categories: gastrointestinal etiologies or a gastrointestinal manifestation of systemic disease. The differential diagnosis of gastrointestinal etiologies can be subcategorized by organ, for example: peptic ulcer disease, pancreatitis, small bowel obstruction, biliary obstruction, acute hepatitis. Diabetic ketoacidosis (DKA) or adrenal insufficiency are examples of how abdominal pain and vomiting may be symptoms of a systemic process.

His abdominal pain was diffuse, constant, and exacerbated with oral intake. He denied fever, diarrhea, constipation, melena, or hematochezia. He had been unemployed for one year and was unable to afford his medications. He denied drug use, but reported consumption of 4-6 beers per day. On examination he was tachycardic and mildly hypotensive. On labs, his blood glucose was elevated to 396 mg/dl along with an anion gap metabolic acidosis and elevated blood ketones. Hemoglobin A1C was 14%. His complete blood cell count was remarkable for a mild leukocytosis. Liver function tests were normal. A CT scan of abdomen/pelvis showed nonspecific stranding surrounding the hepatic flexure of the colon as well as distal gastric antrum and duodenum. He was started on intravenous fluids, insulin, and pantoprazole. With these interventions, he reported improvement in his symptoms and his laboratory derangements normalized the following day.

On the second hospital day, he developed a fever of 102°F. His symptoms from admission were improving and he denied new symptoms. His procalcitonin was elevated at 2.14 ng/ml. Other laboratory data remained unchanged, and urinalysis and chest radiograph showed no infection. The following day blood cultures resulted *Klebsiella pneumoniae*. While a gastrointestinal source

was suspected, no specific etiology was identified. He was transitioned to oral ciprofloxacin and discharged home to complete a two-week course of antibiotics.

With unexpected shifts in a patients' hospital course it is important to step back and evaluate if the newly identified symptoms were present on admission or if they were directly related to the hospital stay itself (such as a new medication started since admission or a hospital acquired infection). As the patient was in the hospital for 24 hours or less, it is likely that this infection was present on admission, just not evident.

Klebsiella bacteremia can result from infections of the genitourinary tract (e.g., pyelonephritis), pulmonary infections, and the gastrointestinal tract (e.g., cholangitis). These more common etiologies have been excluded as sources for this patient's bacteremia. Interestingly, Klebsiella has been an increasingly recognized culprit of primary liver abscess syndrome (without evidence of associated biliary infection) in the United States. In the community setting, Klebsiella liver abscess syndrome is typically seen in patients with poorly controlled diabetes.¹ Reassuringly, he underwent CT imaging without evidence of biliary dilations or liver abscess, and classic elevation of alkaline phosphatase or other liver function tests are not present. A source is identified in 84% of patients with community-acquired Klebsiella bacteremia, unlike in this case.¹

Two weeks after his initial presentation he returned to the emergency room with subjective fevers, nausea, emesis, and decreased tolerance of his oral antibiotics. He was afebrile and hypotensive requiring vasopressors. Labs now demonstrated white blood cell count of 20.5×10^3 ul, alkaline phosphate of 323 U/L, and mildly elevated transaminases. A CT of the abdomen and pelvis was repeated. The previously reported antral and duodenal stranding was resolved; however, a 7 x 5 cm hepatic abscess was

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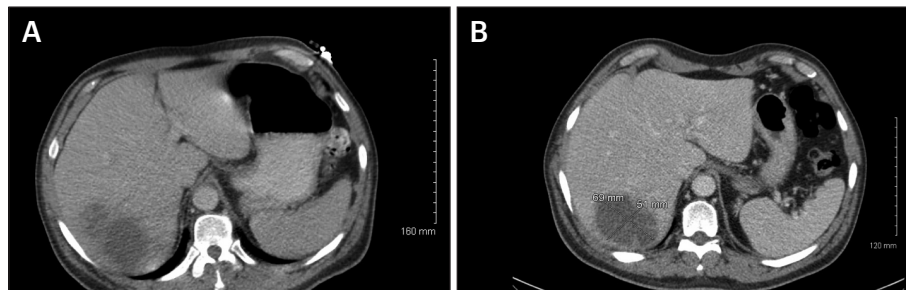
identified (Figure A). Broad spectrum antibiotics were initiated. He underwent CT guided drainage of the hepatic abscess. Culture was positive for *Klebsiella pneumoniae*.

The recurrence of this patients' symptoms prompting readmission with septic shock could represent antibiotic failure in the setting of resistance, antibiotic intolerance since discharge due to emesis, or lack of source control (such as an abscess). The repeated CT imaging sheds light on the etiology for his *Klebsiella* bacteremia from his first admission and explains his failure to improve with therapy. It would be helpful to review the CT images from the first admission to evaluate if early signs of abscess were present.

In fact, the images from the first hospitalization did reveal a lesion in right hepatic lobe. While the "conclusion" on the radiologist report only documented the stranding at the gastric antrum and duodenum, within the full report are details of a 4 x 7 x 5 cm lobulated well-circumscribed hypodense lesion felt to represent a complicated or septated cyst (Figure B).

Discussion

Illness frequently follows patterns and clinicians can rely on their compiled knowledge of a condition, termed an



[A] Computed tomography imaging with liver abscess within the right hepatic lobe. [B] Review of the images from the admission two weeks prior, the abscess was present and larger. Photos courtesy of the patient.)

illness script, to recognize and achieve a diagnosis. In contrast, complex diagnostic dilemmas may result in uncertainty or a delay in diagnosis or treatment. Physicians are encouraged to retrospectively perform a cognitive autopsy of their diagnostic performance following diagnostic inaccuracies.² This works to guide self-feedback while avoiding maladaptive feelings or guilt which may naturally occur with diagnostic error but may impair constructive learning.

In the reflection of this case, we will simplistically review the faulty knowledge, data gathering, and synthesis that led to the delay in diagnosis (see the following table). Errors in synthesis are much more prevalent than errors in data gathering and knowledge combined.³ Unlike errors attributed to systems issues,

the interventions needed to mitigate and learn from diagnostic errors are more metacognitive. Examples of interventions include metacognitive training, use of decision support tools to broaden differential diagnoses, and checklists that serve as de-biasing tools. As the table categorizes the cognitive breakpoints impacting the case, the right column highlights how a checklist approach may have prompted better clinical decision making.⁴

Errors in the radiology field are often classified into perceptual (an abnormality is present but not seen) or interpretive (an abnormality is identified but its importance is interpreted incorrectly).⁵

The radiologist reviewed the initial CT scan with the indication

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Utilizing a Checklist Approach to Improve Diagnostic Certainty ⁴

Errors or Events Leading to Delay or Missed Diagnosis Knowledge (Least Prevalent)	Data Gathering	Synthesis (Most Prevalent)	How a Checklist Approach Could Provide Solutions to Achieve Diagnosis
		Diagnostic Inertia: On Hospital Day 3, the Hospitalists transitioned with same working diagnoses	Obtain your own complete medical history and reperform a focused and purposeful physical exam
	Short cuts in data gathering: reading only the conclusion of the radiology report	Interpretive Error/Framing Bias: Radiologist assessment of liver lesion before the development of fever and bacteremia	Differentiate hypotheses with further history, exam, and diagnostic tests
Association of poorly controlled diabetes as risk factor for <i>Klebsiella</i> primary liver abscess	Correctness assumption of data previously gathered	Context Error: in which abdominal pain was attributed to peptic ulcer disease (based on CT stranding) despite bacteremia	Take a "Time-Out" to reflect. What are we missing? What else could this be? Acknowledge uncertainties and anticipate follow up and patient education

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of “a patient with abdominal pain and vomiting.” The way in which a problem is represented can influence the cognitive process, an effect called framing bias. For instance, the images may have been interpreted differently if the indication for testing was instead “a patient with fever, leukocytosis and bacteremia.”

Taking a diagnostic time-out to ask “what are we missing?” may have prompted the clinical team to revisit the patient for a repeated interview and examination, in addition to reexamining laboratory and radiological data. When encountering these situations in the moment, or in retrospect, take a metacognitive approach to enhance one’s awareness of the cognitive forces impacting clinical reasoning. A simple strategy is to use the tool IDEA: Identify assumptions, Don’t assume correctness, Explore expectations, and Assess alternatives.⁶

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