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Diagnostic Delay in the Emergency Department

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Case Objectives

- Appreciate the importance of a broad differential diagnosis for acute abdominal pain.
- Discuss how the concept of missed diagnostic opportunities in the emergency department setting can be useful to understand diagnostic error.
- List some common causes of diagnostic error and five dimensions where errors can occur.
- Describe recommendations and approaches for individual physicians and health care organizations to address diagnostic error.

Case & Commentary—Part 1

A 43-year-old man with a history of morbid obesity and hypertension presented to the emergency department (ED) with right upper quadrant pain. The patient lived a sedentary lifestyle and received disability benefits. On examination, he was afebrile but tachycardic (heart rate 110–120 beats per minute [bpm]) and hypertensive (blood pressure 155/85 mm Hg). He had mild right upper quadrant tenderness on examination, but the exam was limited because of his obesity.

The ED provider ordered basic laboratory tests and a right upper quadrant ultrasound to look for cholecystitis. While waiting for the diagnostic tests, the patient had progressively severe pain, requiring relatively high doses of intravenous morphine.

Blood test results (including liver function tests) were normal except for an elevated creatinine level of 1.8 mg/dL (up from a baseline of 1.1 mg/dL), indicating acute kidney injury. The ultrasound showed gallbladder sludge with no gallstones and no evidence of acute cholecystitis. This initial evaluation took nearly 7 hours, and there was still no clearly identified cause for his pain.

Over this period, his heart rate increased to greater than 120 bpm and his blood pressure was 175/95 mm Hg. An electrocardiogram showed sinus tachycardia and low voltage throughout. The low voltage was attributed to the patient's obesity, and he was given a small bolus of intravenous fluids.

Although the ED provider pursued further imaging, she avoided a contrast study because of the patient's acute kidney injury. She ordered a noncontrast CT scan of the abdomen and pelvis. For various logistical reasons, the CT scan was delayed 4 hours and a preliminary read was not available for another hour.

Abdominal pain is the most common chief complaint and diagnosis in United States emergency departments (EDs), accounting for more than 10 million visits annually.(1,2) Accurately determining the diagnosis poses special challenges and is known to be error-prone.(3) Although many patients have a benign or self-limited etiology, some have serious and acute pathology. This means that identifying patients that require emergent or urgent intervention is key.

The foundation for an appropriate evaluation of abdominal pain starts with a thorough history and physical examination. However, symptoms may be misleading, difficult for patients to convey, unusual, or even change over time (3), and communication breakdowns related to language or cultural differences can occur.(2) Evaluation of patients with obesity may be more difficult due to several factors, such as provider perceptions (4) and weight restrictions of diagnostic imaging tests (e.g., CT scanning).(5) Furthermore, abdominal processes requiring surgery may be more prevalent in overweight populations and associated with increased morbidity and mortality.(6) Considering a broad differential diagnosis is essential in the initial evaluation of all patients with abdominal pain; this is particularly true in patients with obesity.

The provider in this case was most concerned for cholecystitis, or inflammation of the gallbladder, which can present with right upper quadrant abdominal pain, nausea, vomiting, decreased appetite, and fever. Additional physical examination findings can include tachycardia, guarding, or rebound pain in the right upper quadrant. Initial laboratory and imaging tests ordered for this patient seemed appropriate. While laboratory results such as leukocytosis, elevated serum aminotransferase, elevated bilirubin, or elevated alkaline phosphatase have a low sensitivity and are nonspecific, right upper quadrant ultrasound imaging is the most useful test in the ED. Visualization of the gallbladder without identification of stones has an extremely high negative predictive value for cholecystitis.(2)

The other diagnoses the provider was considering are not described in the case. However, there was a 7-hour delay in obtaining an ultrasound while the patient's pain increased. Worsening tachycardia, severe pain unrelieved with intravenous morphine, and elevated creatinine would lead one to consider a broader differential, including myocardial infarction, aortic dissection, sepsis from a variety of sources, pyelonephritis, or ureteral stones. Thus, an urgent CT scan would have been an appropriate next step, along with additional laboratory tests based on the differential diagnosis. In this case, however, the CT scan report was only available 5 hours later. It is also unclear how many shift changes occurred between initial presentation until the CT report was available and if the treating team recognized the patient's worsening status.

Case & Commentary—Part 2

The preliminary CT read was concerning for an acute aortic dissection, but it was not definitive without intravenous contrast. Cardiothoracic surgery, cardiology, and the intensive care unit team were consulted for further management. The decision was made to order a CT scan of the abdomen and pelvis with contrast to evaluate for the possibility of dissection.

The CT scan of the abdomen showed a dissection of the descending aorta with involvement of the renal arteries and the mesenteric vessels. A CT scan of the chest was then performed 90 minutes later; it showed the dissection started at the proximal aorta with involvement of the carotids and extended into the descending aorta (type A dissection).

At this point, the patient was given aggressive intravenous antihypertensives (his blood pressure had risen to 180/100 mm Hg). He was taken to the operating room for repair of his dissection. Unfortunately, the surgery was complicated and he had massive intraoperative bleeding. He developed hemorrhagic shock and multi-organ failure and died 2 days later despite maximal efforts.

The ED case review committee analyzed the case in detail and wondered how common diagnostic errors are in patients presenting with abdominal pain, and specifically, whether this issue is impacted by patient obesity. They also wondered what steps could be taken to prevent such an error in the future.

Diagnostic error, as defined by the Academy of Medicine (formerly the Institute of Medicine), is the failure to establish an accurate and timely explanation of a patient's health problems or communicate that explanation to the patient.(7) Annually, diagnostic errors are estimated to affect 12 million US adults in the outpatient setting alone.(8) They involve a large variety of common diseases and have significant potential for harm.(9)

In the ED, the frequency of diagnostic errors is not fully known (10); however, malpractice studies have found that 47% of ED claims are due to diagnostic errors.(3,11) Other methods of identifying or estimating diagnostic errors include autopsies, surveys, standardized patients, diagnostic testing audits, second or peer reviews, case reviews, and voluntary reports.(9,12,13) However, none of these methodologies have been applied in a structured way to document the frequency of diagnostic errors in the ED.

The diagnosis of aortic dissection in the ED is missed in 16% to 38% of cases.(14,15) A previous WebM&M commentary identified three key factors that appeared to predispose to errors in the diagnosis of aortic dissection: (i) perceived mildness of presenting symptoms; (ii) diagnostic testing that suggested another disease process; and (iii) absence of typical radiographic findings, such as a widened mediastinum.(14)

So how does one further understand the diagnostic error in this case and learn from it? One operational definition of diagnostic error is missed opportunities to make a correct or timely diagnosis based on the available evidence, regardless of patient harm.(16) This definition helps identify, on a retrospective review, how diagnostic evaluation could have been done differently. The knowledge gained from such an analysis can be used to improve patient safety.

Diagnostic errors can be contextualized within five interactive, process-based dimensions: patient–provider encounter (history, examination, test ordering); performance and interpretation of diagnostic tests; follow-up or tracking of diagnostic information, such as test results; processes related to referrals; and patient dimensions.(9) A previous ED study of abdominal pain related to diagnostic errors showed multiple process breakdowns within the dimensions above, most commonly involving the patient–provider encounter and follow-up or tracking.(3) Within the patient–provider encounter, examples of diagnostic errors included problems with the history or physical examination, failure to review previous documentation, and problems ordering the appropriate diagnostic tests for further workup.

In this case, at least two of the five dimensions involved missed opportunities: the patient–provider encounter and performance and interpretation of diagnostic tests. There were problems with the physical examination owing to the patient's obesity, and the mildness of symptoms likely affected the timeliness of workup. This issue was also described in a previous WebM&M case, where obesity was found to affect physical examination, diagnostic imaging, airway management, and venous access. The present case also illustrates problems ordering the appropriate diagnostic tests for further workup and problems performing diagnostic tests in a timely manner.

When would we have expected the ED care team to get alarmed about the possibility of a much more serious condition in this case? Perhaps when acute kidney injury was identified, along with worsening pain and tachycardia. However, we know very little about clinicians' thought processes in such cases. Making a diagnosis often involves shades of gray, rather than black and white data points. In general, diagnostic errors can be caused by many factors, including bias, premature closure, system factors, and overreliance on type 1, or automatic, heuristic reasoning (3,17), some of which have been discussed in other WebM&M commentaries (here and here). We often underestimate how system factors can affect the way clinicians think. For example, ED crowding and frequent interruptions are associated with delays in diagnosis, inappropriate care, increased mortality, longer length of stay, and higher likelihood of error.(18-20) Other factors that cause EDs to be stressed or chaotic, including problems with staffing, supplies, or equipment, can lead to increased errors.(21) As a strategy to reduce error potential, ED providers often need to balance overzealous diagnostic testing (which increases costs and false-positive results) with more conservative approaches, which could include shared decision-making and watchful waiting.(22) Some emergency medicine physicians argue that pressures to do more with fewer resources, while maintaining timeliness and decreasing costs, increases the opportunity for diagnostic errors.(23) Under-resourced EDs are a significant risk. Our health system needs appropriate resources and personnel to evaluate complex patients with acute presentations like this in a timely fashion.(22,23)

So how can ED providers handle this area of vulnerability? Tools, workflows, and methods to encourage deliberate (type 2) reasoning prior to making critical decisions might help. Such interventions can include checklists (17), deliberate consideration of a broader differential diagnosis (3,24), and learning from missed opportunities.(16) Receiving feedback on unexpected return visits to the ED that led to a hospitalization could be a useful way to look for these missed opportunities. Similarly, the use of treatment protocols or algorithms may reduce the risk of error.(12) Ensuring that providers develop deliberate and thorough differential diagnoses also can help.(3) In one study, 81% of records with diagnostic errors had no differential diagnosis documented.(9) In this case, it is unclear if the care team pursued a broader differential in the face of worsening abdominal pain. Not asking for help during diagnostic difficulty or uncertainty is also a vulnerability.(25) Seeking help could be through either a formal consultation or curbside consult of another team member for a second opinion. Even simpler strategies like calling the radiologist when a test has been delayed or to communicate the urgency of a study can go a long way; unfortunately it seems this practice has waned over time. This case highlights how a focus on basic clinical skills, cognitive processes, and team-based care is essential in this day and age.(9,26)

While we are not there yet, future health IT tools to support busy ED providers and improve their cognitive processes may be beneficial, such as those reviewed by El Kareh and colleagues (Table).(27) Health IT tools such as electronic tracking systems may help reduce wait times and delays in evaluation, like those

present in this case. Additional techniques such as process and workflow mapping and discrete-event simulation modeling can improve flow, shorten wait times, reduce ambulance diversions, and enhance patient satisfaction.(28,29) Furthermore, EDs should use cases like this one to assess current workflows and identify opportunities to reduce waits and delays.

Ultimately, providers and their health care organizations must own the responsibility for addressing diagnostic errors and work together to develop multifaceted approaches for prevention.(30) EDs should put mechanisms in place to identify and learn from diagnostic missed opportunities and work toward a collaborative, nonpunitive environment to foster their reduction.

Take-Home Points

- Evaluation of acute abdominal pain requires a thorough and time-sensitive approach, which should account for high-risk situations such as obesity and a busy emergency department setting.
- Diagnostic errors can be quite common in emergency departments and involve five interactive process dimensions: patient–provider encounter; performance and interpretation of diagnostic tests; follow-up or tracking of diagnostic information; processes related to referrals; and patient dimensions.
- Approaches to reduce diagnostic error could include methods to encourage deliberate reasoning and differential diagnoses as well as system-based improvements, including health information technology solutions.
- Individual providers and emergency departments should put mechanisms in place to identify and learn from missed opportunities in a nonpunitive fashion.

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Table

Table. Health Information Technology Use for Improving Providers' Cognitive Processes (27)

Assist in information gathering
Facilitate cognition by enhance organization and display of data

Aid in generation of differential diagnoses

Assist in weighing diagnoses

Support intelligent selection of diagnostic testing

Enhance access to reference information

Facilitate reliable follow-up and response

Support screening for early detection of disease

Facilitate diagnostic collaboration with specialists

Facilitate feedback and insight into the diagnostic process

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