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Diagnostic Error - Mini Review and Case Report of Patient Death Resulting from Delayed Diagnosis of Acute Prostatitis

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Abstract: A 57-year old man presenting with frequent and painful urination and negative initial urinalysis for infection was given a diagnosis of benign prostate hypertrophy, which was never revised by subsequent providers. Instead, the patient continued to be treated for urinary retention and pain. A potent NSAID, Toradol (ketorolac), was included in his regimen. One day prior to his demise, the patient was diagnosed with prostatic abscess and admitted for treatment with intravenous antibiotics. However the patient died on hospital day one from massive GI bleeding. Autopsy revealed an underlying peptic ulcer.

This case shines a light on diagnostic error: missed, wrong, or delayed diagnosis. It also uncovers the multifaceted nature of diagnostic errors and highlights the importance of system- related interventions, in particular, better communication between health care providers. Based on malpractice claims data, diagnostic error is the most frequent and costly of all medical mistakes, yet it remains one of the least studied areas of patient safety. While the field has some barriers to study, many opportunities exist for impact in the field of diagnostic errors.

Keywords: Diagnostic error, diagnostic process, delayed diagnosis.

CASE PRESENTATION

A 57-year old man presented to the emergency department complaining of frequent and painful urination over the past three days. His past medical history was notable for benign prostatic hypertrophy, post-traumatic stress disorder, and chronic low back pain. His list of medications included fluoxetine, trazodone, aspirin 81 mg, and tramadol as needed for pain.

In the emergency department, urinalysis was negative for white blood cells, red blood cells, and leukocyte esterase. A Foley catheter was inserted with return of 200 cc of dark urine. Terazosin 2 mg orally daily was prescribed. The patient was advised to follow-up in urology clinic with his Foley catheter.

Three days later, the patient called his primary care physician complaining of increased pain since the Foley catheter had been inserted. Over the phone, his primary care physician asked the patient to increase the terazosin dose to 4 mg daily.

Two days later (five days after initial presentation), the patient called his primary care physician again complaining of pain. He was advised to increase terazosin to 6 mg daily and Percocet was prescribed for pain as needed. Since it appeared that his Foley catheter was exacerbating his pain, the patient was advised to come to the clinic to see a nurse for catheter removal that day, which he did.

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The patient presented to the emergency department two days later with suprapubic pain and inability to pass urine since his Foley catheter had been removed. An emergency department physician re-inserted a Foley catheter with return of 1200 cc of urine. For pain, the patient was given ketorolac 60 mg by intramuscular injection. The patient was advised to continue taking terazosin 6mg and to see his primary care physician the next day.

Two days later (nine days after initial presentation), the patient called his primary care physician. Now, in addition to the urinary symptoms, he also complained of back pain which prevented him from sleeping. His primary care physician increased his Percocet dose and ordered ketorolac 6o mg IM injection to be administered in clinic. The nurse who administered the injection gave him the phone number for the urology clinic so he could schedule a follow-up appointment.

After another two days, the patient called his primary care physician again complaining of worsened back pain, suprapubic pain, and burning penile pain. This time, his primary care physician asked the patient to come to see him the same day, but the patient declined since his follow-up appointment with urology was in 3 days. His primary care physician then recommended him to increase his terazosin dose to 10 mg daily. He also ordered a lumbar spine MRI and added MS Contin 30 mg twice a day for better pain control.

Fourteen days since the beginning of his symptoms, the patient came to his scheduled urology clinic appointment complaining of severe abdominal pain and feeling very ill. Per urology note, the patient denied catheter problems. The urologist, however, did mention that the patient had

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significant urinary retention and might need a TURP for symptomatic relief. Also in the note: "No apparent urologic dysfunction at this time (catheter draining well)." There was no documentation of a digital rectal examination (DRE) being performed. The patient was then referred to the emergency department to be evaluated for his diffuse abdominal pain.

Later that same day in the emergency department, the patient complained of the "worst pain imaginable." He was given ketorolac 60 mg IM for pain. His temperature was 100 F. A general surgery consultation was requested. Per their evaluation, there were no signs of an acute abdomen. White blood cell count was 20,000. Hemoglobin was 8.9 g/dl (baseline 13.9g/dl). A CT of the abdomen and pelvis was performed which showed an abscess in the prostate gland. The patient was admitted to internal medicine for treatment with IV antibiotics for prostatic abscess.

About 6 hours after admission, the patient complained to his nurse of not feeling well and being nauseated. Several minutes later, the patient became lethargic, clammy, and poorly responsive. A Code Blue was called. Patient expired in spite of resuscitation efforts. With family permission, an autopsy was done. Diagnosis on autopsy: Massive upper GI bleeding from 3 cm gastric ulcer. A Large prostatic abscess.

THE SCOPE OF THE PROBLEM

What physician has not made a diagnostic error? The vast majority of diagnostic errors do not result in patient harm; however, some diagnostic errors have potential for causing patient harm, substantial suffering, and even patient death. Psychosis may turn out to be missed thyroid storm, which if left untreated, can lead to death. Assigning a benign diagnosis to a patient with abdominal pain may result in delayed diagnosis of ischemic bowel necessitating bowel resection. This is why diagnostic error is one of the most costly of all medical mistakes [1], and poses a continuous threat to patient safety. Besides causing direct patient harm, diagnostic errors carry additional risks due to unnecessary or delayed tests, treatments and/or procedures, not to mention an increase in healthcare costs. Yet, diagnostic errors still remain one of the least studied and most neglected areas of patient safety [2, 3].

There are many reasons why diagnostic errors get short shrift. Clinicians may be resigned to making diagnostic errors, placing heavy stock in the adage, "To err is human." Diagnostic error reporting systems are underdeveloped; in general, only those diagnostic errors that result in patient harm are captured. Experts believe that healthcare organizations have failed to view diagnostic error as a systems problem, and physicians responsible for making medical decisions seldom perceive their own rates as problematic [2]. However, data from malpractice claims indicate that diagnostic errors are one of the top reasons for such claims. In a study of paid malpractice claims which used data from the National Practitioner Data Bank (NPDB), the most common types of adverse events in the outpatient setting were classified as diagnostic. In the inpatient setting, the second most common adverse events were also classified as diagnostic, only behind those classified as surgical [1]. The rate of diagnostic errors from autopsy studies is variable (4.9-49%), the median major error rate being 23.5% [4, 5]. Since autopsy rates have plummeted over the past decade, autopsy data has become an insufficient source of information for determining diagnostic error prevalence. The exact diagnostic error rate is not known, but based on available data, it is estimated that the prevalence of diagnostic errors in clinical medicine is likely to be in the range of 5-15% [6, 7].

SOURCES OF DIAGNOSTIC ERROR

The process of making a diagnosis is complex and includes multiple interactions between patient, provider and healthcare system. The complexity of this process provides numerous opportunities for failure. Root causes of diagnostic errors can be broadly categorized as patient-related, system-related and provider-related cognitive factors, but the majority of diagnostic errors result from interactions of provider-related and systems factors [7, 8]. Patient -related factors play a lesser role, although patients with rare diseases or those with diseases presenting atypically may have delayed diagnosis and excessive diagnostic testing. A systematic review of diagnostic error in primary care revealed that common conditions such as malignancies, myocardial infarction, meningitis, dementia, iron deficiency anemia, asthma, tremor in the elderly and HIV are easily missed [9]. Another study found that the most common pathway leading to diagnostic error was the assignment of a common, benign diagnosis to a patient with uncommon serious disease [10].

Over the past decade, it has become evident that most diagnostic errors arise from two domains: provider-related and system-related. Most frequently, a provider-related diagnostic error is the result of insufficient cognitive reasoning. Lack of medical knowledge remains less common, even when medical trainees are involved [7].

In the diagnostic process, physicians use either intuitive reasoning *(system 1)* or analytic reasoning *(system 2),* so called *dual process reasoning* [11]. For the diagnostic process based on intuitive reasoning, both broad medical knowledge and vast clinical experience are essential. Those physicians who have seen certain medical conditions over and over easily recognize those conditions on subsequent encounters by *pattern recognition.* When faced with a middle-aged man presenting with voiding difficulties, a likely diagnosis of benign prostatic hypertrophy emerges from our subconscious since the pattern of presentation matches previous patient presentations. This type of cognitive processing has been commonly used in medicine because it is fast and usually effective. However, this type of reasoning is prone to cognitive biases, even in physicians with vast clinical experience. What if a patient presenting with urinary symptoms has prostatitis or prostate abscess or prostate cancer instead? *Premature closure* of the case and not considering a broader differential diagnosis, is one of the most frequent thinking traps. In a study which analyzed 583 cases of diagnostic errors reported by physicians, failure or delay in considering the diagnosis was the most common failure in the diagnostic process [12]. Another frequent cognitive bias is *attribution bias,* where physician decisions are influenced by certain social stereotypes or other patient characteristics, leading physicians to the wrong diagnosis. In a patient with history of alcohol abuse who presents with

abdominal pain and elevated liver-associated enzymes, short cut thinking attributes those changes to alcoholic liver disease. However if a broader differential diagnosis is not considered, a potentially serious condition can be missed, such as acute cholangitis. It is not uncommon for physicians to remember "unusual cases" or patients with adverse outcomes for years after these events. Familiarity with certain groups of diseases may sway physicians to suspect the same disease when encountering patients with similar presentations. Again, it is true that many middle-aged men who present with voiding difficulties have benign prostate hypertrophy. The diagnosis appears most logical. However this *availability bias* can lead to premature closure of the case, with the potential of missing more serious conditions. Physicians should be aware of another cognitive trap known as *anchoring,* or focusing only on one set of information and ignoring others. In our case, additional information was available, but it was misinterpreted and ignored: worsening of back pain despite escalating doses of narcotics, was misinterpreted as "chronic back pain." Ignoring or minimizing new or contradictory information to the presumed clinical picture is also known as *confirmation bias*.

Analytic reasoning involves systematic data gathering, data analysis and data synthesis. This process is conscious, rational, reliable and safe, but is time-consuming. This type of approach is exemplified in teaching institutions where medical residents dissect cases during morning report. This process should be also used in clinical practice when complicated situations are encountered. Despite having more safeguards within this process, the end product still can be wrong. In an analysis of 100 diagnostic errors in internal medicine, the most common reasons analytic reasoning went wrong was because of inadequate knowledge, inadequate data gathering or faulty data synthesis [13]. However, it is not always possible to use analytic reasoning in a busy clinical setting. It is difficult to imagine busy emergency room physicians approaching every patient in this analytic way.

There are also numerous *system-related* problems contributing to diagnostic errors. Among system-related factors, insufficient communication, insufficient care coordination, inadequate hand-offs, and, unavailability of experts and poor trainee supervision, are among the most frequent system issues contributing to diagnostic errors. The role of institutional safety culture cannot be overemphasized [8]. In the presented case, poor communication, insufficient care coordination and lack of ownership, resulted in an unfortunate, catastrophic event. Most diagnostic errors result from multiple interactions of cognitive and systems factors [7, 8].

OPPORTUNITIES FOR IMPACT

It is well known that the majority of diagnostic errors go undetected. The initial focus should be on developing better systems for detection of diagnostic errors. Current systems for adverse event detection have flaws that make them unsuitable for diagnostic error detection. In a study by Griffin and Classen [14] both voluntary reporting systems and Patient Safety Indicators (PSIs) missed 90 percent of adverse events. The Global Trigger Tool looks for triggers in a random sample of medical records, providing some indications of harm, but because of coding variations, identifying diagnostic errors by this method is insufficient. A common definition and unified reporting format for diagnostic errors is needed, similar to common formats for other safety events. Currently, the Agency for Healthcare Research and Quality (AHRQ) Common Formats allow healthcare providers to collect and submit standardized information regarding patient safety events but does not have a specific category for diagnostic error [15]. A centralized and anonymous self-reporting system with feedback mechanisms on a national level may be the best solution.

Some efforts have been made in recent years to develop methods for analyzing diagnostic errors in terms of root cause and severity of harm. In 2009, AHRQ sponsored research of diagnostic error through the Diagnostic Error Evaluation and Research (DEER) tool. In this study, authors developed and used the DEER taxonomy Chart Audit Tool to analyze diagnostic errors. Using this methodology, the authors found that 28% of reported diagnostic errors were rated as major: resulting in patient death, permanent disability, or a near-life-threatening event. The authors were also able to identify that most provider-related diagnostic errors occur during data synthesis [12].

POTENTIAL INTERVENTIONS STRATEGIES

While some diagnostic errors are unavoidable, harm from them should be decreased to the lowest possible level. To achieve this, broad-based strategies and interventions should be developed to address all potential domains and sources of diagnostic errors, not only addressing provider cognitive failure but also process breakdowns and broader system deficiencies which set up people for making medical and diagnostic errors.

There is little evidence about effective interventions at the *patient level* to reduce diagnostic errors. But, it is well known that patient and family active participation in the healthcare process can significantly contribute to patient safety [16]. It is fair to assume that patient active participation in the diagnostic process would be an opportunity to reduce diagnostic errors. For example, direct notification of patients with their mammography results has been implemented in many healthcare institutions as a backup system. This intervention could be potentially extended to other radiologic studies and pathology results.

Medical providers should be aware that diagnostic errors are part of practicing medicine. One of the crucial elements in the diagnostic process is medical knowledge. Once acquired, medical knowledge tends to decline over time. In order for medical knowledge to be maintained, frequent refresher courses, case analysis (especially for those cases where something went wrong), feedback, and simulation courses should be undertaken.

Cognitive psychology proponents advocate gaining insight into our thinking as a way to help avoid the most common cognitive traps and biases [16]. Physicians should be aware of their own cognitive processing and affective biases influencing their thought processes. Mindful self-reflection activities, triggered by a situation at hand or a planned activity, improve diagnostic ability. Simply being aware of one's own possible cognitive biases might initiate an analytic mode of thinking. Cognitive de-biasing is an

important way of improving our performance and diagnostic reasoning. When dealing with a complex case, it is worth discussing the case with a colleague or asking for a second opinion.

Routine peer reviews of cases involving an unsatisfactory outcome should be standard practice, including feedback to the providers. Constructive feedback, in particular, is an important factor in improving diagnostic accuracy. Many physicians never learn about their wrong diagnoses, neither from patients nor from their colleagues.

Poorly designed work flows, processes, and policies provide fertile environments for diagnostic error. Clinical decision-making should be viewed as a process, starting with data gathering and physical examination, continuing with diagnostic testing and second opinions, and ending with subsequent follow-up and closure of the case. Multiple elements of the healthcare system are involved in this process. Many solutions are emerging for reducing system-related diagnostic errors. Many such interventions are health information technology-based, such as those integrated with electronic health records (EHRs) [8]. Decision support systems are now on the market. However, there is currently not enough evidence that computerized diagnostic decision support systems improve diagnostic accuracy. Also, it is a challenge to build such systems into regular workflow. Checklists work well in certain clinical settings, but may not be always applicable [17]. Still, it is wise to adopt computerized decision support systems and check lists wherever applicable.

TAKING THE NEXT STEPS

Culture shift: As with other patient safety issues, a positive safety culture in an organization generates positive attitudes towards patient safety. Potential mistakes in such organizations serve as a basis for learning, not for punishment or prosecution. Healthcare providers in organizations with positive safety culture feel valued, appreciated, and safe to report and discuss missteps in diagnostic process.

Communication: Better communication across the healthcare system should be an imperative. While this could be at least partly achieved through electronic medical records, nothing can replace person-to-person communication between providers and between providers and their patients. Patient families and caregivers can provide valuable information, especially when patients are unable to communicate for themselves.

Expert availability: Making experts available early in the diagnostic process would significantly improve early diagnostic accuracy. Expert directed work-up would also decrease costs for unnecessary testing. Experts may also shorten the period between diagnosis and appropriate treatment for better patient outcomes.

Teaching clinical decision-making: In teaching hospitals, there may be a tension between providing trainee supervision and ensuring patient safety. A supervising physician is required to strike a balance between vigilance to assure patient safety and adequate independence of the trainees in clinical decision-making. In addition, with current duty hour rules, admitting residents may not have sufficient opportunities to analyze cases or to learn that they have made incorrect diagnoses due to frequent hand-offs. In spite of these difficulties, incorporating education in diagnostic reasoning and patient safety in daily practice is paramount. Trainees should be encouraged to look for potential biases, system, or safety issues in each clinical encounter. Also, trainees should be encouraged to report and discuss diagnostic errors. So called *"blind obedience,"* where someone accepts a diagnosis because somebody higher in the hierarchy says so, should be abandoned. Critical thinking and respectfully challenging authority should be encouraged.

*Adopting a proactive approach***:** Finally, we need to make the shift from a reactive approach to diagnostic errors (i.e. intervening when something has already happened) to a proactive one, where potential system problems are identified in a timely manner and addressed before diagnostic errors occur.

CONCLUSION

Fortunately, in recent years, much work has been done in the field of diagnostic error. Many solutions are emerging for reducing system-related diagnostic errors. Still there is a lot of work ahead. Detection and reporting systems for diagnostic error need to be developed. A major culture shift is needed in order to stimulate voluntary diagnostic error reporting in a blame-free context and to relate diagnostic errors with the opportunity to learn, not to punish or prosecute. There has been progress in this area with the development of health information technology-based system interventions, checklists, and decision-support tools. As for providers, continuous improvement of medical knowledge is mandatory. When dealing with a complex case, it is worth discussing the case with a colleague or asking for a second opinion. Finally, having insight into one's thinking and developing the skill of self reflection can improve one's own diagnostic accuracy.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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