

Autopsy Revelation

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The Case

A 45-year-old male with development delay presented to the emergency department with acute abdominal pain. His mother, who was his main caregiver, accompanied him. The mother was talkative and answered all questions on his behalf, including questions about his symptoms and past medical history.

The mother described the current episode as the sudden onset of severe pain, which initially seemed to be in the epigastric area, but had since moved over to the right upper quadrant and flank. The patient nodded his assent throughout his mother's account. Mother and son stated that the pain was no longer as severe as it had been at its onset, roughly 2 hours earlier. She stressed that he had experienced very similar complaints the previous year, which were diagnosed as due to renal colic.

On physical examination, the patient was moderately obese and appeared in mild discomfort, but no acute distress. His vital signs were normal except for mild tachycardia to 100 beats per minute. Abdominal examination revealed mild tenderness with deep palpation in the epigastrium and right upper quadrant. There was no costovertebral angle tenderness, and rectal examination was unremarkable.

The emergency physician's working diagnosis was renal colic, but he also considered the possibility of gallstones. He planned to obtain a right upper quadrant ultrasound if the pain did not respond to treatment for renal colic or if laboratory tests suggested a hepatobiliary process.

The patient received an intramuscular injection of ketorolac (Toradol), which provided significant relief, as did a second injection 2 hours later. Serum chemistry and blood count results returned within normal limits. Urinalysis was not available, however, as the patient had forgotten the instructions and flushed his urine sample. He was discharged with a prescription for acetaminophen with codeine, instructions to drink at least 8 glasses of water a day, and a strainer for his urine in case he passed a stone, all of which the mother stated she was familiar with based on the previous episode.

The next morning, the patient's mother found him in bed completely unresponsive and with no palpable pulse. Ambulance personnel pronounced him dead at the scene. The medical examiner requested an autopsy, which revealed a perforated gastric ulcer and widespread peritonitis.

The Commentary

The discharge diagnosis of renal colic in this case almost certainly reflected the operation of ascertainment bias (seeing what one expects to find), anchoring (holding on to initial impressions), "premature closure," and confirmation bias.(1-3) These last two terms refer to the tendency to make up one's mind (prematurely) about a diagnosis and then see all findings as consistent with that diagnosis, even when such findings would be atypical (eg, epigastric and right upper quadrant tenderness from kidney stones). The importance of confirmation bias and other cognitive pitfalls that affect diagnostic reasoning have been discussed in this forum (see related commentary) and elsewhere, including our recent book on medical mistakes.(1-5) A different issue raised by this case, and one which has received very little attention in the patient safety literature, concerns the role of the autopsy as a tool for detecting important errors in clinical diagnosis.

Despite its historical role in clarifying, confirming or refuting clinical diagnoses, the autopsy has all but vanished in many hospitals. In 1994, the last year for which United States data exist, the autopsy rate for all non-forensic deaths had dropped to below 6%, from rates of 40%-50% a generation earlier.(6) A more recent survey found that more than half of all hospitals in one state reported performing no autopsies during a one-year period.(7)

The marked decline in autopsy rates undoubtedly reflects various factors, including reimbursement issues for hospitals and pathologists, disappearance of the autopsy from postgraduate educational criteria (except in pathology), the dropping of minimum autopsy rates from regulatory guidelines, as well as general unfamiliarity with autopsy and techniques for requesting it, especially among physicians-in-training.(8) Perhaps the most important reason, however, is that clinicians believe that advances in medical technology have rendered the autopsy unnecessary in all but extraordinary cases.

The assumption that major diagnostic errors have become a rarity is not borne out by existing evidence. Numerous studies document substantial rates of major diagnostic errors detected at autopsy, including errors that likely affected outcome. Studies comparing autopsy findings over 30-40 years at the same institutions have generally found no change in the rates at which autopsy reveals clinically important diagnoses that had escaped antemortem detection.(9-11) Clinicians often attribute these persistently significant and unchanged rates of diagnostic errors to selection bias, arguing that cases sent for autopsy are precisely those in which there is diagnostic uncertainty.

My colleagues and I recently performed a systematic review of the autopsy literature to examine time trends in autopsy-detected diagnostic errors and address the impact of case selection by clinicians.(12) We captured the degree of clinical selection by considering the percentage of decedents undergoing autopsy. In this model, an autopsy rate of 100% would represent no selection, while an autopsy rate approaching zero would reflect extreme clinical selection. The large number of studies available for analysis permitted generation of a model of diagnostic error rates as a function of time, while controlling for clinical selection, case-mix (medicine, surgery, pediatrics, etc.), and country (US vs. Non-US).

Beginning in 1960, major errors—errors in the principal underlying diagnosis or immediate cause of death—decreased at a rate of 28.0% per decade (95% CI: 9.8-42.6%). Despite this relative decrease, the absolute rates of major errors remain substantial. For instance, the estimates generated by this analysis

indicated that conducting autopsies in all deaths occurring in a contemporary U.S. hospital would reveal major diagnostic errors in at least 8% of cases, but possibly as many as 22.8%.⁽¹²⁾ Moreover, diagnostic errors likely contributed to death in at least 3.8% of all cases, but possibly as many as 7.9% of cases depending on the percentage of decedents undergoing autopsy.

The modest impact of autopsy rates on diagnostic error rates suggests that clinicians are overconfident in their ability to select diagnostically unresolved cases for autopsy. This interpretation is corroborated by prospective studies that found clinicians to have little to no ability to predict cases likely to yield "diagnostic surprises."^(13,14) These findings should themselves not come as a surprise. No matter how advanced diagnostic technology may have become, the vast majority of patients do not undergo 'gold standard' evaluations to establish or confirm a working diagnosis.

In the current case, for instance, the patient was discharged from the emergency department with a diagnosis based almost entirely on the history and physical examination. This is not inherently wrong; several studies have shown that some 70%-80% of diagnoses are correctly made on history and physical examination.⁽¹⁵⁻¹⁷⁾ What clinicians often lose sight of, however, is the frequency with which diagnoses rest on little more than the clinical impression and a few basic laboratory tests, rather than a definitive biochemical, radiologic, or histopathologic result.

Of course, sophisticated tests do not guarantee correct diagnoses, even when they have apparently provided a definitive answer. For instance, one of the studies in the autopsy literature specifically looked at cancer misdiagnoses in patients who had undergone biopsy during life.⁽¹⁸⁾ The substantial discordance between antemortem and postmortem diagnoses reflects a variety of factors related to the sensitivity and specificity of diagnostic tests, but probably also reflects the degree to which clinicians seize on a particular diagnosis among the possibilities listed in radiology or pathology reports.

Clinicians are often annoyed at the litany of conditions tacked onto cautiously worded interpretations from radiologists and pathologists: "These findings are consistent with X, but cannot rule out A, B, C, D and E. Clinical correlation is advised." However, these differential diagnoses are given for a reason, and sometimes, when one looks back to understand how a pathologic or radiologic misdiagnosis might have occurred, one sees that the clinicians did not continue to pursue a differential diagnosis that was presented in a study report.⁽⁹⁾

Little is known about the root causes of diagnostic errors, but any given case likely reflects the interplay of human and system-related factors ([Table](#)). Conversely, missed diagnoses detected at autopsy do not necessarily represent errors. They may instead reflect acceptable limits of antemortem diagnosis or atypical clinical presentations. Nonetheless, clinicians have an intrinsic interest in important missed diagnoses, even when they reflect atypical presentations or shortcomings of current diagnostic approaches rather than quality problems. Repeated detection of certain missed diagnoses may result in the recognition that some patterns of presentation are more typical than previously appreciated.

This case serves as a reminder of the persistent need to remain vigilant for important misdiagnoses, and of the value of the autopsy in bringing such cases to light. It also illustrates the degree to which misdiagnoses continue to involve common conditions, rather than "fascinomas" and "zebras."

Take-Home Points

- Remain aware of the degree to which first impressions or a particular piece of information may have biased your diagnostic reasoning.
- Avoid confirmation bias by having a very low threshold for reopening the differential diagnosis and playing "devil's advocate" with the working diagnosis.
- Recognize the degree to which working clinical diagnoses are often based on limited information.
- An autopsy is almost always reasonable to consider—do not confuse your (perhaps mistaken) impression of diagnostic certainty and the low value of an autopsy in finding a surprising diagnosis with your (perfectly natural) discomfort with asking the family for permission to obtain an autopsy.
- Like discussing advanced directives, asking families about autopsy becomes much easier after you have received some guidance from a more experienced clinician and participated in a few such discussions.
- For answers to common questions about autopsies, click here.

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Table

Table. Example Root Causes of Diagnostic Errors

Human Factors	System Factors
Faulty data gathering (eg, incomplete history, cursory examination, inadequate laboratory tests)	Inability to perform needed tests in a timely fashion
Failure to follow up on abnormal findings (eg, the murmur that is never looked into or the high calcium that no one follows up on)	Inability to access necessary medical information (eg, outpatient records for hospitalized patients and inpatient records for ambulatory patients)

"Premature closure"—Failure to alter initial diagnosis when faced with inconsistent results

Poor communication between inpatient team members (eg, different clinicians caring for the same patient communicate their thoughts and plans solely through written chart notes)

Failure to ask for assistance from a consultant or supervisor when warranted

Poor communication between inpatient and outpatient physicians

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