

In with acute bronchitis; out with duodenal perforation: the potentially harmful cascade of over-testing. A case report

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ABSTRACT

Overutilization of diagnostic imaging can lead to unnecessary interventions and subsequently can jeopardize patient safety. When ordered, the results of these images should always be interpreted in the appropriate clinical context taking into consideration the patient clinical presentation and the natural history of the diseases which are being investigated. We presented a case that demonstrates for the practicing physicians how violating these two notions can lead ultimately to patient harm.

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1. Introduction

Overutilization of medical tests, especially imaging, is a growing problem in the USA and globally and needs to be addressed [1–3]. The American Board of Internal Medicine Foundation's 'Choosing Wisely' campaign, the American College of Physicians' 'High-Value, Cost-Conscious Care' initiative, and the *Journal of American Medical Association's* 'Less Is More' series are examples of some efforts made to raise the awareness of the increasing 'low-value care' in the era of the readily available diagnostic tests and imaging [4–6]. Here, we describe a case which exemplifies the notion that unnecessary tests can lead to a cascade of more unnecessary testing and, subsequently, unnecessary medical procedures and patient harm.

2. Case presentation

A 65-year-old woman with a history of hypertension presented to the emergency department (ED) with a 2-week history of cough and chest pain, without alarming features like hemoptysis, fever, or shortness of breath. Her son-in-law, who lives with her, had similar symptoms that already resolved. A chest X-ray (CXR) was obtained in the ED which showed normal lung fields but also revealed an upper mediastinal mass that 'could represent substernal goiter' per the radiologist report. Subsequently, a computed tomography (CT) scan of chest, abdomen, and pelvis was ordered (ED physician thought to look for masses elsewhere that could represent malignant process given the CXR finding) and the CT revealed a 'marked thyroid enlargement' which 'likely represents

multinodular goiter.' It also showed a heterogenous $3.8 \times 3.1 \times 2.9$ cm possible pancreatic head 'mass.' She was admitted to the medical service for further workup.

She denied any significant gastrointestinal symptoms as well as any smoking or alcohol drinking, or any family history of cancer. Her vital signs did not show fever, tachycardia, or hypoxia. Physical examination of the lungs and abdomen was unrevealing except for mild tenderness in the epigastrium without palpable masses. The thyroid gland was nodular on palpation and non-tender. Laboratory workup was normal, including serum lipase and liver enzymes. Tumor markers including alpha-fetoprotein, the carcinoembryonic antigen, and cancer antigen 19-9 were all within normal limits.

Upon chart review, the pancreatic 'mass' was noted 7 years ago on a prior CT scan of the abdomen and pelvis. At that time, she presented to the same hospital with abdominal pain. An endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) was done and indicated an atrophic pancreatic body and tail without evidence of malignancy. She was discharged to follow up with surgery for further evaluation of the pancreatic 'mass' but she did not show up to her appointment.

During this admission, surgical consultation was requested for the pancreatic 'mass' and they recommended gastroenterology consultation to pursue another EUS-FNA to rule out the possibility of malignancy again. She underwent repeat EUS-FNA of the pancreatic 'mass' as well as FNA of the thyroid mass. Unfortunately, the EUS-FNA this time was complicated by duodenal perforation and she required an

emergent exploratory laparotomy. During surgery, it was noted that she actually had an annular pancreas. In the pathology report, no malignant cells were noted from the pancreatic 'mass' biopsy, and the thyroid biopsy showed a benign thyroid nodule with cystic degeneration. Overall, she was hospitalized for 9 days and slowly recovered from her procedural complications and was discharged home.

3. Discussion

This case highlights two important concepts in medicine. First, unnecessary testing can lead to unnecessary surgical procedures, with all the accompanying risks and complications such as patient harm, increased length of hospital stay, and patient dissatisfaction. Second, imaging findings always need to be interpreted in the context of the patient's clinical presentation and the natural history of the disease being entertained.

As described, the patient was initially evaluated 7 years prior for concerning findings in the CT scan of the abdomen during evaluation of abdominal pain and workup then indicated an atrophic pancreatic body and tail. Seven years later, she presented to the ED complaining of acute respiratory symptoms compatible with acute bronchitis without alarming features but, nevertheless, a CXR was ordered. Data suggest that CXR for acute cough in most cases is unlikely to affect management or outcome [7,8]. In the absence of alarming features to suggest pneumonia (fever, tachypnea, tachycardia, or findings of consolidation in chest exam), the American College of Chest Physicians recommends against obtaining CXR for acute cough [9]. It is likely to show normal lung fields (as in this case) or nonspecific findings that do not suggest specific etiology. The CXR in our case led to the finding of the upper mediastinal mass which was suggested by the radiologist report to represent a substernal goiter and that fits the physical finding of palpable goiter. However, a CT scan of both chest and abdomen was ordered to evaluate for metastatic disease and again it showed the same old pancreatic 'mass.' The patient did not have symptoms or physical findings to suggest a malignant process, especially pancreatic cancer which is known for its aggressive nature [10]. Moreover, prior testing did not reveal the mass to be malignant. Yet, EUS-FNA procedure was performed but this time it was complicated by duodenal perforation requiring emergent exploratory laparotomy and duodenal repair and patient's hospitalization was prolonged as a result.

Pancreatic cancer is an aggressive cancer and is the fourth leading cause of death related to cancer [10]. It is often referred to as the 'silent killer' as it is usually detected in its later stages [10]. The 5-year survival rate

for pancreatic cancer depends on its stage; however for all stages combined, it is calculated to be about 8% [11]. Upon retrospective analysis, it was realized that the patient's clinical presentation did not fit with the known natural history of pancreatic cancer. Furthermore, the radiologist who read the CT scan clearly stated that the findings were similar to the ones 7 years prior, not favoring an aggressive neoplastic process. Such clinical scenarios highlight the importance of evaluating imaging findings within the proper clinical context. As the radiologist Robert Stern alluded in his editorial paper about the epidemic of over-testing, radiology reports by themselves should not dictate the clinical course and management. He said,

Our ability to diagnose subtle findings far exceeds our knowledge of what to do with the information. Advanced diagnostic studies have led to an epidemic of indeterminate incidental findings that physicians and patients often find at least as troubling as the events that triggered the initial imaging study. [12]

It is the responsibility of the clinician who ordered the test to interpret the results in the appropriate clinical framework and to have a reasonable knowledge about the test's sensitivity and specificity in ruling in or ruling out the specific diagnosis being pursued. One example of tools created to assist clinicians in choosing the right radiological test for the right indication is the American College of Radiology's appropriateness criteria which are 'evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition' [13].

One reason for inappropriate use of imaging studies is 'the fear of liability of a missed diagnosis-(also known as) defensive medicine' [3] such as cancer in our case. In one survey of physicians in six specialties at high risk of litigation, 93% of respondents reported practicing defensive medicine, and among physicians who detailed their most recent defensive act, 43% of them reported using imaging technology in clinically unnecessary circumstances [14]. Other possibilities of imaging over-testing include 'ignorance of what specific imaging studies are needed and when; high public expectations for imaging tests; and self-referral (when physicians own imaging equipment or when they refer patients to imaging centers in which they hold equity positions).' [3] Further work by the medical community is needed to address all these issues to limit their potentially adverse impact in patient care.

4. Conclusion

Medical tests and imaging, even if considered 'simple' and 'noninvasive,' should ideally be ordered only when results are expected to alter the management and/or

prognosis and outcome. And when ordered, they should be interpreted in accordance with the patient's history and clinical presentation. For our patient, treating her acute cough with a more conservative approach and reassurance would have been more appropriate – preventing her from having unnecessary procedures which ultimately subjected her to harm.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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