Who's Ordering the CT Anyway? Frequency of CT Scan Use in Suspected Acute Appendicitis

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INTRODUCTION

The incidence of appendicitis in Western Countries approaches 8%, peaking in the second and third decades of life [Maa]. Appendectomy is the most common abdominal surgical emergency in the US, with more than 250,000 operations performed annually [Melton]. However, appendicitis may oftentimes mimic other pathology, requiring a high clinical suspicion to avoid serious ensuing complications [Maa]. A delay in diagnosis can result in perforated appendicitis, which is the leading general surgical cause of death worldwide [Maa].

Despite the first appendectomy being performed in 1735 [Melton], it was not until 1886 that Reginald Fitz accurately identified appendicitis as the primary culprit of right lower quadrant pain. He coined the term "appendicitis" and became a proponent for early surgical intervention [Maa]. Three years later, Chester McBurney described the classic progression of initial migratory to later localized pain along an oblique line from the anterior superior iliac spine to the umbilicus [Maa].

Today, acute appendicitis is often diagnosed by history and physical examination; however, improved imaging techniques using computed tomography (CT) are becoming more commonplace in confirming the diagnosis [Maa]. CT scan using 5 mm sections has a sensitivity over 90% and a specificity of 80-90% for the diagnosis of acute appendicitis in patients presenting with abdominal pain [Maa]. Studies have revealed that the use of CT has decreased negative appendectomy rate from 20% before era of CT to 7% after [Rao]. Although its utility in equivocal cases of appendicitis has been proven, controversy remains regarding routine use of CT to

diagnose appendicitis., contributing to unnecessary delay in surgical care, allergic contrast reactions, nephropathy, and exposure to ionizing radiation [Maa]. Recent studies have shown that organ doses corresponding to a routine CT scan result in an increased risk of cancer, with approximately 0.4% of all cancers in the United States attributable to radiation from CT scans [Brenner]. By adjusting for current widespread CT use, the aforementioned estimate may be upwards of 2.0% [Brenner]. Furthermore, the FDA estimates that a CT scan with an effective dose of 10mSv (a single CT of the abdomen) may be associated with an increase chance of developing fatal cancer for approximately one patient in 2000 [Semelka]. The implications of additional radiation exposure are still not entirely clear. To prevent unnecessary patient harm from liberal use of CT scans, many questions remain to be answered, including: Is the CT scan truly indicated? Which physician specialty is ordering the CT? We sought to quantify the number of CTs obtained for patients with suspected acute appendicitis and to identify the ordering physician group.

METHODS

This is a single institution retrospective chart review of 1579 patients from January 2012 to December 2013. Institutional review board approval was obtained. No funding was needed. Patients with the following ICD 9 codes were queried: appendicitis; right lower quadrant pain; and abdominal pain. Using these codes all CT scans performed for patients with acute appendicitis in the differential were captured. Exclusion criteria included the following: patients under the age of

eighteen and patients highly unlikely to have a diagnosis of appendicitis as documented in the physician's note.

Each chart was reviewed to determine which physician ordered a CT scan if in fact one was ordered. The radiology report was accessed to determine the name of the ordering physician and corroborated with the ED physician note. If the radiology report stated an ED physician as the ordering doctor but the ED note reported that the surgery team evaluated the patient and requested a CT, this was reflected in the data as ordered by the surgical team.

The Alvarado score for each patient was calculated for the positive diagnoses of appendicitis. Alvarado score is a clinical scoring system used in the diagnosis of acute appendicitis [Alvarado]. The elements of this system include the following: nausea or vomiting, anorexia, migratory pain to right lower quadrant (RLQ), fever, leukocytosis, left shift, RLQ tenderness, and rebound tenderness. [Alvarado]. The two most important factors, RLQ tenderness and leukocytosis, receive 2 points each and the other factors receive 1 point. A score of 5 or 6 suggests possible appendicitis. A score of 7 or 8 indicates a probable appendicitis and 9 or 10 indicates very probable acute appendicitis [Alvarado]. Unfortunately this task could not be completed for the negative cases. The majority of the reported negatives did not have documented history and physical exams in the electronic medical records as many of these patients were sent over from primary physicians' offices. As a result, these documents were inaccessible.

Results

A total of 1579 patients met the abovementioned search criteria. Using the exclusion criteria, 365 cases were eliminated, resulting in 1214 total patients. Of those, 260 were positive for appendicitis and 954 were negative. The positive yield for CT use in the diagnosis for acute appendicitis was 21.4%.

The data was analyzed for CT-ordering physician. Of the total 1214 charts reviewed: 827 (68.1%) CTs were ordered by the ED physician, 302 (24.9%) by the primary physician, and 85 (7%) by the surgeon. Positive and negative CT results for each practitioner group were analyzed. Of the total 827 CTs ordered by the ED, 211 were positive for appendicitis (25.5%) and 616 were negative (74.5%). Of the 85 CTs ordered by surgery, 34 confirmed appendicitis (40%) and 51 were negative (60%). Finally, of the 302 ordered by the primary physician 15 were positive (5%) and 287 were negative (95%).

DISCUSSION

Acute appendicitis is the most common surgical emergency of the abdomen with lifetime risk for developing the disease to be 8% [Maa]. History and physical exam remains the foundation when evaluating for suspected appendicitis. However, over the past decade, computed tomography scanning has been found to have high diagnostic utility for this pathology. The aim of this study was to quantify the number of CTs obtained for patients with suspected acute appendicitis and to identify the ordering physician group at a single community hospital. In analyzing the two year data, acute appendicitis was found in 21.4% of patients who underwent CT scan for this suspected diagnosis. Therefore, 78.4% or 954 patients

underwent CT scan and were not diagnosed nor treated for the suspected pathology. These results show an overwhelming high use of a radiologic tool with a low positive yield. The diagnostic value is unquestioned; however, with increase use comes growing concern regarding adverse effects associated with radiation from CT scan. As early as the 1940s and 1950s, publications have discussed the increased incidence of leukemia in radiologists [Semelka]. Adverse effects from radiation can be traced back to the atomic bomb survivors. Although atomic bombs deliver gamma radiation, which is different from x-radiation used in radiology, there is no difference in the carcinogenic risk profile [Semelka]. The low dose range of radiation received by atomic bomb survivors is comparable to organ doses associated with diagnostic CT scans. These survivors have been found to have significant increases in cancer incidence and mortality [Semelka].

The other aim of our paper was to reveal who was ordering the CT scans. In reviewing the data the ED staff ordered the most CT scans and had a positive yield of 25.5%. The PMD ordered the second most with a positive yield of only 5%. Surgeons ordered the least of the three groups with only 85 and the positive yield was 40%. Although it may be tempting for the authors to extrapolate that the surgical staff had the best predictive value of ordering CT, this thought must be tempered. The surgeon usually only sees the patient after they have been evaluated by another physician who consults the surgery team. This lends itself to a bias of sicker or more complicated patients who most likely require more work up. Another bias that must be addressed comes when looking at the number of scans ordered by the ED staff. Although this group ordered the most and had a predictive notion of one in four

they are burdened by the number of patients they see. As the “gatekeepers” to the acute patient they see nearly everyone who presents with an episode of abdominal pain. They are faced with a large patient population in whom they are seeing for the first time. Their need for radiologic adjuvants is likely higher than a primary who sees their patient multiple times over the course of several years.

In summary the authors of this article looked into an issue that nearly all in health care know about but few can quantify. In the changing times of technology and the medico-legal climate physicians practice in, objective tests have become main stays in medicine. Although an appendectomy is commonplace, no invasive procedure is without its risks. Bleeding, infection and bowel injury are all possible even in the most experienced of hands and a surgeon wants to know that they are taking on these risks for a true pathology. The balance that must be found involves a system that will only use CT scan on patients who warrant further work up not for every patient who presents with abdominal pain. The authors of this paper are in no way advocating that the CT be abandoned for diagnosing appendicitis but its use must be looked at and probably decreased. As the saying goes: the pendulum will swing both ways during our career, our job is to try and stay in the middle.

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