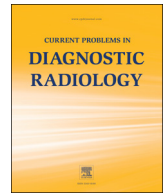




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Missed Acute Appendicitis on Multidetector Computed Tomography and Magnetic Resonance Imaging: Legal Ramifications, Challenges, and Avoidance Strategies



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The failure to diagnose acute appendicitis (AA) is the third most common medical malpractice allegation related to gastrointestinal disease. There is a paucity of detailed data on this topic; however, publications by Whang et al and by Berlin and Berlin, which analyzed all types of malpractice suits against radiologists, have shown that the incidence of litigation has increased over time in the United States. This is likely true for cases of AA as well. The misinterpretation of cross-sectional imaging in patients with suspected appendicitis may be caused by suboptimal technique, errors of omission, i.e., missing key findings, failure to review a portion of the examination, and satisfaction of search error. This article summarizes the published legal, clinical, and imaging literature regarding litigation in cases of missed AA, and reviews optimized multidetector computed tomography and magnetic resonance imaging protocols for the diagnosis of AA, with examples shown of challenging cases.

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Definition of Malpractice

There are 4 criteria that must be met to fulfill the requirements for a malpractice suit against a physician. Firstly, the physician must have had a duty to the patient. The 4 main types of duty that are applicable to a radiologist are as follows: a duty of diagnosis, a duty of care during a procedure, a duty to communicate findings to another provider or family member, and a duty to recommend further testing. The second condition for a malpractice action is that the physician's care of the patient fell below the standard of care in the community. The definition of standard of care may vary somewhat based on the jurisdiction where the malpractice suit is being brought. The published standards of specialty societies, while often used by plaintiff attorneys, have no de facto legal authority, and a judge may choose to ignore or accept them. Rather, expert testimony is the most important determinant of the applicable standard of care. As determining the standard of care can be difficult, in court cases negligence must exceed the accepted norm for possible errors in order for it to be ruled as such. Thirdly, the physician's failure to exercise the standard of care must somehow have harmed the patient. This is the concept of proximate cause. An action or lack of action by a physician could

be considered negligent, but if it did not lead to harm to the patient, proximate cause has not occurred. This must be decided on a case-by-case basis. Lastly, the damage done to the patient is of a sort which the law has demanded compensation in the past. Both the type of injury (emotional damage, quadriplegia, etc.) and the length of impact on the patient's life (younger patients are often awarded more money than older patients, for the identical injury) must be determined. While these 4 things must be proven for a plaintiff to be victorious in a U.S. court of law, most suits are settled without a trial.^{1,2}

GI Radiology Malpractice Cases

There have only been a few major studies examining malpractice rates amongst radiologists, to our knowledge. The data for gastrointestinal (GI) cases specifically are limited, and particularly for cases of alleged missed appendicitis. Berlin et al examined trends in litigation over a 20-year period (1975–1994) in Cook County, IL.³ The study by Berlin was more general, and analyzed data across multiple organ systems rather than focusing on GI-specific cases. Whang et al examined pooled information from the credentialing data of 8401 radiologists across the entire United States.¹ A follow-up study by Baker et al⁴ examined malpractice cases for GI diseases more specifically, and further categorized that data into 3 diagnostic groups—primary cancer, pneumoperitoneum, and AA. We used the information in Berlin, Whang, and

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Baker's studies, combined with prior studies which showed that money is most often awarded in larger amounts to younger patients, to make what we believe are reasonable assumptions concerning the malpractice rates for AA over the past 20 years.^{1,3,4}

The Berlin study found that out of 2219 total malpractice suits brought against radiologists over 20 years, 28 of them were related to GI tract disease. This yields a rate of 0.631 suits per 1000 person-years for GI radiology-related malpractice cases between 1975 and 1994. This is compared to the Whang study, which found that 2.01 suits per 1000 person-years were brought against radiologists for GI-related diseases. This shows a clear increase in the rate at which such malpractice suits are being filed, since there was a higher rate for a subset of GI cases. Both of these studies found that the most common reason for bringing a malpractice action was the failure to diagnose the disease correctly. As the most likely scenario for a malpractice case to be brought is where a diagnosis is allegedly missed in a young patient where the error allegedly resulted in substantial or potentially life-long harm, it is reasonable to assume that this general increase in malpractice actions should also apply to the missed diagnosis of AA, as well as to GI illnesses as a whole.^{1,3,4}

This begs the question of how often a missed appendicitis diagnosis leads to a malpractice suit being brought against a radiologist, and how large the settlement usually is. In Baker's survey of 4073 malpractice suits brought against radiologists, 346 (8.5%) were related to the GI system, and 228 of those suits were related to a failure to diagnose. Of the cases of 228 failures to diagnose GI illness, 33 cases (14.5%) were a failure to diagnose AA. Of the 33 cases where the missed diagnosis was appendicitis, slightly fewer than half (15/33) resulted in payment to the plaintiff, either as a result of a settlement or a verdict. In those cases, the median indemnity awarded was \$60,000.⁴ Appendicitis as a whole was only the third most common missed diagnosis, which resulted in a malpractice suit being brought, as compared to a missed diagnosis of pneumoperitoneum (72/228) or primary cancer (44/228).

Determination of Compensation

Based on the earlier data, the most common malpractice suits brought against radiologists are those where the failure to diagnose allegedly resulted in severe consequences to patient outcome and where the patient involved is younger. These factors also correlate strongly with the amount of compensation the patient is awarded, if the plaintiff wins the suit. Appendicitis, a disorder which most commonly affects young patients (highest incidence at 10–19 years), but which also less commonly affects older patients, can usually be treated effectively (with surgery, and in a subset of patients more recently, with conservative management) if diagnosed promptly. However, major consequences may result if the diagnosis is delayed. The perforation rate is as high as 59% in cases of delayed or misdiagnosis AA. Therefore, the potential for malpractice suits due to a missed AA diagnosis is high due to the high rate of possible patient harm. This makes AA an excellent proxy for general malpractice due to a missed diagnosis.^{4–6}

The rate of 15 of 33 positive outcomes for the plaintiff in the malpractice cases cited by Baker et al may seem relatively low, but makes sense. In most cases of missed AA, patients presented with relatively mild clinical symptoms, so part of the fault can be attributed to a lack of clinical correlation from suboptimal history and physical taking. In two-thirds of pediatric cases, including those related to appendicitis, the malpractice suit was not brought against any doctor singly (radiologists included), but was brought in a multiphysician suit.⁶ In 18% of these multiphysician cases, no particular physician was found to be culpable for a specific medical



Fig. 1. A 73-year-old woman with abdominal pain and peritoneal signs. Preoperative diagnosis of acute appendicitis (AA). Meckel diverticulitis (arrow) was identified on laparotomy, and is present on CT in retrospect. Note inflammation of the fat surrounding the diverticulum (asterisk). The appendix was seen in retrospect on preoperative CT (not shown).

error, a side-effect of including multiple physicians in the medical record, regardless of their individual responsibility.⁶ The difficulty in proving culpability in these kinds of cases is evident from other studies of the trial record: most pediatric malpractice suits are settled out of court. Fewer than 2% of cases that were brought to trial were actually settled in favor of the plaintiff. In those cases where compensation was given out by settlement, some were settled because the costs of taking the case to trial, including emotion burden, lost work hours, and attorney and court fees, would have exceeded the cost of settling with the plaintiff.⁶

Potential Causes of Missed or Delayed Diagnosis of AA

The misinterpretation of cross-sectional imaging examinations, particularly multidetector computed tomography (MDCT), in patients with suspected appendicitis, may be caused by suboptimal technique, missing the key findings, failure to review a portion of the examinations, and satisfaction of search error. Although each case of AA is different, radiologists should keep these in mind, and make an effort to avoid these pitfalls.

On MDCT, a common cause of a false-positive diagnosis of AA is mistaking the terminal ileum for a dilated appendix. For example, in the case of a patient with Crohn disease, the clinical presentation and Crohn-related inflammation of the terminal ileum can



Fig. 2. A 30-year-old woman with right lower quadrant (RLQ) pain. False-positive CT (with oral and IV) interpretation for AA. Patient with infectious terminal ileitis. There is a normal appendix (arrowhead) located posterior to the inflamed ileum (arrow). Normal appendix on laparoscopy. IV, intravenous.

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