



Harms of CT scanning prior to surgery for suspected appendicitis

William Rogers,¹ Jerome Hoffman,² Naudereh Noori³

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¹Department of Emergency Medicine, Georgetown University School of Medicine, Washington DC, USA

²UCLA School of Medicine, Los Angeles, California, USA

³Georgetown University School of Medicine, Washington DC, USA

Correspondence to:

Dr William Rogers,
Department of Emergency Medicine, Georgetown University School of Medicine, 3800 Reservoir Rd, NW CCC Building, Room CG146, Washington DC, USA;
William.D.Rogers@gunet.georgetown.edu



Abstract

In this brief analysis we compare the risks and benefits of performing a CT scan to confirm appendicitis prior to surgery instead of operating based on the surgeon's clinical diagnosis. We conclude that the benefit of universal imaging is to avoid 12 unnecessary appendectomies but the cost of those 12 avoided surgeries is one cancer death due to the imaging.

Introduction

Abdominal pain in young adults is a common symptom in the emergency department (ED) and most young patients who require surgery are suffering from appendicitis. Ten years ago patients suspected of having appendicitis went to surgery without any sort of imaging; today however CT scanning has become a reflexive part of the workup of young people with suspected appendicitis. In this commentary, we raise concerns about the harm/benefit ratio of routinely performing an abdominal CT scan on an otherwise healthy patient who presents to the ED with lower abdominal pain suggestive of appendicitis. We use published data to compare the long-term mortality risks from abdominal CT scanning in individuals younger than 50 with the mortality risks associated with an appendectomy that removes a normal appendix (a 'negative' appendectomy).

Morbidity and mortality risks of negative appendectomy

Although it is commonly assumed that there are significant risks associated with a negative appendectomy, the actual risk is negligible. The safety of negative appendectomy is evident in data describing surgical mortality from the UK National Health Service (NHS) laparoscopic appendectomy study, in which there were no deaths in 234 402 patients below the age of 49 who underwent that surgery.¹ Appendectomies are associated with a 2–5% incidence of postoperative intra-abdominal wound infections.² The risk of infection after a negative appendectomy is probably much lower since the resected appendix is not infected but the incidence of deep infection in these cases has not been studied. The other major morbidity of appendectomy is small bowel obstruction which occurs in less than 1% of cases. The advent of newer, less invasive surgical techniques and the broad range of anaesthesia safety initiatives have dramatically decreased the mortality and morbidity associated with appendectomy.

Morbidity and mortality risks of abdominal CT scan

Abdominal CT scanning is not without risks. The Board on Radiation Effect Research is sponsored by the National Research Council of the National Academies of

Sciences. This board has studied data describing populations exposed to medical, environmental and occupational radiation as well as those exposed to radiation from the two atomic bomb explosions in Japan at the end of WW II. Based on this long term, large scale follow-up data the board has concluded that a 45-year-old patient exposed to 15 mSv of radiation experiences a 1:1250 additional risk for future mortality from cancer.³ Though the radiation dosage of CT scans varies, the average effective radiation dose of a single abdominal CT scan is 8–11 mSv.⁴

Of note, this risk statistic does not account for the increased risk of developing non-fatal cancer. Furthermore the risk of later cancer is much higher for younger patients. Acute appendicitis occurs most frequently in patients aged 10–19 years old,⁵ a group which is 10 times more sensitive to risk from radiation when compared to adults.⁶ An Israeli study investigating the relationship between CT scans in patients under the age of 18 and future cancer mortality risk concluded that CT scans alone performed on the paediatric population will cause a 0.29% increase in baseline future cancer mortality.⁷

Harms of CT scans are not limited to the increased future cancer mortality risk. Other potential harms include contrast dye-induced nephropathy and hypersensitivity reactions. Contrast dye-induced nephropathy, defined as a >25% increase in serum creatinine levels after contrast administrations, occurs in 11% of patients undergoing CT scans. Renal failure occurs in 1% of those patients, 0.7% of those who develop renal failure die as a result.⁸

Estimating the risks and benefits of routine CT scanning for suspected appendicitis in young people

Extrapolation of data from a recent retrospective study of CT scanning and negative appendectomy⁹ rates allow us to estimate the risks and benefit of routine CT imaging of young patients with suspected appendicitis. At the institution studied in the article 2000 abdominal CT scans lead to 58 appendectomies. The Biological Effects of Ionizing Radiations (BEIR V) exposure data predict that 2000 CT scans would lead to at least one cancer death. Before CT scanning began at this institution approximately 23% of appendectomies showed no evidence of appendicitis, now the preoperative scan rate is 97.5% and as a result only 1.7% of appendectomies show no evidence of appendicitis. The benefit therefore of universal scanning was to avoid 12 negative appendectomies, this at the cost of one radiation-induced cancer death. One cancer death from imaging to prevent no surgical deaths from negative appendectomy is a trade-off that should lead us to question reflexive CT scanning of patients we suspect of having appendicitis.

It is unfortunate that there are no randomised trials comparing the management of suspected appendicitis with and without CT scanning. As CT scanners capable of imaging the abdomen became more available, their use in the evaluation of patients with abdominal pain grew rapidly and the advantages of increased diagnostic precision were far more evident than the risks. It is clear that from a diagnostic perspective the 98.3% specificity of CT scanning is far better than the 77% specificity achieved by clinician based purely on clinical judgment.⁹ A randomised study to compare risks and benefits of CT scanning versus clinical judgment would only be instructive if it followed patient outcomes for decades to make sure that the long-term complications of radiation exposure were accurately assessed.

The best diagnosticians among us rely on a detailed history, a careful examination, judicious use of testing and imaging and an intuition which can only be gained by experience. Unfortunately this approach to diagnosis has been supplanted by a blind faith in technology and a belief that an incorrect diagnosis represents a failure on the part of the clinician that could have been avoided if only a few more tests had been run. This reliance on testing and quest for perfection represents a new risk to patients. The principle stated in the Hippocratic oath, to do no harm, suggests that we should avoid routine CT scanning for likely cases of appendicitis in youth.

Competing interests None.

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