

Strategies for Avoiding Recommendations for Additional Imaging Through a Comprehensive Comparison With Prior Studies



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Abstract

Purpose: To determine the frequency and characteristics of recommendations for additional imaging and/or intervention (RAIs) in abdominal CT and MRI interpretations that might be avoided through comprehensive comparison with all available prior examinations.

Methods: A total of 1,006 RAIs in abdominopelvic CT and MRI reports were retrospectively evaluated. Reports and images from each patient's prior imaging examinations, including those of all relevant body parts and modalities, were reviewed to determine if the RAI could have been avoided based on prior imaging. Frequency and characteristics of such "avoidable" RAIs were evaluated.

Results: A total of 41 of 1,006 (4.1%) RAIs were avoidable. The key prior examination that established the RAI as avoidable was a different modality in 53.7% (22 of 41) and on a different body area in 41.5% (17 of 41) of cases, including chest imaging in 31.7% (13 of 41). A total of 83.3% (5 of 6) adrenal RAIs, and 80.0% (4 of 5) liver RAIs were avoidable based on prior chest imaging. The key finding was present on the prior images but was not described in the report in 46.3% (19 of 41) of cases. A greater number of prior examinations were available in cases of avoidable RAIs (mean, 12.2 ± 16.7) than in those of nonavoidable RAIs (mean, 5.7 ± 9.5) ($P < .001$).

Conclusions: A small fraction of RAIs can be avoided by performing a thorough evaluation of all prior imaging examinations, including different modalities and body parts. Nearly half of the key prior examinations did not report the finding, highlighting the importance of directly reviewing relevant images, particularly chest imaging for evaluation of indeterminate upper-abdominal findings. Configuration of PACS for optimized selection and display of relevant examination reports and images may facilitate such comparisons.

Key Words: Recommendations for additional imaging, incidental findings, quality, practice improvement

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INTRODUCTION

Health care costs in the United States are substantial, approaching 18% of the gross domestic product [1]. Advanced radiologic imaging comprises an important portion of this expense and is often a target for cost-containment efforts [2]. One driver of increased imaging utilization that has received particular attention is radiologist recommendation for additional imaging or intervention (RAI) for further evaluation of an indeterminate imaging finding. Estimates indicate that the interpretations of 10.5% of all radiologic examinations and 31% of abdominal CT examinations contain RAIs [3,4].

Although the majority of incidental findings are benign, such recommendations result in patient anxiety, higher health care costs, and risk of complication from the potential chain of additional diagnostic procedures [5]. One study estimated that the annual cost generated by RAIs for abdomen CT alone is \$226 million [3].

When an indeterminate imaging finding is encountered, comparison with the patient's prior imaging can be extremely useful, if not critical, for appropriate assessment, by demonstrating either long-term stability of the finding or additional imaging features that definitively characterize the finding as benign. Patients frequently have numerous prior studies available for review; each prior examination in a given modality provides an opportunity for potentially improved assessment of the indeterminate finding and avoidance of an unnecessary RAI. The advent of PACS has afforded generally instantaneous access to patients' prior imaging results.

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However, for various reasons, interpreting radiologists may fail to identify relevant prior examinations that allow characterization of a lesion as benign, and hence issue an RAI that could have been avoided. Greater understanding and awareness of characteristics of RAIs that are avoidable through a thorough comparison with patients' previous imaging results could be valuable to reduce overutilization of imaging and thereby improve the quality of patient care provided by radiologists. The purpose of this study was to determine the frequency and characteristics of avoidable RAIs within abdominal CT and MRI interpretations.

METHODS

Patients

This retrospective study was compliant with HIPAA and was approved by our institutional review board, with a waiver of written informed consent. All examinations were performed at a single tertiary-care academic medical center and interpreted by radiologists specialized in either abdominal imaging ($n = 15$) or emergency radiology ($n = 8$). First, to identify key words used by radiologists at our institution to provide RAIs, a single board-certified radiologist manually reviewed approximately 500 reports of adult CT examinations performed during a 1-month period, and recorded terms used in the "Impression" section of the report when making a recommendation. These key words included the following: assess, advise, characterize, consider, correlate, evaluate, help, obtain, perform, recommend, suggest, warrant, confirm, and follow, as well as variants of these terms.

A computerized search was conducted of all adult inpatient and outpatient abdominal and pelvic CT and MRI examinations performed between January 1, 2011 and June 30, 2011 in which the report Impression section contained any of the key words, yielding 2,401 reports. The radiologist who initially identified the key words manually reviewed the reports to identify those that contained an RAI, defined as a recommendation for additional radiologic imaging (inclusive of radiographs, fluoroscopy, ultrasound, CT, MRI, and nuclear medicine examinations) and/or intervention (biopsy, surgery, or endoscopy) for further evaluation of an indeterminate finding. Reasons for exclusion of examinations were as follows: they did not contain an RAI ($n = 1,401$); an RAI was made for follow-up of pancreatic cysts ($n = 50$), which routinely undergo annual follow-up MRCP (magnetic resonance cholangiopancreatography) at our institution; and an RAI was for follow-up of Bosniak 2F renal cysts and was adherent to current management guidelines ($n = 14$). One additional

examination was later excluded, because the images were unavailable for review.

This process yielded 931 unique reports, 61 of which contained 2 RAIs, and 7 of which contained 3 RAIs; the remainder contained 1 RAI. Thus, the final cohort comprised a total of 1,006 RAIs in 931 patients (38.2% male [356 of 931]; 61.8% female [575 of 931]; mean age, 62.5 ± 17.1 years [range: 18-98 years]); with 58.8% (547 of 931) outpatients, 17.0% (158 of 931) inpatients, and 24.3% (226 of 931) emergency department patients.

Image and Report Analysis

The previously noted radiologist accessed each patient's record in our institutional PACS (iSite, Philips Healthcare) and reviewed the images of all available comparison studies that potentially imaged the indeterminate finding, including examinations of other body parts and other modalities. The comparison database included studies dating back to 2003, which were available to the radiologists on the PACS at the time of initial interpretation. For the current study, RAIs were classified as potentially avoidable if any of the following 3 criteria were met by any prior examination (hereafter referred to as the "key prior"): (1) demonstration of 2 years of stability of the indeterminate finding; (2) definitive characterization of the indeterminate finding; and (3) the RAI examination had already been performed within the previous 6 months and provided the needed information.

A second board-certified radiologist reviewed the imaging for all instances of potentially avoidable RAIs; those for which the second radiologist did not agree that the RAI was avoidable were not included in the final group of avoidable RAIs. For each instance in this final group, the first radiologist recorded whether the report of the current study mentioned the key prior as a comparison examination and whether the Impression section or body of the report of the key prior mentioned the indeterminate finding. Additional data recorded for all RAIs included: organ involved in indeterminate finding; subspecialty of the interpreting radiologist (abdominal versus emergency); trainee (resident or fellow) involvement in report generation; identity of the interpreting radiologist; recommended follow-up imaging modality or intervention; and total number of imaging examinations performed prior to the examination containing the indeterminate finding.

Statistical Analysis

Frequency of avoidable RAIs and their associated characteristics were assessed using standard summary statistics. RAIs, classified as avoidable and nonavoidable, were

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