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Code Abdomen: An Assessment Coding Scheme for Abdominal Imaging Findings Possibly Representing Cancer

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DESCRIPTION OF THE PROBLEM

Imaging studies frequently reveal unexpected findings that may represent cancer; such findings are seen in up to 18% of patients with no known cancer and in 31% of patients with known cancer [1,2]. Once detected, radiology reports must clearly communicate the malignant risk of these findings and issue specific follow-up recommendations. Cancer imaging assessment coding schemes, such as BI-RADS®, seek to improve communication

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among radiologists and other clinicians through standardized report content, consistent lesion classification, and actionable language [3]. When integrated with IT, these systems can automatically identify and monitor patients for whom follow-up is recommended. We developed a standardized assessment coding scheme, called Code Abdomen, to improve communication and monitoring of suspected cancers in four abdominal organs: the liver, adrenal glands, kidneys, and pancreas. Here we outline the design, implementation, and early outcomes of this coding scheme.

WHAT WE DID

Code Abdomen was created to integrate assessment coding easily into existing radiology workflow and to improve communication about imaging findings of possible cancer. We focused on the liver, adrenal glands, pancreas, and kidneys because of the frequency and clinical importance of focal masses in these organs [4]. In contrast to existing standardized assessment coding schemes, Code Abdomen was envisioned as a global coding scheme in which a uniform code is applied consistently to each of the four specified abdominal organs on CT, MRI, and ultrasound examinations, regardless of the study indication.

Design

Code Abdomen was designed using the ACR's BI-RADS as a model. Code Abdomen defines 9 codes (0 through 7, plus 99) that constitute 5 categories: benign, indeterminate, suspicious, known cancer, and nondiagnostic (Table 1). Codes are applied only to fully visualized organs. Code 99 is assigned to organs when focal masses cannot be excluded because of technical factors. To integrate this coding scheme into the existing workflow, radiologists are instructed to assign codes on the basis of their subjective assessments of the malignant potential of a focal mass. Code Abdomen aligns with existing coding schemes, such as the Bosniak classification system or the Liver Imaging Reporting and Data System™, and applies to all study indications [5,6].

Follow-up recommendation language in Code Abdomen is designed to be relevant to all types of referring clinicians and care settings. At the request of primary care physicians, follow-up recommendations include specific imaging modalities and time intervals. At the request of specialist physicians, the phrasing of recommendations permits flexibility in determining the exact form of follow-up on the basis of clinicians' knowledge of patients' diseases, comorbidities, and dispositions. Risk management officers approved the final recommendation language.

Implementation

Radiologists began using Code Abdomen on July 1, 2013, at the main 695-bed hospital in our system. During the first six weeks, an optional implementation of the coding scheme was put in place. Structured reporting templates for the coding scheme were provided within the dictation system. Educational outreach was directed at staff radiologists, trainee radiologists, and referring physicians in the form of lecture, and electronic communications. Radiologist feedback was solicited through regular reading room rounds and incorporated into the design and implementation.

On August 11, 2013, a mandatory rollout began. An automated system flagged reports that did not include the assessment codes and e-mailed either the dictating trainee or staff radiologist to request that codes be provided through an addendum. Implementation of Code Abdomen coincided with a department-wide incentive to promote the use of structured reporting in September 2013. This included both a section incentive to implement a structured reporting template from which data could be mined for a quality improvement initiative and an individual incentive for the use of a selected template. In December 2013, Code Abdomen was optionally implemented at a second 515-bed hospital within our health system, followed by a mandatory rollout in January 2014.

Time Required to Assign Codes

Despite initial concerns, radiologists required <1 min to incorporate Code Abdomen into a single report. During working hours, the assignment of codes is discussed between staff radiologists and trainees at the time of readout. If staff radiologists disagreed with specific codes assigned in preliminary reports issued after hours or on call, they were expected to revise those codes by issuing addenda.

Coding Organs With Multiple Findings

If an organ contained multiple findings, radiologists were instructed to assign the code that reflected the most suspicious lesion in that organ or paired organs.

Differentiating Categories 0 and 3

Although categories 0 and 3 both refer to indeterminate lesions, they differ with respect to the timing of recommended follow-up. Category 0 is applied to lesions that should be characterized immediately using a different imaging modality; category 3 is applied to lesions that could be characterized on follow-up imaging after a specified time interval, using either the original modality or a different modality.

Coding “Too Small to Characterize” Lesions

For patients with no known malignancies, lesions considered “too small to characterize” are usually assigned category 2 (ie, benign) because the majority of such lesions have been shown to be benign [7]. In a patient with a known primary malignancy, supplemental information, such as tumor biology, number of lesions, or prior imaging, is pertinent for the categorization of these small lesions [8]. If no prior imaging is available, category 0 is assigned if lesion characterization immediately affects treatment planning and category 3 if lesion characterization does not immediately affect treatment planning. Category 4 is assigned to lesions that are new and, in conjunction with known cancer biology, are suspicious for malignancy.

Identification and Monitoring of Imaging Follow-Up

Once reports have been encoded, the codes and follow-up recommendations can be extracted and used to identify patients who need follow-up. Currently, patients whose codes indicate the need for follow-up are added to a follow-up queue that includes a unique patient identifier, organ, assessment code, and follow-up period. If a subsequent imaging study

addresses an organ for which follow-up was recommended, the patient's status is updated accordingly.

OUTCOMES

To date, Code Abdomen has been used at both hospitals by 25 staff radiologists and 73 trainees. Radiologist compliance with this system increased from 30% in July 2013 to 94% in September 2013. Eighteen months after its deployment, radiologists have encoded 48,762 examinations with one or more codes on 30,693 unique patients.

Monitoring of Nonimaging Follow-Up

Our current monitoring system works well for imaging follow-up but requires additional information to monitor nonimaging follow-up; this information is currently stored in disparate databases in our health system. We have begun to collect these data through manual chart review as we explore automated methods of retrieval. For patients with no completed imaging follow-up, a trained coordinator reviews the electronic medical record. If the coordinator suspects that lack of follow-up is inappropriate, the coordinator contacts the referring provider directly to determine the reason and document a follow-up plan.

Notification

Imaging findings of possible cancer are “actionable findings” that typically require nonroutine communication with the referring clinician, such as a phone call or electronic communication [9]. From the radiologist's perspective, such communication is ideally accomplished at the time of report sign-off so that confirmation by the referring clinician can be documented in the report. Automated notification of abnormal test results within the electronic medical record can help providers review relevant clinical data and document the follow-up plan; however, such notification systems are not readily available within most electronic medical records. Alternatively, we have begun the development of e-mail notifications that can be sent to referring providers requesting (1) acknowledgment that they are the correct providers to follow up the finding and (2) designated plans for follow-up within a specific time interval (including no follow-up when clinically appropriate). If a provider response is not received within a specified time interval, a trained coordinator will contact the provider directly.

High-Value Patient Care

Referring providers desire automated systems that identify and monitor patients with imaging findings of possible cancer [10,11]. By assuming responsibility for the development and maintenance of these systems, radiologists can move into a new position of leadership in patient quality and safety. With this responsibility and leadership, radiologists will need to embrace the fundamental paradigm shift of Imaging 3.0™: away from high-volume patient care and toward high-value patient care [12].

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Table 1

Code Abdomen categories, classifications, descriptors, and examples

Category	Classification	Descriptor	Example
0	Indeterminate	Incompletely evaluated. If indicated within the patient's clinical context, follow-up [MODALITY] is advised. *	Adrenal lesion with attenuation > 10 HU on enhanced CT in patient with known malignancy. Follow-up adrenal CT or MRI recommended.
1	Benign	No mass.	
2	Benign	Benign. No further follow-up needed. †	Simple hepatic or renal cyst.
3	Indeterminate	Indeterminate. Future imaging follow-up may be needed. If indicated within the patient's clinical context, follow-up [MODALITY] is advised within [TIME PERIOD]. *‡	Atypical hepatic hemangioma on CTor MRI. Follow-up CT or MRI recommended in 3-6 mo.
4	Suspicious	Suspicious. May represent malignancy.	Enhancing hepatic mass in cirrhotic patient without other classic imaging features of hepatocellular carcinoma (eg, delayed washout).
5	Suspicious	Highly suspicious. Clear imaging evidence of malignancy.	New hepatic soft tissue density lesions in patient with known colorectal cancer.
6	Malignant	Known cancer.	Biopsy-proven cancer or metastatic lesions
7	Benign	Completely treated cancer.	Renal cell carcinoma, status post nephrectomy without abnormality in surgical bed.
99	Cannot be classified	Technically inadequate for evaluation of masses.	Unenhanced CT in cirrhotic patient.

Note: HU = Hounsfield units.

*If patient has known prior outside imaging, the following recommendation can be used: “If prior imaging studies can be provided for my review, direct comparison will be performed and an addendum will be issued to this report.”

†The phrase “no further follow-up needed” may be omitted for focal masses with no malignant potential that may require follow-up (eg, abscess).

‡If patient is known to have scheduled follow-up at our institution, the following recommendation can be used: “This may be re-evaluated at the time of routine imaging follow-up.”