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Is There a Need to Standardize Reporting Terminology in Appendicitis?

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Abstract

While computed tomography (CT) remains the most accurate and widely used modality for appendicitis imaging, ultrasound has developed its own niche role, especially in the pediatric population and in premenopausal women. Ultrasound is commonly used as the initial imaging test when available, with indeterminate or clinically equivocal cases proceeding to CT.

To avoid the radiation and time and cost of CT, ultrasound needs to be improved. While previous studies have focused on improving the diagnostic accuracy of ultrasound through better patient selection and technique, relatively little attention has been brought to the ultrasound report, which often serves as the sole mode of communication between the radiologist and the clinician.

Standardization of reporting and terminology has been found to improve patient outcomes and management in breast imaging. A standardized report for appendicitis has the potential to decrease confusion and increase accuracy. A potential format could include a standardized list of the presence or absence of imaging findings associated with appendicitis, with a final summary or score indicating the likelihood of appendicitis being present. Aggregation of data over time through use of a common format could help guide radiologist recommendations based on which imaging findings are present. Overall, a standardized report could help increase the value of ultrasound, leading to improved radiologist-clinician communication, better patient outcomes, and decreased costs.

The advent of diagnostic imaging has drastically altered the workup of appendicitis in the United States. The diagnosis of appendicitis was historically based on clinical signs and laboratory markers. To avoid the increased morbidity and mortality associated with delayed diagnosis and perforated appendicitis, early surgical intervention was preferred. Negative appendectomy rates of 10% to 40% were routinely tolerated.¹ The advent of ultrasound (US) and computed tomography (CT) has decreased the negative appendectomy rate to less than 10%, while simultaneously lowering the rates of perforated appendicitis.^{1–3}

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While CT remains the most accurate and widely used imaging modality for the workup of suspected appendicitis, US has developed its own niche role. Ultrasound is widely available, is less expensive than CT, does not involve the use of ionizing radiation, and does not require intravenous access or contrast media. Ultrasound rivals CT for specificity, ranging from 88% to 99%, but trails CT in sensitivity, with reported sensitivities of 50% to 100% for US compared with 84% to 100% for CT.⁴ For this reason, CT is the initial diagnostic study for adult patients with suspected appendicitis at the majority of centers.

However, because of the cost savings and absence of ionizing radiation, several studies have suggested that the workup of suspected appendicitis should begin with US, especially in children and women of reproductive age.⁴ Pediatric hospitals, whose patients have the highest incidence of appendicitis, have made the most effort to decrease patient radiation exposure and commonly have US technologists on site 24 hours a day. Computed tomography is reserved to workup cases where US is indeterminate or where a negative US is discordant with a clinician's high clinical suspicion for appendicitis. Thus, US can act as an effective screening tool by ruling out appendicitis where clinical suspicion is low and diagnosing appendicitis when US findings are clearly positive, while the remaining cases can be further evaluated with CT.

Improving appendicitis US would decrease the need for CT, thereby limiting radiation, contrast risks, and the additional delay for the administration of enteric contrast. Previous studies have focused on improving performance by optimizing patient selection, technologist training, and patient positioning and performing multiple scans, all of which have shown increased rates of appendix identification and diagnostic accuracy.⁵⁻⁷

Less attention has been focused on improving the actual radiology report, which serves as the arbiter for further management. The arrival of PACS (picture archiving and communication systems) has released the radiologist away from the site where images are taken and allowed the clinician to view the images themselves. As a result, face-to-face interactions between radiologists and clinicians have diminished,⁸ with the radiology report often serving as the sole mode of communication.

Despite the increase in volume, complexity, and variety of radiology studies, the radiology report has remained unchanged in most practices. Free-form reporting remains common, although structured reporting systems are slowly gaining popularity. In both of these cases, the appearance of the report depends on the discretion of the dictating radiologist. Style, diction, and format vary widely among practitioners. This variability can lead to incomplete evaluations and uncertainty in the findings.⁹ Report clarity needs improvement, as evidenced by surveys of general practitioners and hospitalists.^{10,11} Overall, this can negatively affect patient management. For instance, in appendicitis US, an unclear radiology report can lead to additional CT imaging or a delay in diagnosis where none is necessary.

Standardized reports have revolutionized diagnostic imaging in other fields and should be applied to appendicitis imaging. The use of the Breast Imaging Reporting and Data System (RADS) was created to not only combine literature-derived objective findings but also make a recommendation to clinicians about the probability of malignancy. Breast Imaging RADS

reporting has shown that standardizing terminology for findings and management recommendations improves patient management and outcomes.¹² The success of Breast Imaging RADS led to the creation of the Liver Imaging RADS, intended to similarly standardize hepatic diagnostic imaging for hepatocellular carcinoma.¹³

Standardized reports would increase clarity through synchronizing terminology between radiologists. A standardized lexicon, such as RadLex of the Radiological Society of North America, could be incorporated into the standardized report, limiting the confusing variety of diction often used in current, free-form reports. A standardized lexicon also lends itself well to research. For instance, terms associated with appendicitis would be consistent between reports and could be easily searched for and tracked. This potential for multivariate analysis would allow for the development of data-driven guidelines for expressing the likelihood of appendicitis based on the presence or absence of certain imaging findings.

Ultrasound lends itself to standardization. Structured reporting has stumbled in advanced diagnostic imaging modalities. For instance, a study by Johnson¹⁴ found that structured reports in brain magnetic resonance imaging increased omissions, decreased clarity, and lowered radiologist satisfaction, likely because the number of potential diagnoses, the complexity of structures, and the number of magnetic resonance imaging sequences were not suitable for distillation into the available structured reporting system. Ultrasound, particularly in the workup of appendicitis, has a fixed number of findings to record, each with limited spectrum of appearances, making it ideally suitable for a standardized report. In an ideal system, the presence or absence of “objective” imaging findings and measurements associated with appendicitis, such as a dilated appendix, appendiceal wall thickening, mesenteric stranding, and the presence of an appendicolith, could be clearly included in the report. Certainty of the presence of appendicitis could be expressed as a score, such as a Likert scale from 1 to 5, which would carry a corresponding implication for management.

Communication of “objective findings” in a radiology report serves 2 purposes. First, radiologists are more accurate when they systemically look for weight-specific findings before coming to a final conclusion. In a series of 53 CT scans, Kim et al¹⁵ demonstrated that radiologists’ diagnostic accuracy improved when they reevaluated CT scans previously deemed indeterminate for appendicitis after being informed of the importance of specific CT findings. Second, the documentation of imaging findings allows the referring clinician or surgeon to understand the radiologist’s decision-making process. The integration of objective imaging findings or final score could even be integrated into clinical scoring systems for appendicitis, such as the widely used Alvarado’s¹⁶ and Samuel’s¹⁷ pediatric appendicitis scores.

A standardized report is unlikely to offer additional value when appendicitis is obviously present or absent. However, in indeterminate cases, particularly when the appendix is not visualized, the inclusion of imaging findings in the standardized report may increase accuracy. A Dutch prospective study by Wiersma et al¹⁸ had an appendix nonvisualization rate of 25% (n = 54/212), but found that the presence of secondary signs of appendicitis was associated with true appendicitis in 11 (84%) of 13 cases, whereas the absence of secondary signs was associated with no cases of true appendicitis (n = 41 of 41). Another retrospective

study by Estey et al¹⁹ found the usefulness of individual secondary findings to be lower, but occasionally helpful. Regardless, by including secondary signs into a standardized report, it would ensure the US operator would have to identify them, hopefully decreasing the reported wide range of interoperator sensitivities and specificities.²⁰ As more data become available through use of the standardized report regarding the usefulness of specific secondary imaging findings, the radiologist will be able to further refine his/her decision-making process and accuracy.

The imaging diagnosis of appendicitis has made great strides in the last 20 years, but room for improvement remains.^{1,21} The central position of US in the diagnosis of appendicitis, particularly among the pediatric population, requires that communication of US findings be clear, concise, and reliable to avoid unnecessary CT scans and delayed diagnosis. Using a standardized format and lexicon for the diagnosis of appendicitis in both US and CT has the potential to improve radiology communication with clinicians, especially in cases of indeterminate appendicitis. In this age of increased volume, decreased radiologist and clinician face-to-face communication, and increased focus on outcomes and cost savings, a standardized report for appendicitis represents a step forward toward decreased costs, increased accuracy, and better patient management.

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