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Do you need a computed tomographic scan to evaluate suspected appendicitis in young men: an administrative database review

Abhijit Shaligram, M.B.B.S., Pradeep Pallati, M.B.B.S., Anton Simorov, M.D., Avishai Meyer, M.D., Dmitry Oleynikov, M.D.*

Department of Surgery, University of Nebraska Medical Center, 985126 Nebraska Medical Center, Omaha, NE 68198-5126, USA

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Abstract

BACKGROUND: The purpose of this study was to evaluate the impact of computed tomographic (CT) scans of the abdomen on clinical outcomes and costs in young male patients presenting with suspected appendicitis.

METHODS: Discharge data from the University HealthSystem Consortium was accessed for all male patients between 18 and 55 years of age from October 2007 to June 2011.

RESULTS: Of a total of 13,228 patients who met the inclusion criteria, 11,340 (85%) were assessed using a CT scan of the abdomen, whereas 1,888 (15%) did not undergo CT evaluation. Patients undergoing CT imaging compared with those without a CT scan had less morbidity (.86% vs 2.2%, $P < .0001$) and fewer 30-day readmissions (1.8% vs 5.13%, $P < .0001$). However, CT imaging resulted in a higher overall length of hospital stay and a higher total cost.

CONCLUSIONS: This study suggests that in young men with suspected appendicitis, the use of an abdominal CT scan is associated with improved immediate postoperative complications, lower readmission rates with observed higher length of stay, and increased cost of care.

Appendicitis remains a common cause of abdominal pain in patients requiring surgical intervention. The diagnosis of acute appendicitis is not always clear clinically because the specificities of the classic clinical symptoms (ie, periumbilical pain migrating to the right lower quadrant, nausea, and anorexia) range from 37% to 53%.[1] A computed tomographic (CT) scan of the abdomen has been used in the diagnosis of acute appendicitis with superior sensitivity and specificity.[2,3] This has led to an increased use of preoperative CT scanning with a sustained decrease in rates of both false-positive diagnoses of appendicitis and appendiceal perforation.[4–6]

An article by Rao et al[7] that evaluated the impact of CT scanning of the abdomen advocated CT scans in nearly all females but argued that CT scans should only be selectively used in males with a high likelihood of appendicitis. Other studies have also concluded that the use and impact of CT scanning must be evaluated in a stratified manner.[8] Several studies since have proven the CT scan to be useful and cost-effective for reproductive-age females.[9] Elderly men are also more likely to have other diagnoses (like cancer)

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* Corresponding author. Tel: +1-402-559-4581; fax: +1-402-559-7750.
E-mail address: doleynik@unmc.edu

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when the use of a CT scan could be beneficial. However, the use and impact of CT scans on the subgroup of young male patients presenting with abdominal pain and a high likelihood of appendicitis are not completely known.

However, most studies that addressed the use of CT scans focused on the performance of CT scans as a diagnostic test and used negative appendectomy as the endpoint.[10] These studies also critically excluded the patients in whom appendicitis was ruled out or those who were diagnosed with other pathology by the use of a CT scan but did not require surgical intervention. No prior studies have compared the real-world impact of CT scans on the perioperative outcomes of patients presenting with abdominal pain. We sought to evaluate the impact of CT scans of the abdomen on the clinical outcomes and costs in young male patients presenting with suspected appendicitis.

Material and Methods

Database description

The University HealthSystem Consortium (UHC) is an alliance of more than 100 academic medical centers and nearly 250 affiliate hospitals. The UHC database provides data to member institutions for performance improvement purposes and has been used in several previous studies.[11,12]

Clinical Database Resource Manager

The UHC's Clinical DataBase/Resource Manager (CDB/RM) provides an expanded set of comparative data and analytic tools to support the clinical operations of member institutions. The CDB/RM provides transparent comparisons on risk-adjusted, secure data at the patient and physician levels from more than 100 academic medical centers and their affiliate hospitals located across the country, including observed mortality rates, hospital length of stay (LOS), complication rates, readmission rates, intensive care unit (ICU) admission rate, and cost by service area. The CDB/RM allows users to download patient- and transaction-level information directly into servers for incorporation into existing internal systems and reports that focus on inpatient activity.

Mortality and morbidity outcome measurement

We used the observed mortality rate, which is defined as the number of deaths per the total number of cases. To measure morbidity, the UHC uses a complication profiler to classify patients into risk pools according to diagnosis-related group or *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis and procedure codes. The UHC identifies patients at risk for specific types of complications and reports them as a percentage of cases with 1 or more complications out of the existing 25 specific complication groups.[13]

The UHC risk adjustment methodology

Risk-adjusted outcomes are derived after careful application of the following 4 steps: (1) population is selected for regression model generation, (2) the severity of the illness level is estimated for each patient, (3) regression models are generated to predict and explain outcomes (linear regression for LOS and cost and logistic regression for mortality), and (4) results of regression models are applied to the entire database. This derivation provides a robust means of risk-adjusted outcomes for individual groups of patients.

Study design and inclusion and exclusion criteria

A retrospective study design was used after obtaining institutional review board and UHC approval. The UHC database was accessed for all male patients between 18 and 55 years of age with right lower quadrant pain and acute appendicitis presenting from October 2007 to December 2011 using *International Classification of Diseases, Ninth Revision, Clinical Modification* codes (Table 1). We excluded patients with peritonitis, perforation, or nonspecific appendicitis (Table 1). The patients were then divided into 2 groups determined by whether they had a CT scan performed as part of their diagnostic workup. The CT scan results of individual patients are not available through the database and hence were not reported.

Data analysis

Data are expressed as the frequency percentage for categoric variables, such as observed mortality, morbidity, ICU admission, and 30-day readmission. A chi-square test

Table 1 Criteria used to access the database for the study

Inclusion criteria	
Age	18–55 y
Sex	Male
Diagnosis (*ICD-9-CM* codes)	Acute appendicitis (540.9) Right lower quadrant pain (789.03)
Exclusion criteria	
Diagnosis (*ICD-9-CM* codes)	Acute appendicitis with generalized peritonitis (540.0) Acute appendicitis with peritoneal abscess (540.1) Appendicitis unqualified (541) Other appendicitis (542)
Codes used to identify surgery group	
Procedures (*ICD-9-CM* codes)	Open appendectomy (470.1) Laparoscopic appendectomy (470.9)

ICD-9 = International Classification of Diseases, Ninth Revision, Clinical Modification codes.