Original Investigation

CT for Acute Nontraumatic Abdominal Pain—Is Oral Contrast Really Required?

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Rationale and Objectives: This study aims to compare the diagnostic performance of abdominal computed tomography (CT) performed with and without oral contrast in patients presenting to the emergency department (ED) with acute nontraumatic abdominal pain.

Materials and Methods: Between December 2013 and December 2014, 348 adult patients presenting to the ED of a large tertiary medical center with nontraumatic abdominal pain were evaluated. Exclusion criteria for the study were history of inflammatory bowel disease, recent abdominal operation and suspected renal colic, abdominal aortic aneurysm rupture, or intestinal obstruction. All patients underwent intravenous contrast-enhanced abdominal CT on a Philips Brilliance 64-slice scanner using a routine abdomen protocol. The study group included 174 patients who underwent abdominal CT scanning without oral contrast, recruited using convenience sampling. A control group of 174 patients was matched to the cohort groups' gender and age and underwent abdominal CT with oral contrast material during the same time period. The patients' medical records were reviewed for various clinical findings and for the final clinical diagnosis. The CT exams were initially reviewed by a senior attending radiologist to determine the exams' technical adequacy and to decide whether an additional scan with oral contrast was required. Two senior radiologists, blinded to the clinical diagnosis, later performed consensus reading to determine the contribution of oral contrast administration to the radiologists' diagnostic confidence and its influence on diagnosing various radiological findings.

Results: Each group consisted of 82 men and 92 women. The average age of the two groups was 48 years. The main clinical diagnoses of the pathological examinations were appendicitis (17.5%), diverticulitis (10.9%), and colitis (5.2%). A normal CT examination was found in 34.8% of the patients. There was no significant difference between the groups regarding most of the clinical parameters that were examined. None of the examinations of all of the 174 study group patients was found to be technically inadequate, and therefore no patient had to undergo additional scanning to establish a diagnosis. The consensus reading of the senior radiologists determined that the lack of oral contrast was insignificant in 96.6% of the cases and that contrast material might have been useful in only 6 of 174 study group patients (3.4%). The radiologists found oral contrast to be helpful only in 8 of 174 control group patients (4.6%). There was no significant difference between the clinical and radiological diagnoses in both groups (study group, $P = 0.261$; control group, $P = 0.075$).

Conclusions: Our study shows that oral contrast is noncontributory to radiological diagnosis in most patients presenting to the ED with acute nontraumatic abdominal pain. These patients can therefore undergo abdominal CT scanning without oral contrast, with no effect on radiological diagnostic performance.

Key Words: Oral contrast; computed tomography; emergency room; acute abdominal pain; bowel pathology.

INTRODUCTION

Computed tomography (CT) is the imaging modality of choice for the diagnosis of many causes of acute abdominal pain. CT protocols for evaluating patients presenting with acute nontraumatic abdominal pain commonly include the use of oral and intravenous (IV) contrast agents. This widely used protocol is considered to provide the most diagnostic information (1–3) but is based on data from the earliest days of abdominal CT imaging. The introduction of helical and multidetector CT scanners has made the utility of oral contrast uncertain. The use of both oral and IV contrast materials is remarkably sensitive and specific for the diagnosis of bowel-related pathologies, but is not necessarily the most efficient and safe protocol (4,5). There are no formal definite guidelines regarding the optimal use of oral contrast in patients presenting to the emergency department (ED) with acute nontraumatic abdominal pain, and this has led to a wide variation in clinical practice (6).

The use of oral contrast material for abdominal CT examinations may have several disadvantages, including potential adverse effects of the oral contrast material to the patients, nasogastric tube insertion in patients who are unable to tolerate orally administered contrast material, prolonged ED stay

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and possible delays in diagnosis, treatment, and operative intervention. Prolonged ED stay also results in increased healthcare costs and patient discomfort (7–10). Many studies have suggested that IV contrast alone is sensitive and specific for the diagnosis of appendicitis (11–16). However, insufficient attention has been given in the literature to the impact of oral contrast material on the diagnosis of other bowel-related causes of acute abdominal pain (17–20). To the best of our knowledge, no large prospective randomized trial has focused on this influence.

The purpose of our study was to compare the diagnostic performance of IV contrast-enhanced abdominal CT performed with oral contrast material to abdominal CT performed without oral contrast material, in patients presenting to the ED with acute nontraumatic abdominal pain.

MATERIALS AND METHODS

Patients

The study population included 348 adult patients who presented to our ED with nontraumatic abdominal pain over a 1-year period from December 2013 to December 2014. The 174 patients of the study group underwent CT with IV contrast material alone and were collected by convenience sampling, according to the availability of the recruiting surgeon. Written informed consent was obtained from all of these patients. The control group consisted of 174 patients who underwent CT with both oral and IV contrast material. The control group patients were matched to the study groups' patients according to gender, age, and timing of the examination. All of the patients in the control group underwent the abdominal CT during the same week as the matched study group patients.

Exclusion criteria were age under 18, pregnancy, medical history of inflammatory bowel disease, recent abdominal operation (in the last 3 months), and suspected renal colic, abdominal aortic aneurysm rupture or intestinal obstruction.

The electronic medical records of the patients were reviewed for the following parameters: demographic data, past medical history, clinical symptoms, physical examination, and laboratory tests. The final clinical diagnosis was determined by the discharge letter's diagnosis, clinical outcomes, and surgical pathology. The final diagnoses were divided into five categories: no abdominal pathology and four types of abdominal pathologies—bowel pathology, upper gastrointestinal pathology, nonbowel or mesenteric pathology, and other abdominal organ pathology.

The institutional review board of our medical center approved the study procedures.

CT Technique

All control group patients were given 30 mL of meglumine ioxitalamate (Telebrix Gastro) mixed in 1 L of water, administered over 1.5–2.0 hours before CT scanning. Both the study and control group patients received 100 mL of iomeprol (Iomeron) intravenously, administered via power injection through an IV cannula located in an antecubital or hand vein at a rate of 2.5–3.0 mL/s.

All the abdomen and pelvis scans were done in the supine position on a Brilliance 64-slice MDCT scanner (Philips, USA) using 64.0 × 0.625 mm collimation, a pitch of 0.891, 120 kVp and 230 mAs, and a slice thickness of 3 mm.

The scan was performed in the supine position during the portal venous phase, using fixed timing, 70 seconds after the start of the injection. Portal venous-phase CT images were acquired from the bases of the lungs to the greater trochanters. The direct multiplanar reformation function was used to generate coronal and sagittal reformations with a slice thickness of 3 mm. The imaging protocol did not differ from the standard protocol used in clinical routine.

Image Analysis

The CT scans were interpreted at Picture Archiving and Communications System workstations (Centricity; GE Healthcare, USA). The study group's examinations underwent real-time evaluation by an attending senior radiologist who determined whether a repeat scan with oral contrast material administration was required.

Afterwards, two radiologists (AB and SB), blinded to the clinical outcome and diagnosis, evaluated together, in consensus, the study and control group examinations. The radiologists were asked to determine the technical adequacy of the study and whether the oral contrast material reached the area of pathology in the control group. In addition, the radiologists evaluated the patients' body habitus, the presence of various specific findings of bowel-related pathology, and the final radiological diagnosis. The main imaging findings that were assessed by the radiologists were bowel wall thickening and enhancement, fat stranding, and collection. Additional specific findings that were assessed include distention of the appendix, appendicolith, diverticulosis, and dilatation of a specific diverticulum. The radiologists also had to determine whether oral contrast was necessary to establish a confident diagnosis in the control group or might have been useful in the study group.

The body habitus of the patients was evaluated using a specific index—the intra-abdominal fat (INAF) index. This index was measured on the mid-sagittal plane by drawing a straight line between the anterior-upper corner of S1 vertebral body and the linea alba, or the posterior border of the rectus abdominis muscle (Fig 1).

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS, Inc).

Categorical variables were described using frequency and percentage. Continuous variables were described using either mean ± standard deviation or median and interquartile range.