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Enteric Distribution of Oral Contrast in Emergency Department Patients Undergoing Abdominal-Pelvic Computed Tomography

Tarek N. Hanna, MD[a,*], Drew A. Streicher, MD, MBA[b], Seyed Amirhossein Razavi, MD[c], Faisal Khosa, MD, MBA[a], Jamlik-Omari Johnson, MD[a], Kimberly E. Applegate, MD, MS[b]

[a]*Division of Emergency Radiology, Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, Georgia, USA*
[b]*Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, Georgia, USA*
[c]*Department of Surgery, Emory University School of Medicine, Atlanta, Georgia, USA*

Abstract

Purpose: The study sought to assess the gastrointestinal (GI) distribution of oral contrast (OC) among emergency department (ED) patients and determine if contrast reaches the terminal ileum or site of pathology to assist in diagnosis.
Methods: Retrospectively, adults undergoing abdominal-pelvic computed tomography (APCT) in the ED at 2 hospitals were identified over a 3-month period. APCTs were reviewed for location of OC. Presence, site, type of bowel pathology, and prior gastrointestinal surgery were documented. When applicable, the site of bowel pathology was evaluated for the presence or absence of OC.
Results: There were 1349 exams with mean age 50.5 years (range 18−97 years), 41% male, with 530 (39%) receiving OC. In 271 of 530 (51%), OC reached the terminal ileum (TI). Bowel pathology was present in 31% of cases (165 of 530). When bowel pathology was present, 47% (77 of 165) had OC present at the pathology site. The GI tract was divided into 4 anatomic segments: OC most frequently reached pathology in stomach and duodenum (84%), but was present less frequently at sites of pathology from jejunum to TI (35%), proximal colon (57%), and distal colon (28%). In only 84 of 530 OC cases (16%) did contrast extend from the stomach to distal colon. OC administration contributed to longer mean APCT order to final report of 0.5 hours and longer mean ED length of stay of 0.8 hours compared with all patients who received APCT.
Conclusions: Optimal OC distribution is not achieved in more than half of ED patients, raising questions about the continued use of OC in the ED.

Résumé

Objet : L'étude avait pour objectif d'analyser la répartition gastro-intestinale d'un produit de contraste administré par voie orale chez les patients du service d'urgence. Elle visait également à déterminer si le produit de contraste atteignait la portion terminale de l'iléon ou le site de la maladie pour aider à établir un diagnostic.
Méthodes : Nous avons identifié, de façon rétrospective, les patients adultes qui ont subi une tomodensitométrie (TDM) pelvienne au service d'urgence de deux hôpitaux au cours d'une période de trois mois. La répartition du produit de contraste administré par voie orale a été examinée à l'aide des images de TDM pelvienne. La présence d'une maladie intestinale a été consignée, ainsi que son emplacement et sa nature. La tenue d'une chirurgie gastro-intestinale antérieure a également été documentée. S'il y avait lieu, la présence ou non du produit de contraste administré par voie orale a été vérifiée au site de la maladie intestinale.
Résultats : Ont été réalisés 1 349 examens chez des patients affichant un âge moyen de 50,5 ans (de 18 à 97 ans; 41 % d'hommes), dont 530 examens (39 %) avec administration d'un produit de contraste par voie orale. Parmi ceux-ci, 271 (51 %) ont démontré que l'agent de contraste administré par voie orale avait atteint la portion terminale de l'iléon. La présence d'une maladie intestinale a été confirmée dans 31 % des cas (165 des 530 TDM). De ce nombre, 47 % (77 sur 165) présentaient une prise de contraste au site de la maladie. Le tractus gastro-intestinal a été divisé en quatre segments anatomiques. Le plus souvent, le produit de contraste atteignait le site de la maladie si celui-ci était situé dans l'estomac et le duodénum (84 %). Il a toutefois été décelé moins souvent si la maladie touchait le segment allant du jéjunum à la portion terminale de l'iléon (35 %), le côlon proximal (57 %) et le côlon distal (28 %). Seules 84 des 530 TDM avec administration d'un

* Address for correspondence: Tarek N. Hanna, MD, Division of Emergency Radiology, Department of Radiology and Imaging Sciences, Emory University Midtown Hospital, 550 Peachtree Road, Atlanta, Georgia 30308, USA.

E-mail address: tarek.hanna@emory.edu (T. N. Hanna).

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produit de contraste par voie orale (16 %) ont permis d'observer une prise de contraste allant de l'estomac au côlon distal. L'administration d'un produit de contraste par voie orale a prolongé le délai moyen entre la demande d'examen et le rapport final de 0,5 heure, et la durée moyenne de séjour au service d'urgence de 0,8 heure, par rapport à l'ensemble des patients ayant subi une TDM pelvienne.
Conclusion : Plus de la moitié des TDM réalisées chez les patients du service d'urgence ont révélé une répartition non optimale du produit de contraste administré par voie orale, ce qui soulève des questions quant au recours à un tel produit au service d'urgence.

Key Words: Oral contrast; Emergency department; Abdominal-pelvic computed tomography; Computed tomography protocols; Abdominal pain

Abdominal-pelvic computed tomography (APCT) is routinely used in the evaluation of nontraumatic acute abdominal pain in the emergency department (ED), leading to increased physician diagnostic certainty and more timely therapeutic interventions [1−4]. Because traditional APCT protocols for abdominal pain require an oral contrast (OC) preparation ranging from 60−120 minutes prior to the study, OC administration contributes to increased ED length of stay (LOS) [5−7]. There is an ongoing effort to reduce ED LOS while maintaining optimal patient care, as decreasing LOS controls costs as well as increases patient satisfaction in their emergency care [5]. Recent studies have demonstrated that controlling or eliminating OC usage in the ED results in LOS decrease of 30, 43, and 97 minutes, respectively [5−7].

Decreased LOS resulting from eliminating OC preparation time suggests that CT is 1 rate-limiting step in the management of the subgroup of ED patients who receive APCT. Evaluating the necessity of OC is central in ED LOS management. Current CT technology with improved spatial, contrast, and temporal resolution, as well as increased acquisition speed with resultant decreased peristaltic and respiratory motion artifacts have led to questions about the continued need for OC. Recent publications, including a systematic review, suggest CT protocols without OC have equivalent performance for the diagnosis of acute appendicitis and acute abdominal pain compared to CT with OC [7−10]. Yet many ED protocols continue to utilise OC routinely.

EDs in the United States are crowded, due to an increasing number of annual visits with an overall decrease in the number of EDs [11]. To manage the increasing patient load, there is a growing emphasis on efficient ED patient throughput. With increasing time pressures, current OC preparation time for adult APCT has typically shortened to 1 hour to facilitate faster ED patient care. The added value of OC rests on its location and distribution in bowel at the time of APCT acquisition. In a similar study in children in the ED, Laituri et al [12] questioned the utility of OC and examined its distribution within bowel. They found that only 72% of pediatric patients receiving OC for the CT diagnosis of acute appendicitis had contrast at the point of interest, the terminal ileum [12]. To the best of our knowledge, there is no such study in adult patients. The aim of this investigation is to evaluate the distribution of OC in patients undergoing APCT in the ED and to analyse the relationship between radiologist interpretation of bowel pathology and the presence of OC.

Materials and Methods

Study Population

This study was conducted with institutional review board approval and was compliant with the Health Insurance Portability and Accountability Act. The requirement for written informed consent was waived because of the retrospective nature of the study. Using the institutional clinical data warehouse, we retrospectively identified consecutive APCT examinations performed in the ED of two university-affiliated, urban hospitals between March 13 and May 31, 2012. We used this study period to ensure adequate sample size. The only exclusion criterion was age less than 18 years. Patient characteristics, indication for APCT, ED LOS, the time from APCT order to completion, and the time from APCT order to final radiology report were acquired from the clinical data warehouse. No investigational interventions were performed on any patient.

Hospital 1 is a community-based hospital with 60,000 annual ED visits, ED admission rate of 25%, and a CT scanner approximately 5 m from the ED. Hospital 2 is a tertiary care centre with 35,000 annual ED visits, ED admission rate of 35%, and a CT scanner approximately 100 m from the ED. The CT scanners available in these two hospitals are GE Lightspeed VCT 64-detector row (General Electric, Fairfield, CT), Siemens Somatom Definition Flash dual-source CT (Siemens, Munich, Germany), and GE Lightspeed RT-16 (General Electric). Electronic ordering mechanisms and transport personal are standardized at both hospitals. APCTs were performed with a slice thickness of 4 mm at hospital 1 and 5 mm at hospital 2. The decision to administer OC was at the discretion of the emergency department physician. Both hospitals use a standard OC preparation protocol utilising MD-Gastroview (Mallinckrodt Inc, St Louis, MO), an iodinated contrast consisting of diatrizoate meglumine and diatrizoate sodium, which is sold in concentrate form. The 30 mL bottles of Gastroview are diluted to produce 1000 mL 3% solution and administered by nursing staff; the patient drinks 500 mL, followed 30 minutes later by another 500 mL of this dilute Gastroview. The patients are transported for APCT a minimum of 60 minutes following the initial OC administration.