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The effect of without using anisodamine during CT enterography on image quality, diagnostic performance and latent side effects

Didi Wen, Jian Xu, Ying Liu, Rui An, Jian Li, Hongliang Zhao, Minwen Zheng*

Department of Radiology, Xijing Hospital, Fourth Military Medical University, 127# West Changle Road, Xi'an 710032, Shaanxi Province, China

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ABSTRACT

Objective: To examine whether no anisodamine injection before CTE was feasible without impairing image quality and diagnostic performance.
Materials: The change of mural thickness and luminal diameter were compared between using and no using anisodamine. The diagnostic performance of small-bowel disease was analyzed and compared.
Results: No motion artifact was detected in two groups. There was no significant difference regarding the change of luminal diameter and mural thickness (all $P > 0.05$). The diagnostic accuracy of small-bowel disease was no significant difference ($P = 0.63$).
Conclusion: Lack of anisodamine injection before CTE did not impair image quality and diagnostic performance compared with CTEs performed with anisodamine injection.

1. Introduction

The development of CT technique in the recent years has made computed tomography enterography (CTE) emerge as the mainstream diagnostic tool in the evaluation of small-bowel diseases [1]. The major advantages of CTE are its non-invasive nature and a comprehensive evaluation of both enteric and especially extra-enteric abnormalities [2,3].

An adequate intestinal preparation has to be performed prior to CTE examination. Both bowel cleansing and small bowel distension using a neutral or low-density oral contrast agent are prerequisite for good-quality CTE [2,4,5], which optimizes contrast resolution between mucosa and lumen and facilitates rapid and efficient luminal navigation, thereby maximizing conspicuity of abnormalities arising from the small bowel wall and enabling accurate detection [1,6–12].

During CTE examination, a spasmolytic agent was commonly administrated before the performance of scan in order to avoid motion artifact resulting from bowel peristalsis [13,14]. However, the administration of spasmolytic agent was confused without formal guideline. Some authors have described the use of spasmolytic agent during their CTE studies [2,5,11,13–17], while others have not mentioned in their research methods [18–23]. Recent CTE studies have suggested that spasmolytic agent was not necessary for CTE, because the acquisition of the multi-detector computed tomography (MDCT) images was very rapid, that meant motion artifact attributable to bowel peristalsis was negligible during CTE examination [13,24]. To date, no clinical trial has yet compared with and without spasmolytic agent administration during CTE and had definite conclusion.

Spasmolytic agent administrated in CTE examination mainly includes anisodamine and hyoscine butylbronmide [2,5,13–16]. It may lead to respiratory inhibition, urinary bladder contraction, mydriasis, cycloplegia, bronchodilation, neurological/cognitive impairment and alteration of cardiovascular function [25]. The common symptoms are dry mouth, flush, blurred vision, palpitation and urinary retention [25]. Prior to CTE, some patients, specifically the senile ones, may not know their relevant medical history or forget to tell the CTE examiner. Therefore, the administration of spasmolytic agent may lead to latent risk of adverse outcomes such as urinary retention.

The purpose of this study was to determine whether without anisodamine injection before CTE was feasible while not impairing image quality and diagnostic performance, and the latent side effects were thereby avoided as well.

2. Materials and methods

2.1. Study population

On account of this was a retrospective study, all patients with suspected small bowel diseases were clinically subjected to CTE examination at our hospital between March 2013 and March 2016, informed patients consent was thereby a waiver. From March 2013 to September 2014, 475 patients underwent CTE with anisodamine were

* Corresponding author.
E-mail address: zhengmw2007@163.com (M. Zheng).

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enrolled (ANI group). From October 2014 to March 2016, 520 patients underwent CTE without using anisodamine were included (non-ANI group). General exclusion criteria included: (1) history of intestinal surgery; (2) known or suspected bowel obstruction; (3) renal insufficiency (a serum creatinine level > 1.5 mg/dl); (4) pregnancy or lactation; (5) dysphagia; (6) known hypersensitivity to iodine containing contrast media; (7) hyperthyroidism; (8) unable to drink a large volume of oral contrast agent. In the ANI group, patients with a history of glaucoma or prostatic hypertrophy were also excluded.

The age, sex, body mass index (BMI), clinical manifestations of the patients and diagnostic reference standards, including capsule endoscopy, endoscopy, colonoscopy, surgery and pathology were recorded.

2.2. Intestinal preparation

The method of intestinal preparation has previously been reported with acceptable image quality and diagnostic performance [2,14,16,26]. One day before the CTE examination, all patients were instructed to have a liquid diet for dinner and take laxative to cleanse intestine 30 min after dinner. On the day of CTE examination, patients were requested to fast at least 4 h prior to examination. A total of 1500 ml of dissolved mannitol solution (2.5%) was instructed to drink within 60 min (at a steady rate, approximately 125 ml every 5 min) before examination. In small patients or patients with history of previous small bowel resection, smaller volumes of oral contrast may be sufficient, judged mainly by patient tolerance. Before CTE examination, 20 mg anisodamine (Raceanisodamine Hydrochloride Injection, Minsheng Pharmaceutical Co, Hangzhou, China) was injected intramuscularly 10 min in patients of ANI group. Patients in non-ANI group were not injected anisodamine.

2.3. CT enterography protocol

CTE examination was performed on a dual-source CT device operated in regular single-source mode functioning as a 128-slice CT (Somatom Definition Flash, Siemens Healthcare, Forchheim, Germany). A tube voltage of 100 kV and a reference tube current of 300 mAs were set. Other scanning parameters were as follows: a pitch of 1.0, collimation of 2 × 64 × 0.6 mm using z-flying focal spot, gantry rotation time of 0.5 s. For all scans, patients were positioned supine with both arms up.

Two-phase contrast-enhanced CT scanning was performed in all patients from the dome of the diaphragm to symphysis pubis. Each patient was injected with 1 ml/kg of iopromide (Ultravist 370, 370 mg I/mL, Bayer Schering Pharmaceutical, Berlin, Germany) at a flow rate of 3.5 ml/s followed by 40 ml saline solution. An automatic tracking program was used to trigger the arterial phase with the region of interest placed in the abdominal aorta at the level of the diaphragm. The arterial phase was initiated when the aortic density reached 150 HU after injection of the iodinated contrast. The venous phase scanning was conducted 30 s after arterial phase scanning.

The data were submitted to the external workstation for image processing and analysis. The image reconstruction included multiplanar reconstruction (MPR), maximum intensity projection (MIP) and volume rendered technique (VRT).

After CTE examination, patients were commonly requested to remain in our department for approximately 30 min. All patients were interviewed by a nurse immediately and within 30 min after CTE examination. Any discomfort was recorded. Delayed discomforts within 24 h were requested to inform the dedicated nurse. The time of symptom onset and resolve was also recorded.

2.4. Image analysis

The quality of CTE image was also evaluated and interpreted independently by two radiologists (Z.M.W. and Z.H.L. with 15 and 10 years of experience in reading CTE images) experienced in gastrointestinal imaging without knowledge of diagnostic standard references. A loop of small bowel wider than 3 cm was considered excellent distension by CT criteria [1]. A small bowel wall thicker than 3 mm was considered thickened [1]. To evaluate the change of normal or inflammatory small-bowel loops between two groups, the luminal inner diameter and wall thickness were measured in the same position of descending segment of duodenum, proximal segment of jejunum in left upper abdomen, and distal segment of ileum in right lower abdomen in both phases. All difference values were compared between two groups. The measurement of luminal inner diameter in inflammatory loops was positioned at the most stenostic level of the lumen in both phases. To obtain the wall thickness, the inner diameter was subtracted from the outer diameter and divided by 2. The presence or absence of artifact resulting from bowel peristalsis was also noted in patients of two groups, particularly in those of the non-ANI group.

2.5. Comparison of diagnostic performance between two groups

The results of capsule endoscopy, endoscopy, colonoscopy, surgery or pathology as the reference standard, the diagnostic performance of small-bowel disease was further evaluated and compared between two groups. The small-bowel diseases in this study included Crohn's disease and other inflammation diseases, tuberculosis, stromal tumor, adenocarcinoma, adenoma, polyp, lymphoma, etc. The final diagnosis of small-bowel diseases were determined by one or several reference standards including capsule endoscopy, endoscopy, colonoscopy, surgery and pathology.

2.6. Statistical analysis

Categorical variables were presented as frequency values and proportions, while continuous normally distributed variables were presented as mean values and standard deviations. Continuous variables were analyzed using an independent *t*-test for normally distributed data or a Mann-Whitney *U* test for non-normally distributed data. Categorical data is summarized with number (percentage) and was analyzed by using χ^2 or Fisher's exact tests. Statistical evaluations were performed by using SPSS 19.0 (IBM Corporation, Chicago, Illinois, USA) and MedCalc 12.3.0 (MedCalc Software, Brussels, Belgium). A P value < 0.05 was considered statistically significant.

3. Results

3.1. Patient characteristics

In this paper, 347 patients in the non-ANI group and 301 patients in the ANI group cancelled their CTE because of a history of intestinal surgery (67 vs. 53), known or suspected bowel obstruction (64 vs. 42), renal insufficiency (41 vs. 38), pregnancy or lactation (21 vs. 23), dysphagia (43 vs. 41), known hypersensitivity to iodine containing contrast media (38 vs. 27), hyperthyroidism (34 vs. 35), and unable to drink a large volume of oral contrast agent (39 vs. 33). In addition, 9 patients were contraindicated to spasmolytic were excluded from the ANI group. Furthermore, 18 subjects in the non-ANI group and 22 in the ANI group were excluded for image analysis due to poor bowel preparation (14 vs. 16, $P = 0.74$) or motion artifacts resulting from respiratory movements (4 vs. 6, $P = 0.54$). Finally, 155 subjects in the non-ANI group and 152 in the ANI group with evaluable images were further analyzed. The demographic characteristics and clinical information of patients were summarized in Table 1. There was no significant difference in age, sex, BMI, clinical manifestations of the patients and diagnostic reference standards between two groups ($P > 0.05$; for all comparisons).

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