International Journal of Surgery 33 (2016) S36–S44

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Diagnostic value of computed tomography colonography (CTC) after incomplete optical colonoscopy

N. Maggialetti [a, *, 1], R. Capasso [b, 1], D. Pinto [c], M. Carbone [d], A. Laporta [e], S. Schipani [a], C.L. Piccolo [a], M. Zappia [a], A. Reginelli [b], M. D'Innocenzo [f], L. Brunese [a]

[a] Department of Medicine and Health Science, University of Molise, Campobasso, Italy
[b] Department of Internal and Experimental Medicine, Magrassi-Lanzara, Second University of Naples, Piazza Miraglia 2, 80138 Naples, Italy
[c] Radiological Research, Molfetta, BA, Italy
[d] Department of Radiology, A.O.U. San Giovanni di Dio e Ruggi d'Aragona, Salerno, Italy
[e] Department of Radiology, A.O. Solofra, Italy
[f] General Direction for Health, Molise, Italy

HIGHLIGHTS

- We used computed tomography colonography (CTC) after incomplete optical colonoscopy.
- CTC was useful to detect both colonic and extracolonic otherwise overlooked findings.
- CTC is the recommended examination in first line colorectal cancer evaluation.

ARTICLE INFO

Article history:
Available online 30 May 2016

Keywords:
CTC
Virtual colonoscopy
CT colonography
Extracolonic findings
Optical colonoscopy

ABSTRACT

Introduction: This study evaluated the role of computed tomography colonography (CTC) in patients who previously underwent incomplete optical colonoscopy (OC). We analyzed the impact of colonic lesions in intestinal segments not studied by OC and extracolonic findings in these patients.
Methods: Between January 2014 and May 2015, 61 patients with a history of abdominal pain and incomplete OC examination were studied by CTC. CTCs were performed by 320-row CT scan in both the supine and the prone position, without intravenous administration of contrast medium. In all patients both colonic findings and extracolonic findings were evaluated.
Results: Among the study group, 24 CTC examinations were negative for both colonic and extracolonic findings while 6 examinations revealed the presence of both colonic and extracolonic findings. In 24 patients CTC depicted colonic anomalies without extracolonic ones, while in 7 patients it showed extracolonic findings without colonic ones.
Discussion: CTC is a noninvasive imaging technique with the advantages of high diagnostic performance, rapid data acquisition, minimal patient discomfort, lack of need for sedation, and virtually no recovery time. CTC accurately allows the evaluation of the nonvisualized part of the colon after incomplete OC and has the distinct advantage to detect clinically important extracolonic findings in patients with incomplete OC potentially explaining the patient's symptoms and conditioning their therapeutic management.
Conclusion: CTC accurately allows the assessment of both colonic and extracolonic pathologies representing a useful diagnostic tool in patients for whom complete OC is not achievable.

1. Introduction

In the last two decades, CT colonography (CTC) has increasingly emerged as an acceptable, minimally invasive diagnostic technique for detection of colonic polyps and cancers with high sensitivity and specificity rates [1]. CTC diagnostic performance in detection of these colonic lesions is reported to be similar to that of colonoscopy

* Corresponding author. Via P. da Palestrina 1, 70056 Molfetta, BA, Italy.
E-mail addresses: n.maggialetti@gmail.com (N. Maggialetti), dott.ssacapasso@gmail.com (R. Capasso), dpinto@libero.it (D. Pinto), mattcarb1@tin.it (M. Carbone), a.laporta@virgilio.it (A. Laporta), serena.schipani@hotmail.it (S. Schipani), piccolo_cl@tin.it (C.L. Piccolo), marcellozappia1@tin.it (M. Zappia), alfonso.reginelli@unina2.it (A. Reginelli), m.dinnocenzo@uimol.it (M. D'Innocenzo), lucabrunese@libero.it (L. Brunese).
[1] These authors (NM and RC) contributed equally to this work and share the first authorship.

http://dx.doi.org/10.1016/j.ijsu.2016.05.053
1743-9191/

and is largely superior to that of barium enema (BE), making CTC the best radiological tool for imaging colorectal cancer (CRC) and polyps [2–4]. Because of its high miss rate, BE should be no longer be used as a first line modality to investigate bowel cancer if CTC is available, as recommended by European Society of Gastrointestinal and Abdominal Radiology (ESGAR) and the European Society of Gastrointestinal Endoscopy (ESGE) [3–5].

Presently, the widespread technological improvement, the implementation of image reconstruction algorithms and the advances in decreasing tube current have contributed to minimize CTC radiation exposure allowing to overcome the great historical drawback of this technique [4,6,7]. Thanks to its excellent sensitivity for CRC, minimal invasiveness with high patient compliance, less time consuming and low cost, CTC has great potential to represent the future screening tool for CRC on a universal basis [8–11]. Moreover, it offers staging information and also investigates the presence of any significant extracolonic pathology, which may significantly alter the management [8–11]. Although the use of CTC as screening tool is still under evaluation, it is well established that CTC is mainly indicated when endoscopy is contraindicated, not possible, failed or incompletely performed [3], in patients reluctant to undergo OC or in cases of obstructing colonic tumors [11–14]. Abnormal colic shape or length and lumen narrowing are not limitations for CTC feasibility and this allows CTC to be able to investigate the whole colon detecting any synchronous lesions when a CCR stenosis is present [15]. At the same time, CTC can also detect extracolonic findings, which are described in up to 74% of patients older than 65 years with an incidence rate that increases with age. Although most (90%) of the extracolonic lesions are not clinically significant, in fewer (2–5%) cases these findings are prognostically relevant, such as extracolonic cancer or abdominal aortic aneurysm [16–20]. The aim of this study was to retrospectively assess the diagnostic performance of CTC in patients who were referred for further examination after incomplete OC.

2. Materials and methods

2.1. Patients

From January 2014 to May 2015 we retrospectively evaluated 61 consecutive patients who underwent CTC at our institution. The patient population comprised 26 men and 35 women aged between 39 and 87 years (mean age 63.3 years). Patients underwent physical examination and CTC within 3 weeks after incomplete OC. The main reason for OC execution was abdominal pain. The causes of OC failures were represented by abnormalities in colon length/shape (41 cases), colonic narrowing (11 cases) and patient intolerance (9 cases). The local ethics committee approved this prospective study and all patients gave written informed consent prior to entering the study.

2.2. Bowel cleaning and distension

In our institution, patients started dietary restriction (also avoiding fibers) 3 days before the CTC exam and were asked to swallow 13,8 gr of macrogol solution (movicol®) after each main meal 3 times a day before the examination. Fecal and fluid tagging technique was employed and 3 h before CTC, patients were asked to assume an orally solution made up of 50 mL of radiopaque contrast media Diatrizoate (Gastrografin®- Bracco) diluted in 75 mL of water. Bowel distension was performed with room ambient air insufflations by using a thin and flexible rectal catheter after intramuscular administration of 20 mg hyoscine butylbromide (Buscopan®) [21,22]. Buscopan was not administered in 2 patients with a history of glaucoma. The adequate distension was judged on scout images. All segments had to be distended on at least one view. This condition is favourable to double scan in supine and prone position of in order of prevent luminal collapse [19].

2.3. CTC scan protocol

CTC scans were performed with a 320-row CT scanner (Aquilion ONE, Toshiba Medical Systems, Otawara, Japan), with 1-mm collimation, a 1-mm reconstruction interval, rotation time 0.5 s, 120 KVp, and scan time 4.5 s. Images were acquired without intravenous contrast medium administration, in single breath hold in both the supine and the prone position; no decubitus scans were required [23,24]. For each patient, field of view extended from diaphragm to the greater trochanters to obtain complete anatomic imaging of the colon and the rectum in both positions. In all exams dose modulation devices, adaptive statistical iterative reconstruction and model-based iterative reconstructions (AIDR 3D) were employed. The mean radiation dose exposition was 5.4 mSv. The mean time the patient remained in the CT room was 12 min which includes the time information, consensus, positioning on the table, air insufflation, and data acquisition.

2.4. Image and data processing

Two radiologists with respectively 6 and 10 years of experience in CTC, independently evaluated the examinations using dedicated software. All data was analyzed both in 2D and 3D reconstruction, in agreement with Literature [25–28]. Computer aided detection (CAD) system was not used. Post processing and reconstruction analysis mean time was 4 min. Any discrepancies were resolved by consensus.

2.5. Management of extracolonic findings

All extracolonic findings were defined in agreement with CT Colonography Reporting And Data System C-RADS (Table 1) [29]. Patients with E3 or E4 findings were fully informed and underwent further investigations with intravenous contrast medium administration. E1 and E2 findings only were described in the report.

3. Results

Among the study group, 24 CTC examinations were negative for both colonic and extracolonic findings while 6 examinations revealed the presence of both colonic and extracolonic findings. In 24 patients CTC depicted colonic anomalies without extracolonic ones, while in 7 patients it showed extracolonic findings without colonic ones (Table 2). No severe complications were observed in our study. None of the patients required sedation for CT scanning and all of them were able to return to daily activities immediately after the examination. In 37 patients CTC revealed a lesion that could explain patient symptoms.

3.1. Colonic findings

31 (50,8%) exams were negative for colic lesions. 30 (49.8%) CTCs identified colonic abnormalities as follows: 7 (23.3%) abnormal lengths of part (dolicosigma) or whole colon (dolicocolon); 13 (43.3%) diverticular disease conditions in different stages; 4 (13.3%) nonspecific rectosigmoid wall thickenings (7 mm); 1 (3.3%) pathological anastomotic narrowing from a previous colic resection; 5 (16.6%) polyps (Graphic 1). Polyps were located in cecum - ascending colon (n. 3: 12 mm, 14 mm, 14 mm), sigma (n. 1, 10 mm) (Fig. 1) and descending colon (n. 1, 18 mm) measured with W: 2000 HU and L: 0 HU window setting [30] (see Table 3).