Received:
12 February 2016

Revised:
27 February 2017

Accepted:
1 March 2017

<https://doi.org/10.1259/bjr.20160147>

Cite this article as:

Ratnasingham K, Lo T, Jamal K, Varatharajan L, Tabbakh Y, Kaderbhai H, et al. The role of colonoscopy and CT colonography in patients presenting with symptoms of constipation. *Br J Radiol* 2017; **90**: 20160147.

FULL PAPER

The role of colonoscopy and CT colonography in patients presenting with symptoms of constipation

KUMARAN RATNASINGHAM, MB BS, FRCS, TAMMY LO, MB BS, BSc, KARIM JAMAL, MB BS, FRCS, LAVANYA VARATHARAJAN, MB BS, BSc, YASMIN TABBAKH, MB BS, HUSEIN KADERBHAI, MB BS and NICHOLAS J WEST, MB BS, FRCS

General Surgery Department, Epsom and St Helier University Hospitals NHS Trust, Carshalton, UK

Address correspondence to: Mr Kumaran Ratnasingham
E-mail: kumaran95@hotmail.com

Objective: There is controversy whether constipation as a primary presenting complaint is an indication for diagnostic colonoscopy. CT colonography (CTC) is a less invasive and more acceptable alternative. We compared the completion and sensitivity of colonoscopy with CTC in patients who presented with the primary symptom of constipation.

Methods: A retrospective study was conducted which examined the first 100 colonoscopies and 100 CTCs carried out for the primary symptom of constipation from June 2012 to December 2013. The primary outcome measure was failure rate of the investigations. Secondary outcomes included reasons for failure and comparison of cost effectiveness between the two modalities.

Results: A total of 200 patients were included in this study. Of these, the first consecutive 100 colonoscopies

and 100 CTCs were included. One colonic cancer was detected in each of the CTC and the colonoscopy arm, respectively. 37 (37%) attempted colonoscopies were incomplete examinations. The most common reasons were discomfort (51.4%) and poor bowel preparation (27%). There was no failure of CTC. For 100 patients, CTC as a primary investigation was a more cost-effective investigation ($p \leq 0.01$) costing £55,016 as compared with colonoscopy costing £73,666.

Conclusion: There is an unacceptably high failure rate of colonoscopy in patients who presented with the primary symptom of constipation. Hence, we propose that CTC may be an acceptable first-line investigation with a further colonoscopy/flexible sigmoidoscopy if lesions are detected.

Advances in knowledge: First study to examine the use of CTC in patients with constipation.

INTRODUCTION

Presenting symptoms of colorectal cancer are well described; however, the associated risk that each symptom conveys has not been accurately quantified. Constipation as a primary presenting complaint is common, with a prevalence of 2–30% among the adult population and females being affected twice as more frequently than males.¹ In addition, it results in approximately 2.5 million physician visits in the USA, and many of these result in colonoscopies.² Evidence suggests that for all ages and sexes presenting with constipation in primary care, the absolute risk of a subsequent diagnosis of colorectal cancer is below 2%.³

The yield of colonoscopy in patients with isolated constipation is low and is comparable with patients who are asymptomatic who undergo colonoscopy for colorectal cancer screening. There are many studies evaluating the suitability of colonoscopy in patients presenting with the

sole symptom of constipation.⁴ In 1 study, 563 sigmoidoscopies or colonoscopies were completed for the evaluation of constipation, and colorectal cancer was found in 1.4% of patients and adenomas in 14.6%.⁵ Other disadvantages of colonoscopy include the need for full bowel cleansing, burden of the procedure and the complication rate of 0.1–0.3%, such as post-polypectomy bleeding and perforation.⁶

CT colonography (CTC) is a less invasive alternative to colonoscopy and requires the use of limited bowel preparation. Its sensitivity is similar to or better than that of double-contrast barium enema examination for detection of colonic cancer and polyps.^{7,8} Several studies have shown that CTC has an accuracy similar to that of conventional colonoscopy both in high-risk groups^{9,10} and in a low-prevalence screening population.¹¹ A meta-analysis reviewing the test performance of CTC showed a high specificity.¹² The main disadvantage of CTC is the exposure

Table 1. Demographics of both the colonoscopy and CT colonography (CTC) arms, respectively

Distribution	Colonoscopy	CTC	Statistical difference
Median age + SD	68 (8.3)	69 (7.9)	$p < 0.01$
Female N (%)	56 (56%)	53 (53%)	$p < 0.01$
Male N (%)	44 (44%)	47 (47%)	

SD, standard deviation.

to ionizing radiation, although low-dose protocols are now available. The need for subsequent colonoscopy if substantial lesions are detected is an extra investigation for the patient.⁶

Nevertheless, studies have shown that CTC is safer but importantly more comfortable to patients than colonoscopies.¹³ It has been suggested that in patients presenting with constipation as an isolated symptom, CTC is the more appropriate first line of investigation. This is due to constipation being often associated with conditions such as irritable bowel syndrome and this cohort of patients being more likely to have an incomplete or difficult procedure.¹³ In addition, CTC has the advantage of extracolonic imaging which maybe important in reassuring patients with coexisting abdominal pain.

The aim of this study was to compare the success rate of colonoscopy vs CTC in patients who present with the sole symptom of constipation. The primary outcome measure was failure rate of each investigation. Secondary outcome measures included reason for failure, average time taken to perform the investigation and cost effectiveness of both procedures.

METHODS AND MATERIALS

The first consecutive 100 colonoscopies and 100 CTCs carried out for patients presenting with the primary symptom of constipation at Epsom and St Helier National Health Service Trust, London, from June 2013 to December 2014, were retrospectively analyzed. No power calculation was used to obtain this number of patients. All patients over the age of 18 years presenting with

constipation as their sole symptom are included in the study. Patient allocation to either the colonoscopy group or the CTC group was dependant on clinical preference at the time of assessment and the first diagnostic modality they had. For example, patients who had colonoscopy subsequent to CTC were included in the CTC group alone. Only patients with the sole symptom of constipation were included in the study.

CTC was performed by using a GE64 slice scanner. All CTCs were reported by consultant radiologists. Three-dimensional reconstruction of the presence of a colonic lesion was reported only when it was 5 mm or more in size. Four independent consultant radiologists were involved in reporting the CTC findings. Two individual radiologists reviewed each CTC images separately, and discrepancies in the findings were discussed and conclusions were agreed upon with each other prior to the report being published. Patients received their picolax from the department, and using the same standard as the endoscopy department took two sachets with 4–6 l of water.

Faecal tagging was carried out with prepared barium sulfate suspension (Tagitol™; E-Z-EM, Bicester, UK) administered in three divided doses 1 day before the procedure. A single 325-ml dose of dilute 3% Gastrografin® (Bayer Schering Pharma, Berlin, Germany) was routinely given for fluid tagging 2 h before the procedure.

CT scan was performed initially in the prone position followed by supine and then right lateral position. A single bolus of 90 ml of i.v. low-osmolar agent, iohexol (Ominipaque™ 350; GE Healthcare, Waukesha, MI), was administered in all patients, at a fixed rate of 2 ml s⁻¹, before scanning in the supine position. Contrast-enhanced CT images are routinely acquired in the portal venous phase, approximately 60 s following initiation of contrast administration.

Colonoscopies were carried out by consultant surgeons, consultant gastroenterologists, specialist registrars or specialist endoscopy nurse practitioners.

Both CTCs and colonoscopies had the same bowel preparation. First line is two sachets of picolax with 4–6 l of fluids. Second

Figure 1. A flow chart of total attempted colonoscopies, further test rate and their histology results are shown. CTC, CT colonography.

Table 2. Reasons for failure to complete colonoscopy

Reason for failure	Number of patients
Poor bowel preparation	10 (27.0%)
Discomfort	19 (51.4%)
Diverticula	5 (13.5%)
Stricture	3 (8.1%)
Total number of failed colonoscopies	37

line is MoviPrep for patients who are frail or those with chronic kidney disease. At our trust, we are undertaking roughly 6000 colonoscopies in 1 year. Our success rate is similar to national guidelines; more than 90% of our patients have adequate bowel prep and completion colonoscopies.

Sedation was achieved with 2 mcg of pethidine and a variable dose of midazolam dependant on each patient.

Data were collected from an online clinical manager database, patient notes and clinic letters. Data analysis was carried on Microsoft Excel® (Microsoft, Redmond, WA), and the Student's *t*-test was used to detect statistical significance.

RESULTS

A total of 200 patients were included in this study, and a total of 100 colonoscopies and 100 CTCs were performed. 24 of the 100 patients from the colonoscopy arm crossed over to the CTC arm. None of the patients from the CTC arm crossed over to the colonoscopy arm in the study. Table 1 shows the demographics of both the study arms.

Colonoscopy

100 colonoscopies were carried out for constipation, of which only 1 colorectal cancer was detected (Figure 1). Most colonoscopies were carried out by consultant surgeons or gastroenterologists (61%) and the remaining colonoscopies (39%) were performed by nurse practitioners. The mean time for the procedure was of 26 min. 37 (37%) of attempted colonoscopies failed for multiple reasons: discomfort (51.4%), poor bowel

Table 3. Amount of midazolam and pethidine to carry out colonoscopy

Type of sedation used	Number of patients
<2 mg midazolam + 25 mg pethidine	23
2 mg midazolam + 25 mg pethidine	23
2–4 mg midazolam + 25 mg pethidine	54

preparation (27%), the presence of significant diverticular disease (13.5%) and stricture (8.1%) (Table 2). There were no complications of colonoscopy. In terms of sedation, 54 (54%) of the patients had >2 mg of midazolam and 25 mg of pethidine (Table 3).

CT colonography

100 patients had CTC as an investigation for constipation, of which 1 colonic cancer was detected (Figure 2). There was no failure of CTC. However, 22 (22%) patients required either or colonoscopy or flexible sigmoidoscopy to investigate the presence of polyps (18 patients) and strictures (4 patients) detected by the CTC.

The need for second investigation in CTC arm was 22%, and in colonoscopy arm it was 37%. Two-tailed *z*-test showed the difference to be statistically significant.

Cost of CT colonography vs colonoscopy

Figures 3 and 4 show the cost of carrying out the investigations used in both arms. These were based on tariffs from Payment by Results, NHS reference costs and major procedure codes for surgical interventions. The tariffs for CTC and colonoscopy were £434 and £518, respectively.¹⁴

DISCUSSION

Constipation is a non-specific symptom with a low yield of colorectal cancer or pathology causing the symptom. In a retrospective series, Berkowitz et al¹⁵ analyzed 471 colonoscopies; the sole symptom of constipation yielded the least significant diagnoses with only 1 carcinoma among 79. Other studies are in accordance with the above study and demonstrate that

Figure 2. A flowchart of total attempted CT colonography (CTC), further test rate and their histology results is shown.

Figure 3. The flowchart of cost for the colonoscopy arm is shown. Total cost for this arm of patients is £73,666. CTC, CT colonography.

constipation is a poor predictor of pathological findings.^{16,17} However, there is an increase in referrals to gastroenterology or general surgical clinics to exclude colorectal cancer in patients with the sole presenting symptom of constipation. Despite the low yield of pathology, colonic luminal examination is often necessary to reassure patients.

Our data revealed that among the 100 colonoscopies and 100 CTCs in patients with constipation, there was a diagnostic yield of 2 adenocarcinomas. Both of the cancers were found to be non-obstructing right-sided colonic lesions, indicating that constipation is unlikely to be related to the diagnosis.

The Joint Advisory Group on Gastrointestinal Endoscopy, an intercollegiate body responsible for standards, quality and training, has issued guidance for caecal intubation rates of over

Figure 4. A flowchart of cost for the CT colonography (CTC) arm is shown. Total cost for this arm of patients is £55,016.

90% on an intention-to-colonoscopy basis. Our study revealed a colonoscopy failure rate in patients with constipation of 37%. However, the overall failure rate for all colonoscopies within the trust is 11%; this is similar to the accepted 10% failure rate of caecal intubation recommended by the British Society of Gastroenterology.¹⁸ In our trust, we complete roughly 6000 colonoscopies in 1 year.

There were no failed CTCs reported. The higher colonoscopy failure rate was mainly due to patient discomfort (51.3%). This is supported by 54% of patients having higher than the Joint Advisory Group on Gastrointestinal Endoscopy-recommended dose of midazolam and pethidine in our patient cohort. The high failure rate of colonoscopy could have been due to technical difficulty in those with constipation or due to operator skill. A prospective study of 909 consecutive colonoscopies in Seoul revealed that constipation caused prolonged insertion time.¹⁷

It is worth noting that bowel preparation regimes were the same for both modalities; this removes bias.

CTC has been shown to be the more cost-effective investigation ($p < 0.05$). Lee *et al*¹² published the mean costs per patient for CTC and colonoscopy as £434 and £518, respectively, in the National Health Service in 2012. Our calculated total costs for both the colonoscopy arm and CTC arm of patients are £73,666 and £55,016, respectively.

CTC has been established to have a good diagnostic yield.^{19,20} A meta-analysis reviewing the performance of CTC compared with colonoscopy concluded that 6393 patients also showed a high specificity with CT up on detecting polyps >9 mm.¹² The above, coupled with studies showing that CTC may be preferable to colonoscopy in terms of patient comfort and acceptability, favours the use of CTC.²¹ CT availability and the number of radiologists trained in interpreting CTC, however, may be limiting factors, which should be taken into consideration when choosing between the two diagnostic modalities.

Limitations of the study

A limitation of our study is that the data are collected retrospectively. Therefore, it is limited to the accuracy of the medical notes and request forms. Randomizing patients to either arm with the sole complaint of constipation would give more robust results. Patient satisfaction after each procedure would have been useful, as it would indicate which modality is preferred.

CONCLUSION

Our study shows that there is low rate of malignant pathology and a relatively high failure rate of colonoscopy in patients who present with the primary symptom of constipation. As a result, further procedures are often required with an increase in financial burden. We propose that CTC may be an acceptable first-line investigation with further endoscopy if required to investigate those presenting with an isolated symptom of constipation.

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