



E-ISSN: 2706-9575

P-ISSN: 2706-9567

IJARM 2023; 5(2): 126-133

Received: 28-03-2023

Accepted: 30-04-2023

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## Comprehensive study between conventional colonoscopy and virtual CT colonography in assessment of colonic disorders

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DOI: <https://doi.org/10.22271/27069567.2023.v5.i2b.490>

### Abstract

**Background:** Colonic and extracolonic staging is critical in colorectal cancer patients and can be assessed with Conventional Colonoscopy (CC), which is accepted as the gold standard for evaluating the colon; however, there is data that indicates that colonoscope localization of cancer is frequently imprecise and depends on distances may be misleading. Computed Tomography Colonography (CTC), on the other hand, has demonstrated the ability to offer excellent preoperative staging of colorectal cancer, particularly in cases of incomplete CC, and allows examination of the whole colon, even in cases of obstructive lesions; It also enables proper staging of extracolonic cancer spread. The purpose of this study was to compare CTC to colonoscopy in the identification of colorectal disorders in patients with colonic symptoms and signs.

**Methods:** A prospective double blind comparative study was conducted on 50 patients suffering colorectal symptoms and altered bowel habits, bleeding per rectum, abdominal pain, weight loss, unexplained fatigue and loss of appetite. All patients involved in the study were subjected to Preparatory investigations, CT virtual colonoscopy and colonoscopy.

**Results:** The correlation between clinical presentation, colonoscopy, colonographic findings and histopathological results revealed that among 5 abdominal pain cases (2 cases had diverticulum (no finding) and remaining 3 cases had either mass or polyp (adenomatous polyp (moderate dysplasia)) or no finding (no finding) in histopathology). The sensitivity, specificity, PPV, NPV and accuracy of Colonography vs. Colonoscopy in detection of mass in colon was 100%, 93.75%, 90%, 100% and 96.88% respectively. While for colon ulcer they were 44.44%, 100%, 100%, 76.19% and 72.22% respectively. For detecting colon polyp these parameters showed 75%, 100%, and 100%, 95.45% and 87.50% respectively. Lastly, for diverticulum in colon or any abnormality in colon, the result reached 100%.

**Conclusion:** Colonic and extra colonic staging is critical in colorectal cancer patients and can be assessed with Conventional Colonoscopy (CC), which is accepted as the gold standard for evaluating the colon; however, there is data that indicates that colonoscope localization of cancer is frequently imprecise. The technique enjoys higher sensitivity than conventional colonoscopy in detecting colorectal carcinoma, abnormalities resulting from an obstructive lesion, segmental identification of colon abnormalities, and tumour staging prior to surgery.

**Keywords:** Computed tomography colonography, conventional colonoscopy, multislice computed tomography

### Introduction

There has been tremendous progress in the research and clinical deployment of Computed Tomographic Colonography (CTC) or (virtual colonoscopy) since its inception in 1994. CTC is offered as an elective at a large number of universities throughout the world. The use of Multislice Computed Tomography (MSCT) technology is a CTC advancement. MSCT enables fine spatial resolution at shorter capture times, enhancing the scan's sensitivity to tiny lesions [1].

Computed tomographic colonography (CTC) is a effective approach for assessing the whole colon It offers potential advantages over traditional colonoscopy since it is less intrusive and does not require anaesthesia or recovery time. A helical, thin-section CT of the cleaned and distended colon is used in the examination. Data analysis is carried out using commercially available CTC post-processing software, which includes multiplanar 2D and virtual

endoscopic 3D image presentations [2].

CTC's capacity to identify colorectal polyps has been evaluated in several research. CTC showed to be promising in high-risk groups, with a reported sensitivity of more than 90% for polyps larger than 10 mm. In Western nations, colorectal cancer is the third most prevalent malignancy and the second largest cause of cancer-related mortality. Colorectal cancer, like other cancers, requires screening and early discovery to be successfully treated. CTC has become more widely used as a standard screening test for colorectal cancer diagnosis in the recent decade since it is more convenient and less intrusive than colonoscopy [3].

CTC generates two-dimension and three-dimension images as if it is seen through endoscopy of the colon. Although radiologists are most familiar with two-dimension abdomen CT scanning, the gas-distended colon poses unique problems to "film" readers. Planar assessment may be complicated by the complex intraluminal architecture of bowel loops, haustrations, gut fluids and faeces, and the degree of distention. On the other hand, CTC of the big bowel gives an "intraluminal" viewpoint on CT data. In early versions of virtual endoscopic software, manual navigation or data preparation, as well as inadequate rendering, may have hindered this technique [2].

We aimed to study the role of CTC in diagnosis of colorectal diseases in patient with colonic symptoms and signs compared to conventional colonoscopy.

### Patients and Methods

This prospective double blind comparative study was conducted on 50 patients with colorectal symptoms and signs as altered bowel habits, bleeding per rectum, abdominal pain, weight loss, unexplained fatigue and loss of appetite. An informed written consent was obtained from all patients and the approval of the Faculty Research Ethics Committee was obtained.

All patients involved in the study were subjected to history taking and clinical assessment, preparatory investigations such as CBC, Stool analysis, abdominal ultrasonography. Moreover, they were subjected to CTC where patients generally receive oral laxative for bowel evacuation 24 hours before the exam, and receive diet low in fibers and semisolids and then only water at day of CTC.

The technique of CT virtual colonoscopy included the following steps:

#### A. Insufflation and scanning

Bowel insufflation is performed while subject is in decubitus position on his left side. A Foley's catheter is inserted through anal canal with gentle inflation inside the rectum. Antispasmodics are given to the subject intravenously to decrease pain like hyoscine butyl bromide.

Fine CT cut images were performed with a row CT scanning machine (Emotion Siemens Medical Systems) with thin collimation, with the patient in the supine posture. Prior to scanning, a scout view is taken to make sure that gut is adequately insufflated with gas.

Colon wall can be accentuated by administering an iodinated contrast agent intravenously. The examinations were acquired while patient is holding breath, useful exposure settings are 120 kVp and 50–100 mAs with section

thickness of 0.75–3 mm, with reconstruction intervals of 1.3 mm.

#### B. CT data reconstruction and analysis

Image processing and virtual colonography were performed by using advanced workstation and the studies were recorded on CDs.

#### Statistical analysis

Data was analyzed using STATA version 14.2 (Stata Statistical Software: Release 14.2 College Station, TX: Stata Corp LP.). Quantitative data was represented as mean, standard deviation, median and range. Qualitative data was presented as number and percentage. Sensitivity, specificity, positive predicted value, negative predictive value and accuracy of colonography vs. colonoscopy were calculated. Graphs were produced by using Excel program.

#### Results

When correlate between clinical presentation and Colonoscopy finding; we found among 5 cases presented by abdominal pain (2 cases had Diverticulum (No finding) and remaining 3 cases had either mass or polyp (Adenomatous polyp (moderate dysplasia)) or no finding (No finding) in histopathology). When correlate between clinical presentation and Colonography finding; we found (2 cases had Diverticulum and remaining 3 cases had either mass or polyp or no finding).

When correlate between clinical presentation and Colonoscopy finding; we found Among 9 cases presented with chronic constipation (mass was the common finding in 4 cases (Adenocarcinoma grade III), and Mass & Polyp (Adenocarcinoma grade II/ adenomatous polyp) or Diverticulum (No finding) or Stricture (Adenocarcinoma grade III) in one case while remaining 2 cases had No finding (No finding)). When correlate between clinical presentation and Colonography finding; we found (mass was the common finding in 6 cases, and Diverticulum in one case while remaining 2 cases had No finding).

When correlate between clinical presentation and Colonoscopy finding; we found Among 11 cases presented with Bleeding per rectum (the majority of them also, had ulcer (4 cases, Ulcerative Colitis – active & Non-specific colitis), 3 cases had mass (Adenocarcinoma grade II & III, 2 cases had Mass & ulcer (Adenocarcinoma grade III – Ulcerative colitis) and Diverticulum (No finding) or Polyp (Adenomatous polyp (mild dysplasia)) was present in one case respectively). When correlate between clinical presentation and Colonography finding; (the majority of them also, had mass (4 cases), 2 cases had Mucosal thickening or Mucosal thickening & Ulcer, and Mucosal thickening, ulcer & mass or Diverticulum or Polyp was present in one case respectively).

Finally, among 5 cases with Chronic diarrhea Colonoscopy finding showed (the majority (3 cases) had Ulcer (Ulcerative Colitis – active) & No finding (no finding) or Polyp & ulcer (Crohn's disease - Adenomatous polyp) was present in one case respectively) and Colonography finding showed (the majority (2 cases) had Mucosal thickening and normal finding, Mucosal thickening & Ulcer and Mucosal thickening & polyp was present in one case respectively). Table 1.

**Table 1:** Summary of Colonographic, Colonoscopic and Histological findings in studied population

Presentation	Colonography finding	Colonoscopy finding	Histological diagnosis
Abdominal pain (5)	No finding (1) Mass (1) Diverticulum (2) Polyp (1)	No finding (1) Mass (1) Diverticulum (2) Polyp (1)	No finding (1) Adenocarcinoma grade III (1) No finding (2) Adenomatous polyp (moderate dysplasia)
Chronic constipation (9)	No finding (2) Mass (6) Diverticulum (1)	No finding (2) Mass (4) Mass & Polyp (1) Stricture (1) Diverticulum (1)	No finding (2) Adenocarcinoma grade III Adenocarcinoma grade II/ adenomatous polyp Adenocarcinoma grade III No finding (1)
Chronic diarrhea (5)	No finding (1) Mucosal thickening (2) Mucosal thickening & Ulcer (1) Mucosal thickening & polyp (1)	No finding (1) Ulcer (2) Ulcer (1) Polyp & ulcer (1)	Non-specific colitis (1) Ulcerative Colitis – active (2) Ulcerative Colitis – active (1) Crohn's disease - Adenomatous polyp (1)
Bleeding per rectum (11)	Mucosal thickening (2) Mass (4) Mucosal thickening & Ulcer (2) Mucosal thickening, ulcer & mass (1) Diverticulum (1) Polyp (1)	Ulcer (2) Mass (3) Mass & ulcer (1) Ulcer (2) Mass & ulcer (1) Diverticulum (1) Polyp (1)	Ulcerative Colitis – active (1) Non-specific colitis (1) Adenocarcinoma grade II (1) Adenocarcinoma grade III (1) Adenocarcinoma grade III – Ulcerative colitis (1) Adenocarcinoma grade III – Ulcerative colitis (1) Ulcerative Colitis – active (2) Adenocarcinoma grade II (1) No finding (1) Adenomatous polyp (mild dysplasia)

Sensitivity, specificity, positive and negative predictive values (PPV & NPV), and accuracy of Colonography vs. Colonoscopy in detection of mass, ulcer, Diverticulum,

polyp, and abnormalities in colon were as follows respectively. Table 2

**Table 2:** The diagnostic potential of Colonography vs. Colonoscopy in detection of mass, ulcer, Diverticulum, polyp, and abnormalities in colon

Study	Finding	Colonoscopy		Diagnostic potential (%)	
		Mass	No mass		
Colonography	Mass	9	1	Sensitivity	100
				Specificity	93.75
	No mass	0	15	PPV	90.00
				NPP	100
				Accuracy	96.88
	Ulcer	4	0	Sensitivity	44.44
				Specificity	100
	No ulcer	5	16	PPV	100
				NPP	76.19
				Accuracy	72.22
	Diverticulum	2	0	Sensitivity	100
				Specificity	100
	No Diverticulum	0	23	PPV	100
				NPP	100
				Accuracy	100
	Polyp	3	0	Sensitivity	75.00
				Specificity	100
	No polyp	1	21	PPV	100
				NPP	95.45
	Abnormal	21	0	Sensitivity	100
				Specificity	100
	Normal	0	4	PPV	100
				NPP	100
				Accuracy	100

## Discussion

Diseases of colon includes a big range of conditions including inflammation and cancer, with cancer colon being the main mortality cause globally. Conventional

colonoscopy (CC) was the most important procedure for diagnosis of colonic problems. This modality can only provide information on the colon and does not provide information on other abdominal organs. Unfortunately, it

only shows 5-15 percent of the colon in 5-15 percent of patients<sup>[4]</sup>.

Furthermore, Singh *et al.*, 2015<sup>[5]</sup> discovered perforation risk in a small but significant proportion of patients. With the advent of computed tomography (CT), it became feasible to examine the colon as well as other abdominal organs. Traditional CT using cross-sectional pictures, on the other hand, is insufficient for detecting tiny mucosal polyps and small tumours.

Patel and Chang, 2016<sup>[6]</sup> For the sake of rapid, precise and superficial technique for evaluating colorectal disease, computed tomography (CT) colonography (CTC), often known as "virtual colonoscopy," has progressed rapidly.

Vining *et al.*, 1994<sup>[7]</sup> pioneered this method early in the nineteen's as a single exam for both colon and other intra-abdominal organs. CTC creates two-dimensional and three-dimensional pictures of the colon using volumetric CT data and sophisticated imaging software. MPRs and 3-D display modalities, including intra-luminal viewing pictures, are generated from thin section axial images. Because 3-D endoluminal pictures mimic the endoluminal viewpoint of a colonoscope, CTC is also known as virtual colonoscopy. Those pictures complement one other and, when combined, provide superb detail about the colon.

CTC has become a tool for comprehensive colon examination and early cancer identification and also cancer staging<sup>[7]</sup>.

Our results were in agreement with Singh *et al.* 2015,<sup>[5]</sup> the purpose of the study was to diagnose and describe abnormalities of the gut wall in individuals suspected of having colonic lesions, as well as to correlate these findings with CC and histology. In addition, the research group included 25 males and 25 females. The youngest patient was 10 years old, while the oldest was 75 years old. The most patients were between the ages of 61 and 70. (20 percent). The p-value for the relationship between age and gender distribution was 0.132.

Similarly, in study conducted by Nissar *et al.* 2017<sup>[8]</sup>, When 120 CRC patients were compared to 200 healthy controls, 72 of the 120 confirmed cases of CRC were males and 48 were females; the mean age of patients with confirmed CRC was 55 years. There were no significant gender or age differences between the groups ( $p > 0.05$ ).

In addition, Semlali *et al.* 2016<sup>[9]</sup>, research included 115 colon cancer patients and 102 healthy controls, which is consistent with our findings. The study cohort varied in age from 45 to 88 years old, with a mean age of  $56.04 \pm 14.37$  for colon cancer cases and  $52.84 \pm 15.88$  for controls. The mean age difference between the two groups was statistically insignificant. The ratio of males to females in cases and controls was not substantially different (66/49 for patients and 60/42 for controls).

The Messaritakis *et al.* 2018<sup>[10]</sup>, study included 397 newly diagnosed and histologically documented individuals with CRC. The median age was 65 years old, and 246 (62.0 percent) of the patients were men.

In addition, the mean age at diagnosis of colon cancer was 53.32 years (SD = 14.326) in the Metwally *et al.* 2018<sup>[11]</sup> research, with the youngest case identified at 16 years old and the oldest at 88 years old. Data, on the other hand, suggest a small female majority of around 1.2:1.

236 patients satisfied the inclusion criteria for the Ben-Ishay *et al.* 2013<sup>[12]</sup>, research over a ten-year period. The mean age was 71.5 years; 52.5% were men, and 59.3% had cancer

in the left side of the large intestine. The average period from onset of complains and definitive diagnosis was 1.8 months. The average time between follow-ups was 36 months. Mortality rate was 39.4%. The adjusted mortality rate (including both total and peri-operative mortality) was 33.9 percent. Abdominal pain was the most prevalent symptom, which occurred in 51.3 percent of cases, followed by alteration in gut habits in 41.5 percent and loss of weight in 32.6 percent.

The Arfaoui in 2008, Cherif in 2014, and Khiari and Hsairi in 2017<sup>[13-15]</sup>, the study found that the average age at diagnosis in northern Tunisia was 60 years, which was supported by our study, which had a sex ratio of 1.2. This ratio has remained steady in Tunisia for 15 years, which is somewhat longer than that seen in our study and other north-African nations with an average age of approximately 55 years.

As reported by us, Egypt and certain African nations have considerably lower mean age at diagnosis, with 50 and 47 years, respectively<sup>[16-18]</sup>. In contrast to, the Westernized nations which have mean age of about 70 years at diagnosis<sup>[19, 20]</sup>.

In harmony with the current study, The Singh *et al.* 2015<sup>[5]</sup>, study comprised 50 individuals with clinical suspicion of colonic disease. All patients had CTC as well as traditional colonoscopy. Patients most commonly presented with changed gut habit (66 percent), followed by rectal bleeds (46 percent), abdominal discomfort (38 percent), and loss of weight (22 percent).

In line with our current results, Smith *et al.* 2006<sup>[21]</sup>, found that, In the early cancer group, 89 percent had bleeding per rectum, 58 percent had alteration in gut habit, and 24 percent experienced colic, but colicky pain ( $P = 0.001$ ) and alteration in gut habit ( $P = 0.001$ ) were prevalent and were significant in the advanced group. Systemic symptoms, such as loss of appetite and weariness, were distributed similarly across both groups; on the other hand, weight loss was not significant, there was an inclination towards it in the advanced colon and advanced rectal tumours group ( $P = 0.17$ ).

Ben-Ishay *et al.* 2013<sup>[12]</sup>, research were satisfied by 236 subjects. Abdominal discomfort was the most frequent symptom, occurring in 51.3 percent of patients, followed by alteration in gut habit in 41.5 percent and loss of weight in 32.6 percent.

Sotoudehmanesh *et al.* 2007<sup>[22]</sup>, in this Iranian study, 134 average-risk people with limited brilliant fresh bleeding per rectum from anal fissures of the mid-line had no malignancy and 4 adenomatous polyps (3 percent).

By colonoscopy, Carlo *et al.* 2006<sup>[23]</sup>, found that, rectal haemorrhage has predictive value for CRC diagnosis and considered the most common presentation correlated with malignant changes.

Different results were reported by Fine *et al.* 1999<sup>[24]</sup>, made a comprehensive prospective research that found no connection between anal bleeding and colon lesions. Because only three carcinomas were discovered in proximal segments of the colon, from 45 patients with bleeding per rectum, the researchers concluded that a full colonoscopy is always a safer, more effective, and less expensive alternative.

Histopathologic findings were available from the study by Kim *et al.* 2010<sup>[25]</sup>, 118 out of 120 colonic lesions, 2 patients each had two 7-mm sessile non-anastomotic



polyps. Non-anastomotic lesions had sessile ( $n = 73$ ), pedunculated ( $n = 11$ ), or flat morphology, whereas anastomotic lesions had sessile ( $n = 19$ ), flat ( $n = 2$ ), ulcerative ( $n = 1$ ), or diffusely nodular along the anastomotic rim morphology ( $n = 1$ ). A total of 65 people had at least one adenomatous lesion (either an adenoma or an adenocarcinoma). A total of twenty-two people were diagnosed with advanced neoplasia (either advanced adenoma or adenocarcinoma). Six of the 742 people developed adenocarcinomas, totaling seven lesions, six of which were metachronous tumours and one of which was recurrent malignancy at the anastomosis.

Also, Khiari and Hsairi in 2017<sup>[15]</sup>, found that, the most common histological type was adenocarcinoma, which was found in 86.3 percent of males and 82.0 percent of females. This proportion is consistent with what has been seen in other Maghreb<sup>[26]</sup>, Middle Eastern, and Asian nations (73.4 percent in Niger, 82 percent in Morocco, 84.6 percent in Jordan). However, it is far lower than in Western nations (94 percent of cancers in Europe)<sup>[27]</sup>.

Reported in Bohorquez *et al.* 2016<sup>[28]</sup>, their study, Adenocarcinoma was the most prevalent tumour type, accounting for 91.5 percent of all cases, followed by mucinous carcinoma in 5.2 percent of cases and carcinoma with signet ring cells histology in 1.6 percent of cases. Other histological categories that accounted for 1.7 percent of the cases were squamous cell carcinoma and neuroendocrine tumours.

But in their study Johnson *et al.* 2008<sup>[29]</sup>, found in 109 (4.3 percent) individuals, there were 128 big lesions. All seven adenocarcinomas in seven individuals were 10 mm in size. Non-adenomatous lesions 5 mm in size comprised 136 (25%) hyperplastic polyps, 7 (1%) lipomas, and 30 (5%) with various histologies.

In a 2013 research by Fini *et al.*, All 304 1st degree relatives had thorough CTC and CC<sup>[30]</sup>. There were 133 lesions discovered. 49.6% were adenomatous and 49.6% non-adenomatous lesions. 101 (75.9%) of the 133 polyps were small, 22 had at least one polyp measuring 6 mm at minimum, and 2.9% had at least one polyp measuring 10 mm at minimum.

CTC assisted in accurately identifying 17 of the 22 participants who had polyps measuring 6 mm at minimum and 278 of the 282 subjects who did not have polyps measuring 6 mm at minimum. Nikpour and Ali Asgari in 2008,<sup>[31]</sup> found colorectal carcinoma in 6.5% of our patients and adenomatous polyps in 7.5%.

In 2015<sup>[5]</sup>, Singh identified seven instances of ulcerative colitis, three of which were acute and four of which were chronic. The results of CTC in ulcerative colitis are discussed. The rectum was the most commonly affected in both acute and chronic UC, this portion is used. With an average wall thickness of 8 mm, diffuse mural thickening was the most common CT colonographic abnormality detected. Aside from mural thickness, other observations in chronic ulcerative colitis were haustration loss and loss of mucosal granularity. The granularity of the mucosa was best seen on endoluminal imaging. There were three instances of tuberculosis. The caecum was found to be involved in all of the patients (100 percent). In two individuals, the terminal ileum and ascending colon were affected (66.6 percent). The average thickness of the mural was 9 mm. All of the patients showed pericolic stranding, mesenteric lymphadenopathy, and luminal constriction. Colonic lipoma was discovered in

a 50-year-old female patient who complained of changed bowel habits. A smooth surface sessile polyp with 3.5 cm size could be identified in the lateral wall of sigmoid colon by CTC. The findings were verified by CC. Later, surgical resection was performed, and histology findings confirmed the diagnosis of lipoma. With CTC, all of the lesions were accurately located. However, because CC cannot go through an occlusive tumour, all eight rectosigmoid adenocarcinomas were reported as lesions originating from the rectum. One transverse colon lesion was found to be in splenic flexure on CC, and one lesion of the ascending colon was found to be in transverse colon. Two proximal successive lesions were overlooked as the colonoscope could not go further beyond the occluding mass, and one lesion proximal to the anastomotic spot was overlooked due to the colon's complicated and bizarre structure. CTC was used to find all of these lesions.

The existence of complaints such as rectal bleeds and alteration in gut habit, which lead patients to visit a physician early, is likely to explain the high incidence of rectal and distal cases<sup>[32]</sup>.

Regarding the symptoms with respect to location of the tumor, Ben-Ishay *et al.* 2013<sup>[12]</sup>, observed that, bleeding per rectum and alteration of gut habits occurred at considerably greater rates in individuals with left colon cancers ( $P = 0.002$  and  $0.006$ , respectively). Within the node-positive phases, there are substantial variations in the presentation of symptoms, with a higher incidence of stomach discomfort ( $P = 0.01$ ), weight loss ( $P = 0.04$ ), and a change in bowel habits ( $P = 0.03$ ).

In a 2018 research by Horvat *et al.*, CTC<sup>[33]</sup> were found in 23 of 65 people, with 40 synchronous colorectal polyps at least 5 mm in size proximal to the occlusive tumour (35.4 percent). Thirty-four polyps (85.0 percent) were pedunculated, whereas six (15.0 percent) were sessile. 25 (67.6 percent) were TA, six (16.2 percent) were TVA, four (10.8 percent) were hyperplastic, one (2.7 percent) was VA, and one (2.7 percent) was SA. CTC discovered all 65 occlusive CRCs previously diagnosed on incomplete pre-operative colonoscopy, as well as four additional proximal synchronous colon tumours in different patients, one in the cecum, two in the ascending colon, and one in the rectum. The pathology of the four more synchronous colon tumours indicated that they were all adenocarcinomas. CTC also found a synchronous appendiceal tumour more proximally, which was later confirmed pathologically as a grade 1 neuroendocrine appendiceal tumour.

CTC was found to be a helpful technique for evaluating the proximal colon following incomplete colonoscopy in studies done by Rockey DC *et al.* 2007<sup>[34]</sup>, and Pickhardt PJ *et al.* 2011<sup>[35]</sup>, due to high sensitivity to detect any colonic mass.

Also, our observation was supported by Liedenbaum *et al.* 2009<sup>[36]</sup>, study showed that, when using a CTC cut-off  $>10$  mm, the patient sensitivity of CTC was 82% and the specificity was 86% for finding lesions at colonoscopy  $>10$  mm. When using a CTC cut-off  $>6$  mm per patient sensitivity of CTC was 91% and the specificity was 69% for finding lesions at colonoscopy  $>6$  mm.

Similarly, Singh *et al.* 2015<sup>[5]</sup>, showed the sensitivity for detecting acute and chronic ulcerative colitis of CTC is 66.6% and 100%, respectively.

In contrast to the findings of Anderson *et al.* 2006<sup>[37]</sup>, CC is more sensitive than CTC in identifying early mucosal

erosions. As of 63.6 percent and 100 percent sensitivity, respectively.

The sensitivity of 90% implies that in 10% of individuals, CTC failed to identify a lesion 10mm in size. For big adenomas or malignancies, the per-polyp sensitivity was 0.84 0.04. The estimated sensitivity per patient in recognising patients with adenomas 6 mm was 0.78 [29].

Devir *et al.* 2016, [38] found that, CTC demonstrated 83 percent sensitivity and 95 percent specificity, with a PPV of 95 percent and a NPV of 83 percent for the identification of colorectal polyps and masses, independent of size.

This results was similar to that by Liedenbaum *et al.* 2009, [36] as a per polyp sensitivity for colonoscopy of 96% for lesions >6 mm.

And Fini *et al.* 2013 [30], showed the accuracy of CTC for polyps measuring at least 6 mm was 97%.

Also, Pickhardt *et al.* 2003 [39], reported that, A CT scan has a high sensitivity and specificity for detecting polyps or cancers. CTC had a sensitivity of 93.8 percent for polyps bigger than 10 mm in diameter, 93.9 percent for polyps at least 8 mm in diameter, and 88.7 percent for polyps at least 6 mm in diameter for screening purposes.

According to Horvat *et al.* 2018 [33], Preoperative CTC had a sensitivity and specificity of 88.9 percent and 83.3 percent in identifying colorectal polyps larger than 5 mm, respectively. CTC has an 81.1 percent sensitivity on perpolyp analysis. The sensitivity was 36.4 percent when only polyps less than 10 mm (n = 9) were evaluated, but it was 100 percent when polyps 10 mm or bigger (n = 28) were considered.

And in agreement with us, Singh *et al.* 2015 [5], found the CTC had a sensitivity and specificity of 97.56 percent and 100 percent in identifying lesions, respectively. The Positive predictive value and Negative predictive value were both 100% and 93.75 percent, respectively. CC had a sensitivity and specificity of 92.68 percent and 100 percent, respectively, in identifying lesions. The Positive predictive value and Negative predictive value were both 100% and 83.3 percent, respectively. The p-value for the difference in sensitivity and specificity between CTC and traditional colonoscopy was 0.305. Visualization of the whole colon was available in all individuals with CTC but only in 31 patients (62 percent) with CC. As a result, it was discovered that CTC is a superior modality than traditional colonoscopy for seeing the whole colon, even in the presence of occlusive lesions. ( $p < 0.001$ ).

The results of our study agreed with Pickhardt *et al.* who showed 96.1% and 94.7% for CTC and colonoscope respectively [35].

Halligan S, *et al.* 2015 [40], discovered that CTC had a sensitivity of 95.9 percent in detecting colorectal cancer.

In a comparison research, Neri *et al.* 2010 [41], found that CTC outperforms traditional colonoscopy in identifying colonic masses. CTC sensitivity, specificity, PPV, and NPV in identifying the precise site of colonic masses were 100 percent, 96 percent, 85 percent, and 100 percent, respectively.

CTC identified 398 (96.1 percent) of 414 histologically proven malignancies (95 percent confidence interval [CI]: 93.8 percent, 97.7 percent) [35].

Sabanli *et al.*, 2010 [42], from New Zealand investigated the sensitivity of CTC for cancer in almost 4000 people using their national cancer registry database as the reference

standard and reported a comparable sensitivity of 95%. (123 of 131).

CTC showed a sensitivity of 100% and a specificity of 99.2% for the diagnosis of colorectal cancer in a smaller British trial of 150 symptomatic individuals [29].

A study of CTC for screening families of CRC patients, found that CTC was 77% sensitive for 6 mm lesions, 89% sensitive for 10 mm lesions and 89% sensitive for advanced cancer [30].

T Johnson *et al.* in 2008 [29]. Claimed that there are 78 percent and 90 percent sensitivities at the 6- and 10-mm thresholds reported in standard-risk subjects, respectively, and are slightly superior to the 69 percent and 80 percent sensitivities recently obtained in a national based CTC study [43].

Importantly, a 2010 research by Kim *et al.* [25] found that CTC had 100 percent sensitivity for cancer within the colon.

### Limitations

In our investigation, several drawbacks of CTC were difficulties detecting sessile lesions and a scarcity of information concerning congestion and mucosal defects, where CC outperformed CTC. Also, the limited sample size and the sample cannot be considered representative of the entire population. Patient exposure to higher dose of radiation during CTC is the procedure's major drawback. The dosage of radiation received is increased while screening in both supine and prone positions. To decrease the radiation dosage, the researchers lowered the tube current. Subjects were enrolled along a lengthy duration during which CT technology changed, as well as the lack of faecal tagging (which some radiology specialists frequently employ to increase CTC accuracy) during the CTC exams.

### Recommendations

Longitudinal studies are required to evaluate people's overall screening behaviour in terms of demographic variables. Due to a dearth of comparable studies in the nation, it is suggested that similar and complementary research be conducted in other locations with larger populations to reach better conclusions from the entire data.

### Conclusion

CTC is a noninvasive, quick and reliable method of examining the whole colon. It does not require any previous anaesthesia and is often more tolerable than traditional colonoscopy. CTC offers greater sensitivity than traditional colonoscopy for detecting colorectal cancer, with the capacity to identify abnormalities proximal to the obstructive lesion, precise segmental localization of abnormalities within the colon, and reasonably good pre-operative tumour staging.

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#### How to Cite This Article

Mohammad MAR, Abdelwahed SR, Eid KA, Mostafa HM. Comprehensive study between conventional colonoscopy and virtual CT colonography in assessment of colonic disorders. *International Journal of Advanced Research in Medicine* 2023; 5(2): xx-xx

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