A Comparative Study between Virtual Colonoscopy (CT Colonoscopy) and Conventional Colonoscopy in Different Presentations of Suspected Colonic Disorders

Wael M. Aref[1]; Ahmed El-Mazny[1] and Farid G. Amin[2]

[1]Department of Internal Medicine, Faculty of Medicine, Cairo University
[2]Department of Radiodiagnosis, Faculty of Medicine, Cairo University
waelaref@yahoo.com

Abstract: Background: Virtual colonoscopy is a promising new modality for investigating suspected colonic disorders, it is relatively safe, can be done without sedation and in less time compared to conventional colonoscopy. **Aim of this work:** to evaluate the application of virtual colonoscopy in different indications of conventional colonoscopy and compare between both procedures as regards sensitivity and specificity of both methods, putting the hypothesis that virtual colonoscopy can replace the conventional colonoscopy. **Subjects and Methods**: a group of eighty two patients having different indications for colonoscopy were included; all patients underwent full medical history, examination and any needed investigations. Patients were scheduled to undergo both conventional and virtual colonoscopy on the same week, both endoscopist and radiologist were unaware of the other report. **Results:** Both conventional and virtual colonoscopy detected colonic masses in 18 patients, colonic diverticulae in 5 patients and colonic strictures in 2 patients with no missed or false positive results with 100% sensitivity and specificity; and 100% positive and negative predictive values. Meaning that virtual colonoscopy was accurate in detection of masses, diverticulae and strictures. However detection of polyps by virtual colonoscopy was 88% sensitive and 77% specific with 3 missed polyps (small polyps) and 13 false positive polyps detected by virtual colonoscopy. Virtual Colonoscopy Could not detect any of the following lesions**:** angiodysplasia (2 patients), ulcerative colitis (without pseudo polyps) (3 patients), flat ulcers and non-specific colitis (11 patients), with a Sensitivity 0%. **Conclusion:** Virtual Colonoscopy can be used in evaluation of patients presenting with constipation, weight loss or abdominal pain in whom colonoscopic examination was indicated (in these patients colonic lesions were masses, strictures and diverticulae, so virtual colonoscopy is sensitive in detecting these lesions). But the use of virtual colonoscopy is limited in patients presenting with anemia and positive occult blood in stools, bleeding per-rectum and chronic diarrhea (in these patients the colonic lesions were angiodysplasia, flat ulcers and non specific colitis, so virtual colonoscopy is not sensitive in detecting these lesions). Also, virtual colonoscopy is a good diagnostic tool for screening for colorectal carcinoma**,** however using the recent technology in virtual colonoscopy as new faster CT multi-slice machines with the least possible slice thickness in order not to miss a small lesion is recommended.

[Wael M. Aref; Ahmed El-Mazny and Farid G. Amin. **A Comparative Study between Virtual Colonoscopy (CT Colonoscopy) and Conventional Colonoscopy in Different Presentations of Suspected Colonic Disorders.** *Life Sci J* 2012;9(3):561-567] (ISSN:1097-8135). http://www.lifesciencesite.com. 79

Key words: Virtual Colonoscopy - Conventional colonoscopy – Lower GIT symptoms - Colorectal carcinoma

1. Introduction

Three-dimensional Computed tomographic (CT) Colonography or Virtual Colonoscopy, is a promising new imaging method. The technique combines the use of rapid helical CT with computer software capable of rendering images of the whole colon. This method is being promoted by some as a noninvasive screening test for colorectal neoplasia **[1].** Current Computed tomographic (CT) Colonography protocols use submillimeter detector collimation, resulting in more than a thousand images for a single examination. Various image display techniques are used to interpret these large data sets. Image interpretation may include a two-dimensional (2D) axial reviewed by **[2],** 2D multiplanar reformation reviewed by **[3],** Primary 2D reviewed with three-dimensional (3D) comparison for problem solving by **[4],** primary 3D reviewed with 2D comparison for problem solving by **[5],** also computer-aided diagnosis**,** use of non radiologists as second readers, and use of various 3D display options including virtual dissection reviewed by **[6-9].**

Virtual colonoscopy has a number of advantages over conventional colonoscopy. With virtual colonoscopy, the examination is performed without sedation, in less time than and involves little risk of complications observed with conventional colonoscopy such as perforation and distension. It can help to examine the colon in case of failed colonoscopy due to either stricture or a large mass partially obstructing the colon, also it has a better patient compliance in patients who refused the conventional colonoscopy. The radiologist, using a number of static and dynamic display options, can examine and reexamine segments of the colon after the procedure has been performed. The localization of abnormalities is precise, and both sides of the bowel folds can be visualized **[10]**. The disadvantages of virtual colonoscopy include the need for bowel cleansing and infusion of gas to expand the

colon. Scanning hardware is expensive, and the interpretation of the images is relatively difficult and time consuming. Retained stool or fluid or contracted segments of the bowel interfere with the detection of lesions **[11].**

The current cost of virtual colonoscopy probably prohibits its use as a screening test. A major component of the cost is the time now required for a radiologist to perform the procedure. To be economically feasible for use as a screening method, the cost probably would need to drop below the cost of conventional colonoscopy, since virtual colonoscopy is only a diagnostic test. An appreciable number of patients undergoing screening would need a subsequent colonoscopy to evaluate abnormalities and resects polyps. This additional procedure must be included in any analysis of cost. The relatively low specificity of virtual colonoscopy in most series (i.e., the many false positive results) magnifies its cost, because it leads to unnecessary conventional colonoscopies. **[12]**

The use of CT imaging for the detection and staging of CRC (Colorectal carcinoma) was proposed as early as 1980 **[13]**. In 1983, **Coin et al., [14],** found that CT had potential mass screening method for colorectal polyps**.** Over a decade later, in 1994, the term "virtual colonoscopy" was formally introduced by **[15].** Since then, great advances in software and hardware have occurred**.** Since 1996, studies have been conducted using multiple scanning parameters, different risk populations, multiple stool and fluid tagging techniques, multiple colon preparation techniques, different image processing techniques, and differing radiologist experience with CTC to determine the best technique for screening.

So the aim of this study is to evaluate the applications of virtual colonoscopy in different indication of conventional colonoscopy and compare between both procedures in patients having different lower GIT complaints, putting the hypothesis that virtual colonoscopy can replace the conventional colonoscopy.

2. Subjects and Methods

Our study was a cross section study that included eighty two patients (42 male and 40 female). They were referred to Kasr El Aliny Hospital, El-Ebrashy Endoscopy unit, Internal Medicine Hospital, Cairo university between May 2008 and January 2010 for evaluation of different indications for colonoscopy including: iron deficiency anemia with positive occult blood in stool, bleeding per-rectum, repeated abdominal pain, chronic diarrhea, constipation or weight loss (as a screening tool for colorectal carcinoma). Those patients were invited to enroll in the study. Upper GI endoscopy was done for all patients with anemia with positive occult blood in stools, weight loss and abdominal pain before colonoscopy and all patients have irrelevant upper GIT findings.

All patients underwent full medical history, examination and investigations to exclude other causes of their complaint. Patients were scheduled to undergo both conventional and virtual colonoscopy on the same week; both endoscopist and radiologist were unaware of the other's report. There were no post-procedure complications after both conventional and virtual colonoscopy.

All patients were examined by using a four channel Multi-slice CT scanner (light-speed plus; GE Medical System, Milwaukee), The data was recorded in DICOM format and re-evaluated using a "GE medical system advantage window 4.0 sun works" for post-processing.

Preparation for Conventional and Virtual colonoscopy:

Patients were instructed to: maintain a clear liquid low fiber diet 48 hours prior to examination, followed by oral intake 500 ml of Mannitol 20 % which gives the best results in emptying the colon from its natural contents**.** Rectal cleaning enema was done few hours before the study.

Patient position during CT colonography:

Thirty patients underwent scanning in both prone and supine positions, while the remaining fifty eight patients, were examined in the supine position only. The choice of whether additional prone position scanning was needed, was taken based on adequate preparation of the patient judged at the scanning time.

Bowel distension during CT colonography:

A rectal tube was placed, and air was insufflated to maximum patient tolerance, with an average of 30-40 blub compressions, the scout CT image allowed rapid assessment of colonic distension. When necessary, further insufflations were performed to maximum patient tolerance before data acquisition. The rectal tube was removed for improved patient comfort and to prevent possible rectal lesions from being obscured.

Image processing:

Performed with computer workstation with commercially available software (NAVIGATOR; GE medical system) that provided image reconstruction that was performed by using an interval of 1.5 mm. The processed images included sagittal and coronal two-dimensional (2D) reformatted, endoluminal and virtual dissection "Colon Splitting" images. The 2D CT reformatted images and endoluminal images were represented in a multiple-image display format. The endoluminal images viewed continuously in the interactive mode provided an endoscopic- like examination.

All images were interpretated on the computer workstation by radiologists blinded to the patient's history and to results of standard conventional colonoscopy. The evaluation consisted of initial review

of the magnified 2D transverse CT images followed by review of the endoluminal images in the interactive (Fly-through) mode. Endoluminal viewing was performed in both antegrade and retrograde directions and with the patients in both supine and prone positions by using a step interval of 3-5 mm. the transverse and reformatted coronal and sagittal 2D CT images were displayed alongside the endoluminal images in a four-quadrant display format.

Segmentation:

The colon was classified into 6 segments: Rectum-Sigmoid Colon- Descending Colon- Transverse Colon (including both hepatic and splenic flexures)-Ascending Colon- Caecum.

Statistical analysis

Data were checked, coded, entered and analyzed using computer based statistical package for social sciences (SPSS) for windows 16 program. Comparison between data of the study group was done using sensitivity, specificity, positive predictive value, negative predictive Value, total Accuracy, and measure of agreement. The "*p"* value of 0.05 was considered the limit below which the difference of the values would be statistically significant.

3. Results

The studied group consisted of eighty two patients [42(51%) male and 40 (49%) female]. The age of studied patients ranged from 14-70 years their mean age was 45.90 ± 15.76 years.

The prevalence of the main indications for colonoscopic examination among the studied group showed 22 (27%) had anemia, 15(18%) had bleeding per rectum, 14 (17%) had constipation, 12 (15%) chronic diarrhea, 10 (12%) had weight loss and 9 (11%) had abdominal pain.

The lesions found among studied group at conventional colonoscopy were as follows: polyps {small in 6 patients (7.3%), medium in 3 patients (3.6%), large in 16 patients (19.5%)}, mass in 18 patients (22%), stricture in 2 patients (2.4%), diverticulae in 5 patients (6%), angiodysplasia in 2 patients (2.4%), ulcerative colitis in 3 patients (3.6%), flat ulcers & non-specific colitis in 11 patients (13.4%), internal piles in 2 patients (2.4%) and no lesions in 14 patients

The lesions found among studied group at virtual colonoscopy included the following : polyps { small in 2 patients (2.4%). medium in 2 patients (2.4%), large in 20 patients (24.4%)}, mass in 17 patients (20.7%), stricture and large polyp in 2 patients (2.4%), medium and small polyp in 1 patient (1.2 %), large and small polyp in 3 patient (3.6%), mass and medium sized polyp in 1 patient (1.2%), diverticulae in 5 patients (6%) and no lesions in 29 patients (35.3%) (more than one lesion may be present in the same patient).

By comparing the findings in both conventional and virtual colonoscopy in each indication for colonoscopy we found **(22)** patients with anaemia that were indicated to undergo colonic examination, **(15)** of them have lesions on conventional colonoscopy and **(7)** had no lesions,. Only **(9)** had lesions on virtual colonoscopy with **(7)** missed lesions and (1) false positive lesion, with 53.33% Sensitivity and 85.7% Specificity of virtual colonoscopy in detection of lesions in patients with anemia. Also **(15)** patients with bleeding per-rectum were indicated to undergo colonic examination all of them had lesions on conventional colonoscopy while in the **(15)** patients, **(18)** lesions were detected on virtual colonoscopy (more than one lesion may be present in same patient), with **(3)** missed lesion and (6) false positive lesions with a Sensitivity 80% and Specificity 60% in finding lesions in patients with bleeding per-rectum.

As regards patients with constipation, **(12)** out of **(14)** had lesions on conventional colonoscopy, while **(14)** lesions were detected in the **(12)** patients on virtual colonoscopy (more than one lesion may be present in same patient), with **no** missed lesion and (2) false positive results, with Sensitivity 100% and Specificity 85.7% in finding lesions in patients with constipation. We found that **(10)** patients with chronic diarrhea out of **(12)** had lesions on conventional colonoscopy while in virtual colonoscopy, only **(3)** out of the **(12)** patients had lesions, with **(10)** missed lesions and **(3)** false positive lesions, with **0** % Sensitivity and Specificity of virtual colonoscopy in finding lesions in patients with chronic diarrhea

As regards patients presenting with unexplained weight loss**, (9)** out of **(10)** had lesions on conventional colonoscopy while in virtual colonoscopy, **(10)** lesions were detected in the **(9)** patients with no missed lesions and (1) false positive lesion, with 100 % Sensitivity and 90% Specificity of virtual colonoscopy in finding lesions in patients with unexplained weight loss. Also **(7)** patients with repeated abdominal pain out of **(9)** had lesions on conventional colonoscopy, while in virtual colonoscopy there were also **(7)** lesions on virtual colonoscopy detected in the **(7)** patients with **(1)** missed lesion and (1) false positive lesion, with 85.7% Sensitivity and 88.8% Specificity of virtual colonoscopy in finding lesions in patients with abdominal pain.

By comparing the finding in both conventional and virtual colonoscopy regarding each colonic lesion. Regarding polyp detection, the total number of polyps detected by conventional colonoscopy were **(25)**, (**6** small, **3** medium, **16** large), while by virtual colonoscopy were **(35)**, (**6** small, **4** medium, **25** large). There were **(13)** false positive results and **(3)** missed results in virtual colonoscopy with overall Sensitivity for detection of polyp lesions 88% and Specificity 77%. Summary of the results and statistical analysis in polyp

detection by both conventional and virtual colonoscopy were shown in table (1).

Table (1): Comparison between both conventional and virtual colonoscopy as regards polyp detection

Polyp size	**Small < 5 mm**		**Medium 5-.9mm**		**Large > 10 mm**	
The procedure	VC	CC	VC	CC	VC	CC
Detected No.	6	6	4	3	25	16
Missed polyps	3	0	0	0	0	0
False positive polyps	3	0	1	0	9	0
Sensitivity%	50%	100%	100%	100%	100%	100%
Specificity%	96%	100%	98.5%	100%	86.5%	100%
PPV	50%	100%	75%	100%	64%	100%
NPV	96%	100%	100%	100%	100%	100%
Total Accuracy	88.2%	100%	100%	100%	89.7%	100%
Measure of agreement(Ķappa)	0.363	1.00	1.00	1.00	0.752	1.00
P value	0.02		<0.001		<0.001	

PPV= positive predictive value, NPV= negative predictive value, CC=conventional colonoscopy, VC=virtual colonoscopy.

The results of both conventional and virtual colonoscopy in polyp lesions detections at different colonic segments were shown in table (2).

Table (2): The results of both conventional and virtual colonoscopy in polyp's lesions detections at different colonic segments

	Small < 5 mm		Medium 5-9.9mm		Large > 10 mm	
	CC	VC	CC	VC	CC	VC
Rectum	1	2	1	1	6	8
Sigmoid C.	2	3	1	2	6	7
Descending	2	1	0	0	2	2
Transverse	0	0	0	0	0	0
Ascending	1	0	1	1	2	3
Caecum	0	0	0	0	0	5

CC= Conventional colonoscopy, VC=Virtual colonoscopy**.**

The total number of masses detected by both conventional and virtual colonoscopy were **(18)** with no missed or false positive results with a **Sensitivity 100%**, **Specificity 100%, Positive Predictive Value 100%, Negative Predictive Value 100%** and **Total Accuracy 100%** with **measure of agreement (Ķappa) = 1.00**, **(P < 0.001).** (table 3)

Both conventional and virtual colonoscopy could detect strictures in 2 patients, one with a sigmoid colon stricture and the other with a descending colon stricture. In both patients, the scope of the conventional colonoscopy failed to pass through the stricture, while in virtual colonoscopy, examination was completed. In patient with sigmoid stricture, there was a 2 cm ascending colon polyp while the patient with descending colon stricture, virtual colonoscopy detect a 1 cm caecal polyp. So, virtual colonoscopy had a Sensitivity 100%, Specificity 100%, Positive Predictive Value 100%, Negative Predictive Value 100% and Total Accuracy 100%, (P < 0.001). (table 3)

The total number of diverticular lesions detected by both conventional and virtual colonoscopy were **(5)** with no missed or false positive results and with a Sensitivity 100%, Specificity 100%, Positive Predictive Value 100%, Negative Predictive Value 100% and Total Accuracy 100%, with measure of agreement (Ķappa) = 1.00, (P < 0.001) (table 3).

Table (3): comparison between conventional and virtual colonoscopy as regards mass, stricture and diverticulosis

Lesion	**Mass**		**Stricture**		**diverticulosis**	
The procedure	VC	CC	VC	CC	VC	CC
Detected No.	18	18	2	2	5	5
Missed lesions	0	0	0	0	0	0
False positive lesions	0	0	0	0	0	0
Sensitivity%	100%	100%	100%	100%	100%	100%
Specificity%	100%	100%	100%	100%	100%	100%
PPV	100%	100%	100%	100%	100%	100%
NPV	100%	100%	100%	100%	100%	100%
Total Accuracy	100%	100%	100%	100%	100%	100%
Measure of agreement(Ķappa)	1.00	1.00	1.00	1.00	1.00	1.00
P value	<0.001		<0.001		<0.001	

PPV= positive predictive value, NPV= negative predictive value.

In two patients with internal hemorrhoids, virtual colonoscopy detected the piles as false positive rectal polyps. In the rest of the lesions detected by conventional colonoscopy, virtual colonoscopy could not detect any of the following lesions: angiodysplasia: (2 patients), ulcerative colitis (without pseudopolyps) (3 patients), flat ulcers and non-specific colitis (11 patients).

CT colonography detected several extra-colonic lesions as enlarged lymph nodes (8 patients), abdominal aortic atherosclerosis (6 patients), abdominal aortic aneurysm (3 patients), focal hepatic lesions (5 patients), liver hemangiomas (4 patients), hepatic steatosis (15 patients), solid renal mass (2 patients), renal cysts (4 patients), pleural effusion (7 patients), solid pancreatic mass (2 patients), ovarian teratoma (1 patient), bilateral renal hydronephrosis (1 patient), ileal wall thickening (1 patient), vertebral body lytic lesion (1 patient). All these lesions could not be detected by conventional colonoscopy.

4. Discussion

Virtual colonoscopy is a non-invasive relatively novel health technology used to examine the large bowel mainly in screening of colorectal cancer **[15]**. The accuracy of virtual colonoscopy in assessing different pathologies in different indications for colonoscopy was the aim of this study.

Comparison between virtual and conventional colonoscopy as regards their results and sensitivity for colonic lesions detection has been the goal for several studies in order to assess the accuracy of virtual colonoscopy. In our study, the overall sensitivity of Virtual colonoscopy in polyp detection was **88%**; for the detection of large polyps (10 mm or more) the sensitivity was **100%** and specificity was **86.5%**; for detection of medium sized polyps (5-10 mm) the sensitivity and specificity was **100%** and for detection of polyps smaller than 5 mm the sensitivity was **50%** and specificity **was 96%.** These results matched the results of **Gluecker et al. [19],** who reported an overall sensitivity of virtual colonoscopy in polyp detection **85.3%,** with sensitivity for small polyp detection **65%** and medium sized polyp detection **97%** and large polyp detection **100%.** Also **Kalra et al. [20]**, who reported Sensitivity **65 %** and specificity **92%** in small polyps detection, Sensitivity **97%** and specificity **93%** in medium sized polyp detection and sensitivity **100%** and specificity **88%** in large polyp detection.

In this study the colon was divided into six segments with highest prevalence of polyps at the rectum and sigmoid colon **"34.6%"** for each. Our results agreed with **Zalis et al. [18]**, who has divided the colon into the same six segments and showed predominant variable sized polyps detected at the rectum and sigmoid colon each constitutes "**33.3%"** of the number of detected polyps**.**

In our study, the false positive results in detecting large polyps by virtual colonoscopy was largely (five patients) due to misinterpretation of the ilieo-caecal valve as a large caecal polyp which is one of the disadvantages of virtual colonoscopy. This agreed with **[21], w**ho concluded that the ileocecal valve (ICV) can have a polypoid shape and is a common cause of false-positive findings during CT Colonography.

In our study, The main missed lesions in virtual Colonoscopy were 3 polyps smaller than 5 mm (from total 6 small polyps detected by conventional colonoscopy) with 50% sensitivity. Other missed lesions included internal hemorrhoids in 2 patients, hyperemic mucosa and flat ulcers in 3 patients with ulcerative colitis, colonic angiodysplasia in 2 patients and 11 patients with flat ulcers and non-specific colitis. These results are matching with the conclusions of **Park et al. [22],** who reported that flat lesions, ulcers, vascular lesions, non-complicated flat inflammatory lesions and small polyps are the main causes for missed lesions at CT colonoscopy. In this study, when all flat, sessile or pedunculated lesions are included, sensitivity was **75%** for lesions 10 mm or larger, and **79%** for those 6 mm or larger. When only sessile and pedunculated lesions were included, corresponding sensitivities were **100%** and **98%** respectively which matches our results. All missed lesions larger than 10 mm were flat. Sessile or pedunculated polyps 5 mm or smaller were more likely to be missed more than those 6 mm or larger**.** On the other hand, our study did not agree with **Bond [23],** who reported a **95%** sensitivity of virtual colonoscopy in small polyp detection and this may be due to the use of a multislices CT used was with more advanced technology and higher speed with very thin slice thickness.

In our study, there were two patients with colonic strictures in whom conventional colonoscopy failed to pass and to complete the study, but Virtual colonoscopy was able to detect both strictures and was able to complete the study in both patients, in both of them we discovered a polyp in each one proximal to the stricture in Virtual Colonoscopic examination, which agreed with **Iannaccone et al. [24],** who has reported a Sensitivity of **100%** for Virtual colonoscopy in the detection of both strictures and colonic mass lesions and discovered lesions proximal to the occlusive growth (mass or stricture) in 45 out of 100 patients.

In patients presented with anemia with positive occult blood in stool, virtual colonoscopy overall sensitivity in lesions detection was 53.33% and has high sensitivity and specificity in patients presenting with anemia due to large or medium-sized polyps, but in small polyps, it has sensitivity 60% only. It detected diverticulae in one patient presenting with anemia, but it couldn't detect angiodysplasia, flat ulcers, ulcerative colitis in other 4 patients. So, we concluded that the

use of Virtual Colonoscopy can be helpful in some but not all patients presenting with this type of anemia.

Many authors **[17-18-21-26-29],** stressed the role of virtual colonoscopy in colorectal cancer (CTC) screening, with excellent sensitivity for polyps (the precursor of colorectal cancer) masses and malignant strictures with safety and acceptability. Our results meets the results of **[24],** who reported a sensitivity of 100% in masses, strictures and large polyps detection by the virtual colonoscopy, also our study agreed with **Lieberman et al.[30],** who reported a 100 % sensitivity of virtual colonoscopy in large polyps and masses detection.

This high sensitivity in virtual colonoscopy in patients with constipation is due to the presence of colonic masses or large polyps in this group of patients, which were all detected by the virtual colonoscopy (sensitivity of virtual colonoscopy in mass and large polyps detection was **100%** for both).

So, the application of virtual colonoscopy in patients presenting with weight loss and constipation can be tried as a screening tool due to its high sensitivity in detecting the lesions causing these symptoms which proved to be malignant lesions in our study. Also it has advantages over the conventional colonoscopy due to its ability to diagnose extra-colonic spread and detect the mural tumor invasion with high efficacy in colorectal carcinoma staging with detection of lymph node or liver metastasis. But on the other hand, Virtual Colonoscopy has a very unaccepted pifall in such patients as we cannot perform a diagnostic biopsy from the causative lesion which is essential to diagnose the nature of such lesions.

A limitation of the present study is the small sample size in some patient groups regarding each indication. Hence, our results need to be verified in a larger prospective study.

In Conclusion, multi-detector CT Colonography (Virtual Colonoscopy) is a reliable tool for detecting colonic mass lesions larger than 5 mm, polyps larger than 5 mm, strictures and colonic diverticulae. CTC is of value in evaluating the colonic segment lying proximal to colonic cancers including those with occlusive growths or strictures. Contrast-enhanced CTC is also useful in identifying extra-colonic findings.

Virtual Colonoscopy is a good screening tools for malignant or premalignant lesions in patients presenting with constipation or weight loss. Also it helps in staging of colorectal carcinoma regarding the detection of tumor mural growth, lymph node or liver metastasis and in diagnosis of associated extra-colonic lesions as ascites which could not be done by conventional colonoscopy. But its use as a good diagnostic tool is limited due to inability for a diagnostic biopsy from such lesions.

From this study we recommended further evaluation of some patient groups as those with bleeding per-rectum, diarrhea and anemia as our study has some limitations due to small sample size.

It is recommended to apply the use of virtual colonoscopy as a follow up tool in patients with previous known precancerous lesions and familial polyposis or suspicious lesions who need at least annual colonoscopic follow up using the new faster CT multi-slices machines with the least possible slice thickness in order not to miss a small lesion that cannot be seen between two slices of the CT.

Corresponding author
Wael M. Aref
Department of Internal Medicine, Faculty of Medicine, Cairo University
waelaref@yahoo.com

References:

1-WINAWER J., FLETCHER H., MILLER L., et al.: Colorectal cancer screening clinical guidelines and rationale. Gastroenterology., 112:594-642, 2003.

2-BRUZZI J., MOSS A., BRENNAN D., et al.: Surveillance by CT colonography using axial images only. Eur. Radiol. 14:763-767,2004.

3-MCFARLAND E., BRINK J., PILGRIM T., et al. : Spiral CT colonography reader agreement and diagnostic performance with two and three dimensional image display techiques. Radiology. 218:375-383,2001.

4-BARISH M., SOTO J. and FERRUCCIL J. : Consensus on current clinical practice of virtual colonoscopy. AJR Am. J. Roentgenol. 184:786-792, 2005.

5-PICKHARDT P., CHI J., HWANG I., et al. : Nonadenomatous polyps at CT colongraphy prevalence, size distribution and detection rates. Radiology 232:784-790,2004.

6-VOS F., GELDER R., S ERLIE I., et al. : Three-dimensional display modes for CT colongraphy conventional 3D virtual colonoscopy versus unfolded cube projection. Radiology. 228:878-885, 2003.

7-BLAKE M., SOTO J., HAYES R., et al.: Automated volumetry at CT colonography a phantom study. Acad. Radiol. 12:608-613,2005.

8-BODILY K., FLETCHER J., E NGELBY T., et al. : Nonradiologists as second readers for intraluminal findings at CT colonography Acad. Radiol. 12:67-73,2005.

9-ROTTGEN R., FISCHBACH F., PLOTKIN M., et al. : CT colonography using different reconstruction modes. Clin. Imaging. 29: 195-199, 2005.

10-BYERS T., LEVIN B., ROTHENBERGER D., et al. : American Cancer society guidelines for screening and surveillance for early detection of colorectal polyps and cancer. Cancer J Clin. 47:154-160,1997.

11-FENLON H., NUNES D., SCHROY P., et al. : A comparison of virtual and convention colonoscopy for the detection of colorectal polyps. N Engl. J Med. 341:1496-1503,1999.
12-MACKENZIE S., VALLANCE R., and O` DWYER J.: Virtual colonoscopy NEJM. 342:737-739,2000.
13-HUSBAND J., HODSUN N., and PARSONS C.: The use of computed tomography in recurrent rectal tumors. Radiology. 134: 677-682,1980.
14-COIN C., WOLLETT F.,COIN J., et al. : Computerized radiology of the colon a potential screening technique computerized. Radiol. 7:215-221,1983.
15-VINING D., SHIFRIN R., GRISHAW E., et al. : Virtual colonoscopy. Radiology. 193:441-446, 1994.
16-BOWLES C., LEICESTER R., ROMAYA C., et al. : Colonoscopy practice in the UK today: are we adequately prepared for national colorectal cancer screening tomorrow. Gut. 53:277-83,2004.
17-YEE J., AKERKAR G., HUNG R., et al. : Colorectal neoplasia: Performance characteristics of CT colonography for detection in 300 patients. Radiology. 219: 685-692, 2001.
18-ZALIS L., HAHN F., ARELLANO S., et al. : CT colonography with Tele-radiology: Effect of lossy wavelength compression on polyp detection. Radiology. 220: 387-392, 2001.
19-GLUECKER T., JOHNSON C., HARMSEN W., et al.: Colorectal cancer screening with CT colonography colonoscopy and double contrast barium enema examination prospective assessment of patient perceptions and preferences. Radiolology. 227:378-84,2009.
20- KALRA, SURI, KOUR et al.: Comparison of multidetector computed tomographic colonography and conventional colonoscopy for detection of colorectal polyps and cancer. Indian J Gastroenterol. 25(5): 229-32, 2006.
21-FENLON H..: CT colonography : pitfalls and interpretation. Abdomen Imaging. 27: 284-291, 2002.
22- PARK P., HA H., KIM A et al.: Flat polyps of colon and false negative results at CT colonography Multivariate analysis of causes of missed lesions. Radiology, 235, 495-502., 2005.
23- BND JH : Clinical relevance of the small colorectal polyp. Endoscopy. 3: 454-457, 2009.
24- IANNACCONE R., LAGHI A., CATALANO C et al. : Detection of colorectal lesions: lower dose Multi detector row helical CT colonography compared with virtual colonoscopy. Radiology. 229: 775-781, 2008.
25-TAYLOR A., LAGHI A., LEFERE P., et al. : European Soicety of gastrointestinal and abdominal radiology (ESGAR): Cnsensus statement on CT colonography. Eur. Radiol. 17:575-579, 2008.
26- YEE J., STEINAUER M., GEETANJALI A., et al. : Colonic distension and perspective evaluation of colorectal polyp detection with and without Glucagon during CT colonography. Radiology. 24:224-256, 2009.
27- ROGALLA P., MEIRI N. and BARTRAM C : Virtual endoscopy of the colon. In Virtual and related 3D techniques. Eds Rogalla. Springer Verlag, Berlin Heidberg. Pp101-163.
28- MULHALL B., VEERAPPAN G. and JACKSON J : Mata-analysis: computed Colonography. Am. Intern. Med. 142: 635-650, 2005.
29- LIEBERMAN M., WEISS DG. And JONE GD: One time screening for colorectal cancer with combined fecal occult-blood testing and examination of the distal colon. N Engl. J. Med. 345: 555-560, 2007.

6/6/2012