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Radiodiagnosis

Comparison of CT Colonoscopy and Conventional Colonoscopy in Patients with Lower Gastrointestinal Tract Symptoms

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Original Research Article

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Abstract: CT colonoscopy is an upcoming revolutionary modality of imaging pertaining to the colon. It challenges the efficacy of conventional colonoscopy in evaluation of colorectal lesions. Our study included 50 patients with lower GI symptoms who were evaluated by CT colonoscopy and results were compared to conventional colonoscopy and documented by histopathology in all cases. 37 of them had positive colonic findings, 13 were normal. The results in our study showed that CT colonoscopy is almost comparable to conventional colonoscopy in diagnosing and evaluating colonic lesions , especially inflammatory bowel disease and colorectal malignancy.
Keywords: CT colonoscopy, polyp, hemorrhoid, malignancy, conventional colonoscopy.

INTRODUCTION

Mostly in clinical practice, physicians think sigmoidoscopy and colonoscopy as the first investigation/modality of choice for colorectal evaluation [1]. Although conventional colonoscopy is a complete colonic examination that allows lesion biopsy and excision, it fails to evaluate the entire colon in up to 5% of cases examined by an experienced gastroenterologist Furthermore, it is invasive, time consuming and expensive. Sedation is frequently needed, and there is a risk of complications associated with diagnostic and therapeutic colonoscopy, including perforation (1 in 1000), major hemorrhage (3 in 1000), and death (1 in 30,000) [2].

The development of a safe noninvasive reliable method has an obvious appeal [3]. Virtual colonoscopy is a new procedure that combines computed tomography of the large bowel with advanced techniques and produces three dimensional volume rendered images which produces views of the colonic mucosa similar to those obtained during conventional colonoscopy. These technical developments have been paralleled by changing perception towards luminal bowel imaging with computed tomography [4].

The main purpose of the study is to compare the findings obtained from CT colonoscopy with conventional colonoscopy and provide better understanding about the use of CT colonoscopy in regular practice and to determine the utility, advantages and limitations of virtual colonoscopy in detection and diagnosis of colonic pathologies.

MATERIALS AND METHODS

Sample size: 50 cases.

Duration of study: 2 years (August 2016 to October 2018)

Inclusion criteria

All patients with lower GI symptoms were included (Age group > 20 years)

Exclusion criteria

Asymptomatic individuals; Children and pregnant women

Methods

All patients will be subjected to CT colonoscopy and followed up by conventional colonoscopy keeping histopathology as gold standard for comparison.

Ethical committee clearance obtained

Imaging protocols and Procedure

Patients of the inclusion criteria were referred from the department of gastroenterology and after overnight fasting on empty stomach CT colonoscopy is done using HITACHI ECLOS 8 SLICE SCANNER. Patient was placed in supine position and manual insufflations of colon was done

Scanning parameters

All patients were examined in cranio-caudal direction starting from the level of the diaphragmatic cupola down to the anus.

Slice thickness 2.5 mm, Pitch factor 2:1 Milli ampere 200 mAs,
Kilo volt 120 to 150 kv, matrix 512 · 512.
Range for scanning time 20 to 30 s,
Field of view Full Reconstruction interval 1.25 mm

Procedure

The colon was insufflated by gentle squeezing of the BP cuff using room air, until the patients stated they were full or ~15 to 20 manual compressions. The adequacy of air insufflations was evaluated with a CT scout view, with more air insufflated if required. Bowel distension with air till cecum was considered adequate. Now the patient is made to lie down prone and scout view taken to look for if additional air insufflations were necessary. When air insufflation is satisfactory then image acquisition in prone position is done.

Data analysis

All the data acquired from the examination including the scanograms supine and prone acquisitions were transferred to work station unit.

2D image evaluation

2D image evaluation has many advantages;

- Gives a good estimate about the colonic distention and allows choosing which appropriate sequence for navigation
- Evaluates the colonic preparation and identifies areas containing fecal residue. The fecal residue can be recognized by two main criteria; usually containing air pockets, and changing location in the supine and prone positions.
- Assess the texture, extra luminal extension and relation of suspected lesions as well as additional side findings accidentally discovered which may or may not be related to the colonic pathology.

After the study is complete patients were sent to gastroenterology department for conventional colonoscopy. Results of CT and conventional colonoscopy were compared with the histopathological correlation.

RESULTS AND INTERPRETATIONS

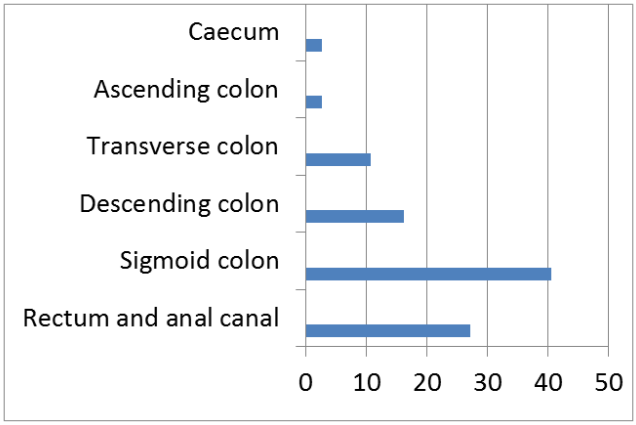
Table 1 – Age distribution

Age group	No. of cases	%
21-30	03	6%
31-40	15	30%
41-50	14	28%
51-60	18	36%
Total	50	100%

Table shows the distribution of various age groups in the cases taken for the study. Majority of the patients come under age group of 51-60 years (36%) followed by the 41-50 years age group (28%).

Table-2: Anatomical Prevalence of Lesions

Anatomical Site	No. Of Cases:	Percentage (In %)
Caecum	1	2.7
Ascending Colon	1	2.7
Transverse Colon	4	10.8
Descending Colon	6	16.2
Sigmoid Colon	15	40.5
Rectum	10	27.1
Total	37	100

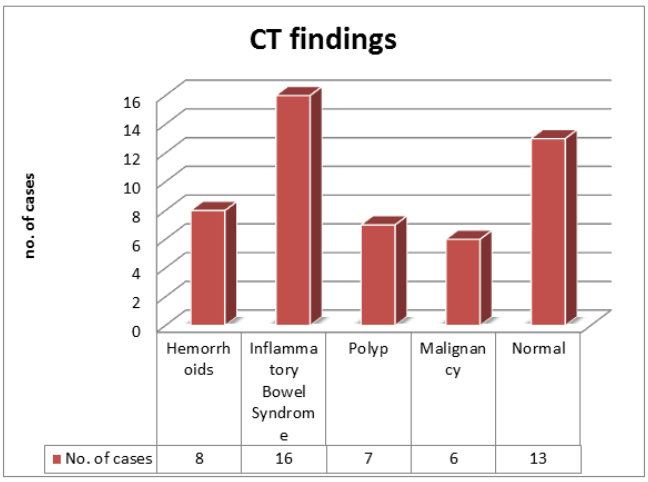


Graph-1: Anatomical Prevalence of Lesions (percentage)

The virtual colonoscopy/ CT findings showed incidences of various conditions in the cases, where maximum findings were of Inflammatory Bowel disease (32%), followed by Hemorrhoids (16%). The incidence of Polyp findings were 14%, colorectal malignancies were 12% and rest cases showed no significant findings.

Table-3: CT findings

CT findings	No. of cases	Percentage
Inflammatory Bowel Syndrome	16	32%
Hemorrhoids	08	16%
Polyp	07	14%
Malignancy	06	12%
Normal	13	26%
Total	50	100

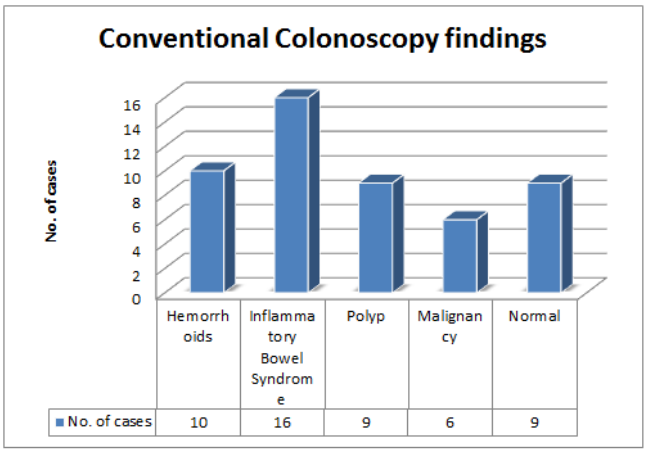


Graph-2: CT findings

The conventional colonoscopy findings showed incidences of various conditions in the cases, where maximum findings were of Inflammatory Bowel disease (32%), followed by Hemorrhoids (20%). The incidence of Polyp findings were 18%, Adenocarcinomas (malignancy) were 12% and rest cases showed no significant findings.

Table-4: Conventional Colonoscopy findings

Colonoscopy findings	No. of cases	Percentage
Inflammatory Bowel Syndrome	16	32%
Hemorrhoids	10	20%
Polyp	09	18%
Malignancy	06	12%
Normal	09	18%
Total	50	100%



Graph-3: Conventional Colonoscopy findings

There were various extra-colonic findings observed in which Ascites, hepatic metastasis, renal calculi & cortical cyst, hernia etc. were observed.

The comparison of CT and conventional colonoscopy in regard with each other showed that the CT findings were exact for Inflammatory Bowel disease and Carcinomas as they were in Conventional colonoscopy. But, for Hemorrhoids and polyp, CT findings showed 8 and 7 respectively, whereas both the proven and conventional colonoscopy figures were 10 and 9 respectively.

Table-5: Distribution of Extra-colonic findings

Findings	**No. of cases**
Ascites	02
Hepatic metastasis	01
Renal calculi	05
Renal cortical cyst	02
Inguinal Hernia	03
Lumbar spondylosis	02
GB wall thickening	01
Cholelithiasis	01
Cirrhosis and Portal hypertension	01
Hiatal Hernia	01

Table-6: Correlation of no. of findings of CT colonoscopy and Conventional colonoscopy for various incidences

Incidence	CT colonoscopy	Conventional colonoscopy	Biopsy/surgically proven cases
Inflammatory Bowel Disease	16	16	16
Hemorrhoids	08	10	10
Polyp	07	09	09
Carcinoma (malignancy)	06	06	06

Table-7: Comparison of Sensitivity of CT and Conventional colonoscopy in detection of various incidences

Incidence	No. of findings		True no. of findings	Sensitivity	
	CT	Conventional		CT (%)	Conventional (%)
Inflammatory Bowel Disease	16	16	16	100%	100%
Hemorrhoids	08	10	10	80%	100%
Polyp	07	09	09	77.78%	100%
Carcinoma (malignancy)	06	06	06	100%	100%

Table-8: Results for CT colonoscopy in detection of various incidences

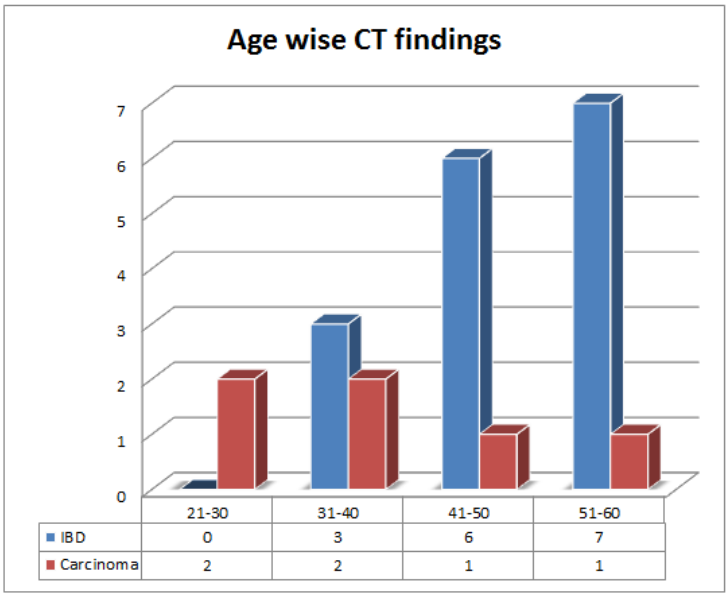
Incidence	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Inflammatory Bowel Disease	100	100	100	100
Hemorrhoids	80	100	100	95.24
Polyp	77.78	100	100	95.35
Carcinoma (malignancy)	100	100	100	100

Table-9: Comparative study for the sensitivity of incidence findings between CT colonoscopy and conventional colonoscopy

Incidence	CT colonoscopy Sensitivity (%)	Conventional Colonoscopy sensitivity (%)
Inflammatory Bowel Disease	100	100%
Hemorrhoids	80	100%
Polyp	77.78	100%
Carcinoma (malignancy)	100	100%

Table-10: Age wise distribution of IBD and malignancy for CT findings

Age group	IBD (n=16)	Carcinoma (n=6)
21-30	0 (0%)	2 (33.33%)
31-40	3 (18.75%)	2 (33.33%)
41-50	6 (37.5%)	1 (16.66%)
51-60	7 (43.75%)	1 (16.66%)
Total	16 (100%)	6 (100%)

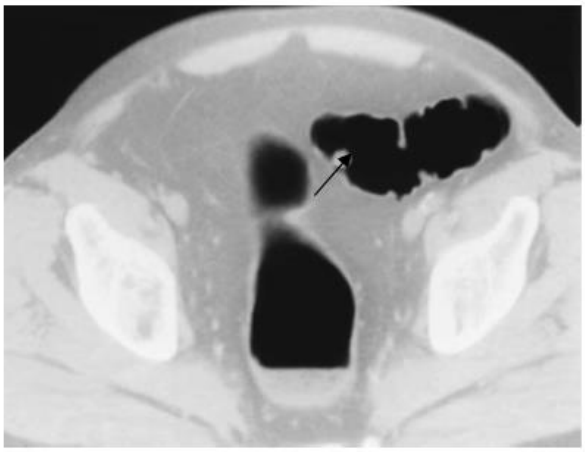


Graph-4: Age wise distribution of IBD and malignancy for CT findings

Age wise distribution of malignancies shows 66.6% of the cases were less than 40 years of age. Inflammatory bowel disease showed predominance in age group more than 40 with 81.25% of cases more than 40 years of age.

CASE 1

A case of 30 year old male with complaints of pain during defecation. Axial CT shows an 8mm polyp in the sigmoid colon (arrow in A).The polyp was confirmed on conventional colonoscopy (arrow in b) performed the same day.



a)

b)

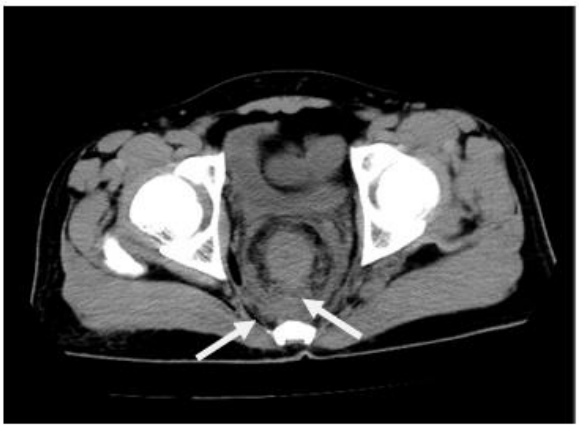
CASE 2

A case of 28 year old male with complaints of bleeding per rectum. Axial CT shows diffuse circumferential wall thickening involving the entire rectum, recto sigmoid junction (black arrows in A, B) and the distal part of the sigmoid colon.

(a)

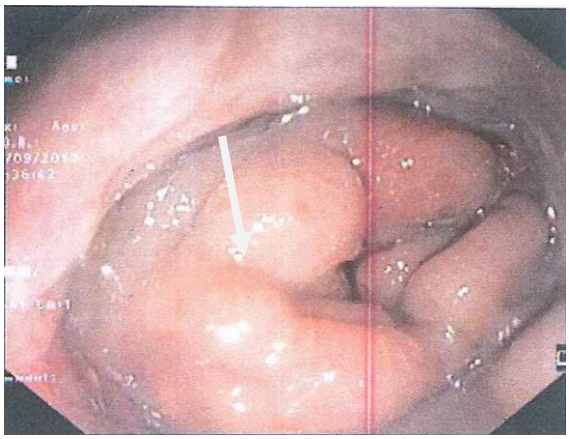
b)

CASE 3



(c)

CT axial section shows extensive fat stranding involving the peri and meso rectal fascia (arrows)



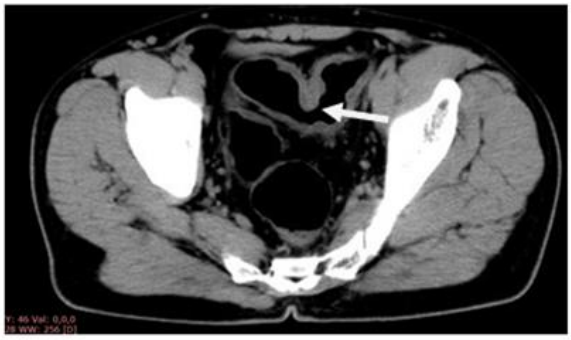
D)

Fig d) Conventional colonoscopy shows circumferential proliferative growth with luminal narrowing noted 3cm from anal verge in the rectum. This lesion was proved to be moderately differentiated adenocarcinoma.

CASE 4

A case of 40 year old male with complains of lower abdominal pain and diarrhea for past 2 years.

CT axial section shows (arrows in a & b) long segment circumferential wall thickening noted involving distal 2/3rd of descending colon and sigmoid colon for a length of ~ 30cm. Maximum wall thickness measures ~ 5 to 7mm. Mild pericolic fat stranding noted along the thickened descending colon and sigmoid colon.

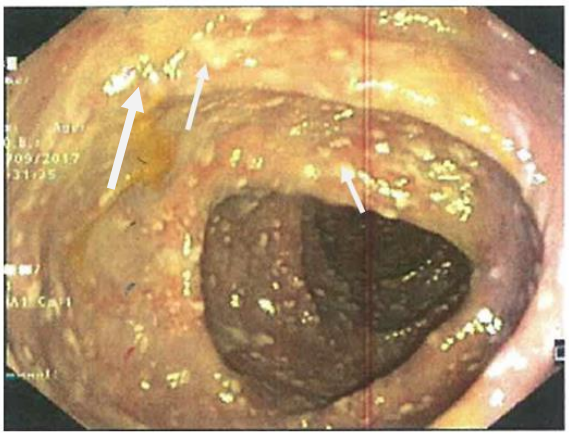


a)

b)

CASE 5

Fig C Conventional colonoscopy shows loss of mucosal granularity with multiple ulcers seen throughout the rectum and descending colon (arrows in C). The lesion proved to be ulcerative colitis in histopathological diagnosis.



(c)

DISCUSSION

Among the 50 patients in our study, 37 patients had pathologies on CT colonoscopy with the most common being inflammatory bowel disease found in 32 % of the patients included in the study. CT colonoscopy had 100% sensitivity and specificity in detecting the inflammatory bowel disease which is similar to that of the conventional colonoscopy. There has been no similar comparisions done in any previous studies as far as our knowledge is concerned.

In a study by Ayman osama *et al*. more prevalent lesions were found in sigmoid colon accounting for 46.4% of lesions.

Similarly in our study lesions were more prevalent in the sigmoid colon accounting for 40.5% of the lesions, while 27.1 % of the lesions were seen in the rectum and colon, 16.2% lesions in descending colon, 10.8% in transverse colon, 2.7% each in ascending colon and cecum [5].

Riss S *et al*. in his prospective study among 976 patients found out the incidence of hemorrhoids was 38.93%, which is higher compared to our study. Our study indicates 20% incidence of hemorrhoids [6].

In another cross sectional study conducted by Najar F. A. *et al.* among 1800 patients the incidence of hemorrhoids was 9.08 % which is lower compared to the 20% incidence in our study?

In our study comparison of the CT and conventional colonoscopy shows CT colonoscopy has 80% sensitivity in detecting hemorrhoids compared to the 100 % sensitivity in conventional colonoscopy. To our knowledge such a comparative study for hemorrhoids has not been done earlier.

Most of the literature dictates that colorectal polyps are more common in males compared to females. This was confirmed in our study that a predominant male population was involved with 3.5:1 male to female ratio. This result matches with that of Van Gelder *et al*. study [7].

Ayman Osama *et al.* in his study of role of CT virtual colonoscopy versus conventional colonoscopy in the evaluation of colonic polyps among 35 patients have sensitivity of 87% in polyp detection [5]. In our study the sensitivity of polyp detection was 77% which is comparatively lower than the study by Ayman *et al*.

White TJ1 *et al.* in their study Virtual colonoscopy vs conventional colonoscopy in patients at high risk of colorectal cancer--a prospective trial of 150 patients concluded that virtual colonoscopy was an effective and safe method for evaluating the bowel and was the investigation of choice amongst patients surveyed. Virtual colonoscopy identified 19 cancers-with a sensitivity and specificity of 100% and 99.2% respectively. In our comparative study of CT vs Conventional colonoscopy, CT colonoscopy identified 6 cancers with a 100% sensitivity and specificity which showed improved specificity and sensitivity compared to the study conducted by white TJI *et al*.[8].

All the cases of malignancies were further evaluated for the presence of pericolonic / perirectal fat stranding and peri rectal lymphnodes, in which all the 6 cases showed the involvement of the perirectal fat stranding and peri rectal lymph nodes. Further staging by evaluation of the fat plane between the rectum and the bladder, between the rectum and the prostate were also done. Hepatic metastases in a patient with colorectal malignancy were also detected.

Perry J. Pickhardt *et al.* in his study of 30 patients with colorectal cancer where the systematic review and meta-analysis of detection of colorectal cancer by CT colonography and colonoscopy was done concluded computed tomography colonography was highly sensitive for colorectal cancer which is in concordance with our study[9].

Ayman Osama *et al*. in his study of role of CT virtual colonoscopy versus conventional colonoscopy in the evaluation of colonic polyps among 35 patients has described that 76% of the cases with malignancy were above the age of 40 and 60 % were above 50 %[5]. Jarmillo *et al*. has described that the incidence of colorectal cancer rises sharply after the age of 40, and 90% of cases occur over the age of 50[10]. This has been correlated by Halligan *et al*. [11] 70.But in our study 66.66% of the cases with colorectal cancer were detected in age group less than 40 years of age which is indicating a shift in the incidence of colorectal malignancies.

Extracolonic findings are the incidental findings found in the axial CT images during the evaluation of the colon. This is an advantage over the conventional colonoscopy in which there is no role for extracolonic evaluation.

Michel *et al*. in his study of prospective comparision of thin low dose multi detector row CT colonography and conventional colonoscopy among 296 patients 13.2 % had extracolonic findings (13.2%), varying in nature including aneurysmal dilatation of the aorta, vertebral changes, hemangiomas in the liver and pancreatic pseudocysts, leiomyomas of the uterus, mature teratomas in female patients and, in one case, a urothelial cell carcinoma was detected [12]. In our study the 19 out of 50 patients had extracolonic findings (38%), which were hepatic metastases in 1 patient, ascites in 2 cases, renal calculi in 5 cases, renal cortical cysts in 2 cases, inguinal hernia and lumbar spondylosis each in 2 cases; Gall bladder wall thickening and cholelithaisis in 1 case each; hiatal hernia in 1 case and 1 case of cirrhosis with portal hypertension.

In our study only four patients (8%) complained of abdominal discomfort. It was also found only verbal reassurance was sufficient in these patients and the study could be completed without any sedatives or analgesics. Ayman osama *et al*. in his study has described ~ 20% (7 patients out of 35) felt discomfort and similar to our study no patient needed sedatives or analgesic [5].

SUMMARY

- Most common pathology was inflammatory bowel disease involving predominantly the distal end of descending colon and sigmoid colon. CT colonoscopy had 100 % sensitivity and specificity in detecting these lesions.
- CT colonoscopy had 100 % sensitivity and specificity in detection of colorectal malignancies. Incidentally one patient had coexisting hepatic metastasis. Conventional colonoscopy also had similar sensitivity in detection of colorectal malignancy but it could not further evaluate the extraluminal extent of the malignancy.
- In our study around 66% of colorectal malignancies were predominant in the age group less than 40 which shows a shift in the incidence of colorectal malignancy to a younger age group.
- In our study CT colonoscopy had a sensitivity of 77% in detecting the polyps which was lesser compared to that of conventional colonoscopy. Conventional colonoscopy has the advantage of therapeutic resection of polyp and biopsying the specimen.
- In our study CT colonoscopy 80 % sensitivity of detecting haemorrhoids which was lesser compared to that of conventional colonoscopy.
- CT colonoscopy detected that 38% of the patients had extracolonic findings of which the predominant finding was renal calculi.
- Patient acceptability was better in our study and there was no need for sedation and analgesics.
- The main drawbacks of CT colonoscopy from our study were its low sensitivity in detecting polyps and the radiation exposure to the patients. Conventional colonoscopy is ultimately necessary for diagnostic and therapeutic excixion of lesions and obtaining histopathological diagnosis which cannot be done using CT colonoscopy.

CONCLUSION

CT Colonoscopy is an excellent, minimally invasive method of investigation of lower GI pathologies with equal sensitivity in detecting malignancy and inflammatory bowel disease as compared to the gold standard conventional colonscopy. In addition to the detection of the lesion CT colonoscopy can evaluate the locoregional extent of the lesion and gives us the information about any extracolonic incidental findings which may help the clinicians to provide further management to the patients. CT colonoscopy will be of immense use in evaluation of colorectal pathologies in bed ridden and chronically ill patients.However conventional colonscopy will still be a necessary tool for evaluation of colonic pathologies due to its concurrent excision of lesion which will be helpful for the histopathological correlation.

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