IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 11 Ver. 2 (November. 2018), PP 22-31
www.iosrjournals.org

Role of Virtual Colonoscopy in Colonic Pathologies

Dr.K.Pavan Kumar[1], Dr.Ayesha[2], Dr.Sandhya Rao[3]
[1](Asst professor, Department of Radio diagnosis, Osmania Medical college / Hyderabad ,India)
[2](Associate professor, Department of Radio diagnosis, Osmania Medical college / Hyderabad ,India)
[3] (Asst professor, Department of Radio diagnosis, Osmania Medical college / Hyderabad ,India)
Corresponding author – Dr.Ayesha

Abstract: *The colon is the primary target of many functional and pathological disorders, which may have acute and chronic presentations among which Colorectal cancer (CRC) is a formidable health problem worldwide. It is the third most common cancer in men (663000 cases, 10.0% of all cancer cases) and the second most common in women (571000 cases, 9.4% of all cancer cases) [1]. Almost 60% of cases are encountered in developed countries. The number of CRC-related deaths is estimated to be approximately 608000 worldwide, accounting for 8% of all cancer deaths and making CRC the fourth most common cause of death due to cancer. In India, the annual incidence rates (AARs) for colon cancer and rectal cancer in men are 4.4 and 4.1 per 100000, respectively. The AAR for colon cancer in women is 3.9 per 100000. Colon cancer ranks 8th and rectal cancer ranks 9th among men. Hence this study plans screening motivated volunteers and patients with 128 slice MDCT available in the Hospital and interpreted based on the amount of the colon lumen distended for study and if possible screen for the pathology accordingly.*

Date of Submission: 25-10-2018 Date of acceptance: 06-11-2018

I. Aims & Objectives

1) To evaluate the ability of virtual colonoscopy to detect colorectal cancers and polyps in suspected patients of colonic pathology.
2) Right Colonic evaluation and post-stenotic evaluation of Colon
3) Evaluate miscellaneous extra-colonic findings.

II. Patients And Methods

TECHNIQUE

CT Colonography involves air insufflation of a clean, prepared colon via a small rectal tube, thin-section CT scanning of the abdomen and pelvis in both the supine and prone positions, and interpretation of images at a reading monitor capable of two-dimensional (2D) and three-dimensional (3D) post-processing using Philips Ingenuity software.

Virtual colonoscopy (CT-VC) examinations will be performed according to a standard protocol. Patients is placed in the right lateral decubitus position on the CT table and a rectal enema tube was inserted. Patients will be then turned supine and room air gently insufflated into the colon to patient tolerance.

A standard CT scout film of abdomen and pelvis was acquired to assess the degree of colonic distension, and further air insufflation performed if required. Using the CT scout film, each examination is tailored to encompass the entire colon from caecum to rectum.

All CT examinations shall be performed using a MDCT scanner. Images shall be acquired using a collimation of 64 × 0.625 with a pitch of 0.797, 110 mA, 110 kVp, and a 512 × 512 matrix. A single breath hold acquisition will be used when possible to encompass the entire colon. Images shall be reconstructed at 1 mm intervals. Following the supine scan, the helical CT will be repeated with the patient prone.

The CT data downloaded to an independent software Data segmentation is performed to remove unwanted soft tissue and osseous structures. Using perspective volume rendering algorithms, a retrograde intraluminal "flythrough" navigation through the volume of CT data from rectum to caecum is generated.

The navigation is repeated in an antegrade direction from caecum to rectum. Both antegrade and retrograde "fly through" virtual colonoscopy studies will be stored in a cine loop format and viewed directly from the workstation monitor.

Bowel Preparation:

All the patients will be given 30 ml heptulac (lactulose) mixed in water at 9 pm the earlier day and put them on NBM overnight which will be followed by rectal enema twice spaced 4 hours and 1 hour before the CT

scan. Care will be taken regarding volume loss due to diarrhoea with iv fluids and blood pressure and electrolyte monitoring. The combination of stool softener also includes PEG (poly ethylene glycol) and soap water depending on the availability.

Bowel insufflation:
Patients with prepared clean bowel will be insufflated with clean warm room air through small rectal tube to patient's tolerance and checking for optimum distention of the entire colon with CT scout films.

III. Inclusion And Exclusion Criteria:

Inclusion
1) Patients age 30 to 80 yrs. complaining of colonic symptoms like constipation, melena, haematochezia, loss of weight.
2) Known cases of colonic pathology.

Exclusion
1) Pregnant women, children.
2) Acute abdominal conditions like intestinal obstruction, peritonitis etc.

Interpretation:
1) Interpretation of abnormalities include morphology and heterogenicity based on location and mobility with changing position. Incomplete preparation requiring changing the patient position and observing for the shift of residual fluid or faecal matter.
2) While lesions greater than 5 mm classified as polyps including sessile and pedunculated.
3) Any growth where ever possible contrast study of video colonoscopy for correlation.
4) All the cases will be seen on both 2D multiplanar and 3D navigation for interpretation.
5) Metastasis and local extension will be included under ECF's.

Statistical Method:
Findings and percentages in tables and graphs comparing the methods used for bowel preparation, distension, and lesions in age wise, gender wise and location wise distribution charts, descriptively.

IV. Observations & Results

Our study comprises of 32 cases with suspected colonic pathologies showing the following results

Table 1 Study group age wise composition of the cases

Age	No.of cases	Percentage
30-40	4	13%
40-50	10	31%
50-60	11	34%
60-70	5	16%

Most of the cases in the study group were between 40 to 60 with combined percentage being 65%.

Graph 1 Study group age wise composition of the cases

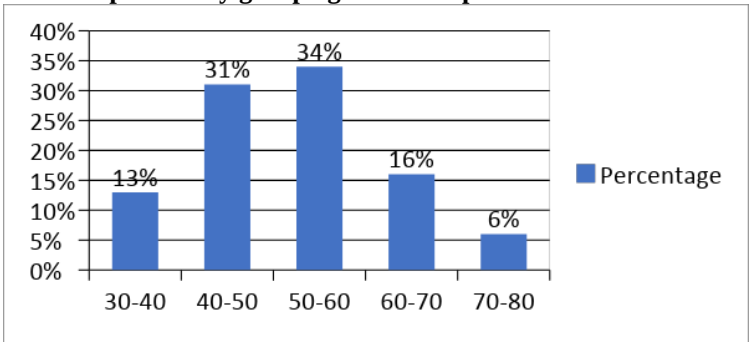
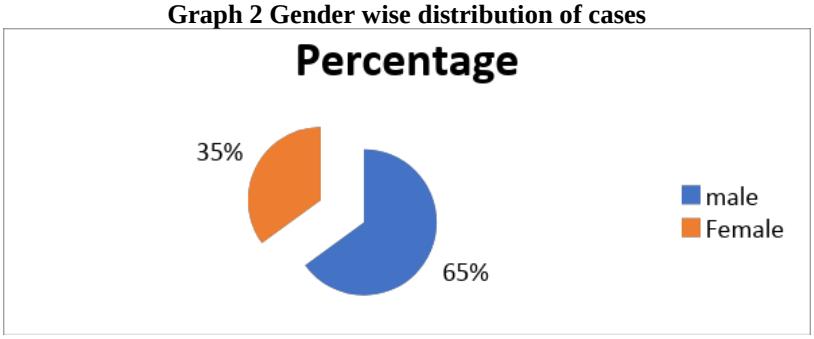


Table 2 Gender wise distribution of cases

Gender	No.of Cases	Percentage
Male	21	65%
Female	11	35%
Total	32	100%

Graph 2 Gender wise distribution of cases

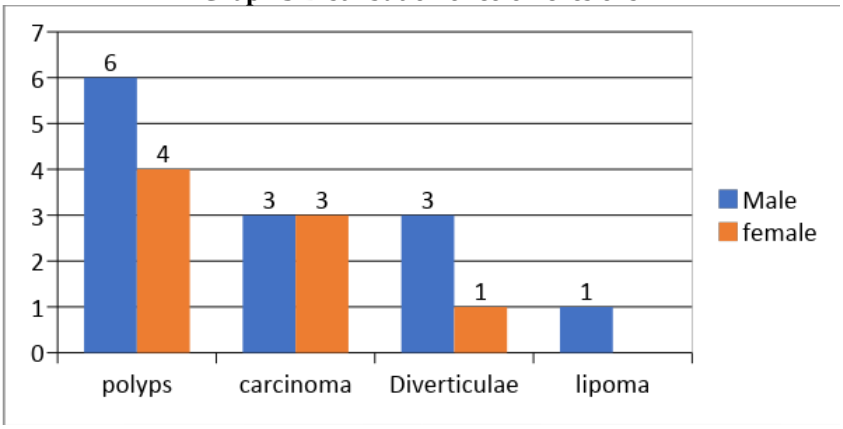


In the study group 65% were male and 35% females' hence male predominance in composition of the study group.

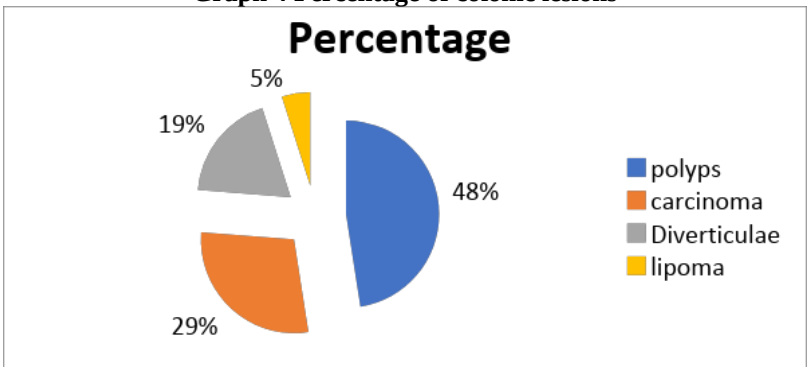
Table 3 Distribution of colonic lesions

Lesions	Male	female	Total No. of cases	Percentage
polyps	6	4	10	48%
carcinoma	3	3	6	29%
Diverticulae	3	1	4	19%
lipoma	1	0	1	5%
Total	**13**	**8**	**21**	**100%**

Graph 3 Distribution of colonic lesions



Graph 4 Percentage of colonic lesions

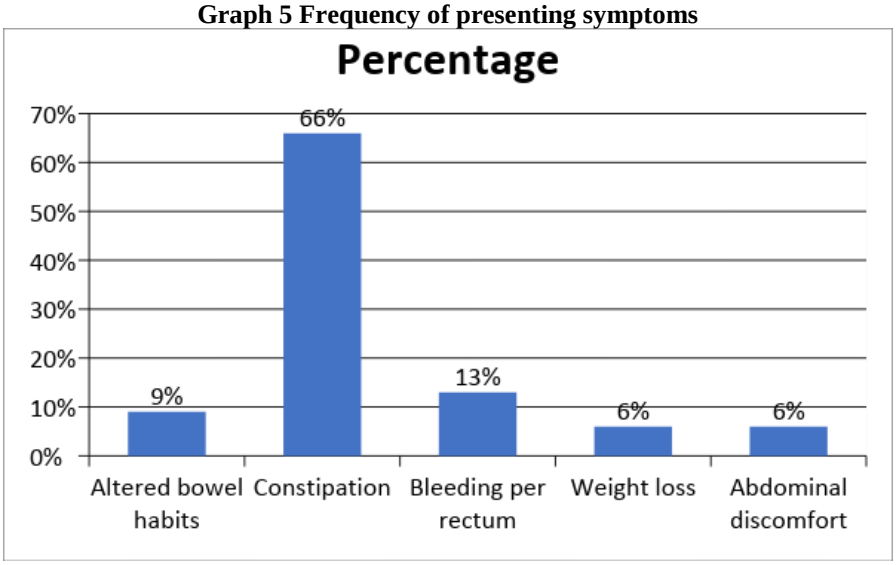


Among the 32 cases 21 cases had colonic findings forming 65% of the cases with positive colonic findings.48% had some kind of polyps while 29% had carcinoma colon.

Table 4 Frequency of presenting symptoms

Symptoms	No.of Cases	Percentage
Altered bowel habits	3	9%
Constipation	21	66%
Bleeding per rectum	4	13%
Weight loss	2	6%
Abdominal discomfort	2	6%
Total	**32**	**100%**

Graph 5 Frequency of presenting symptoms

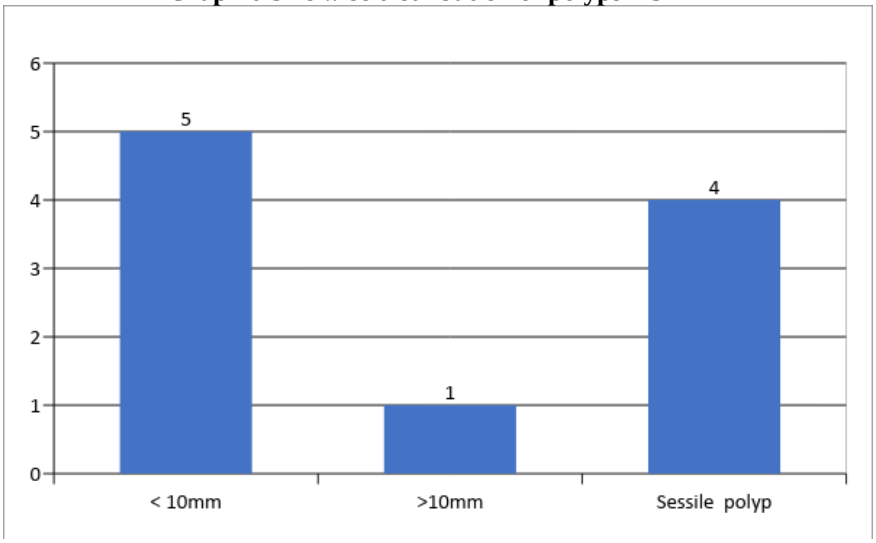


66% of the cases complained some form of constipation while 13% complained of bleeding per rectum.

Table 5 Size wise distribution of polyps > 5mm

Size of pedunculated polyp	No.of Cases
< 10mm	5
>10mm	1
Sessile polyp	4
Total	10

Graph 6 Size wise distribution of polyps > 5mm

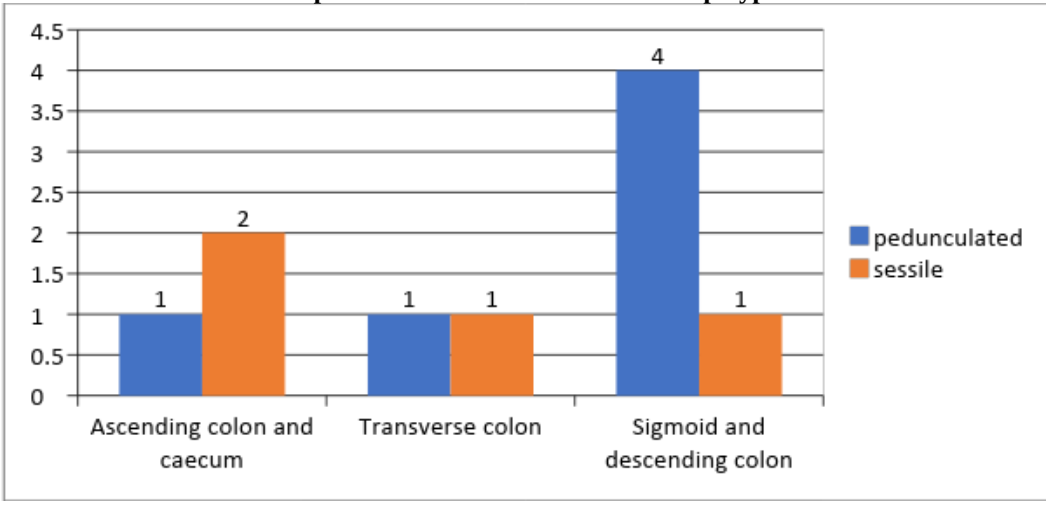


Among the 10 reported polyps only one case had a > 10 mm polyp forming 10% of the significant polyps.

Table 6 Location wise distribution of polyps

Type of Lesion	Ascending colon and caecum	Transverse colon	Rectum, Sigmoid and descending colon
Pedunculated	1	1	4
sessile	2	1	1
Total	3	2	5

Graph 7 Location wise distribution of polyps

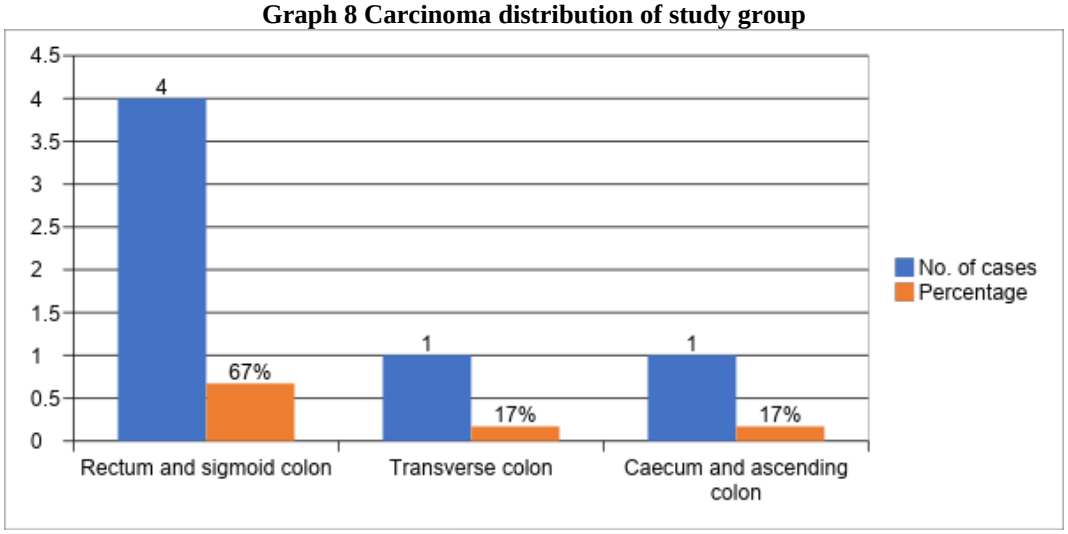


5 cases had polyposis of Distal colon and rectum hence 50% of the reported polys in distal colon.

Table 7 Carcinoma distribution of study group

Location	No. of cases	Percentage
Rectum, sigmoid and Descending colon	4	67%
Transverse colon	1	17%
Caecum and ascending colon	1	17%
Total	**6**	**100%**

Graph 8 Carcinoma distribution of study group

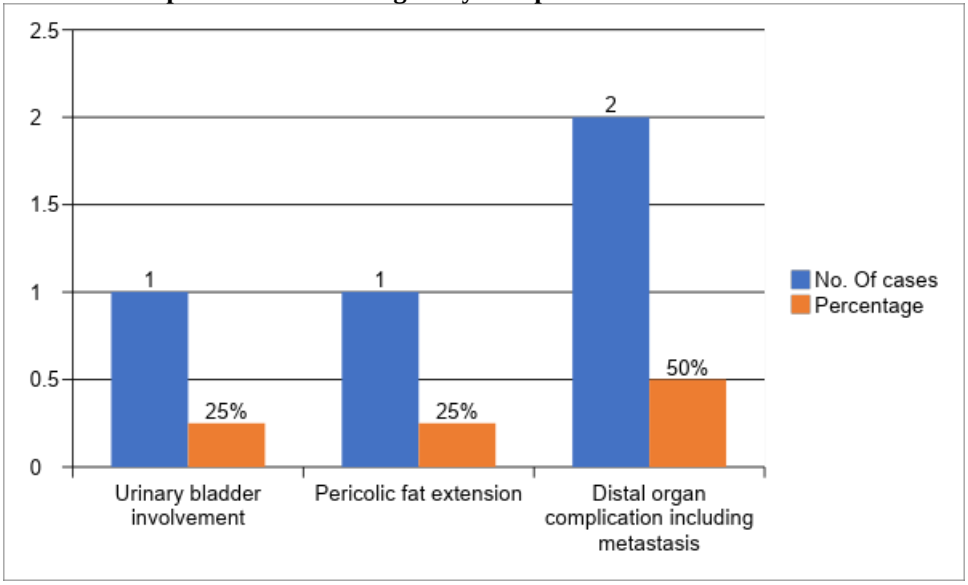


6 cases had carcinoma of the colon among the 32 cases forming 18.7% of the cases. While 67 percent of the carcinomas were in the distal colon.

Table 8 Advanced malignancy in reported cases characteristics

Organ involved	No. Of cases	Percentage
Urinary bladder involvement	1	25%
Pericolic fat extension	1	25%
Distal organ complication including metastasis	2	50%
Total	**4**	**100%**

Graph 9 Advanced malignancy in reported cases characteristics

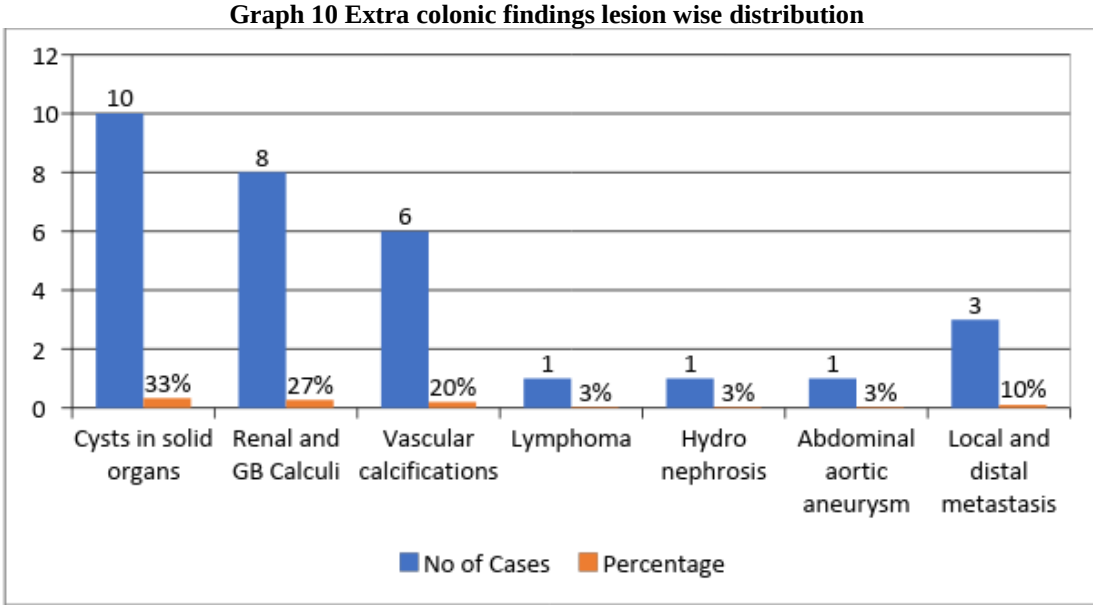


Among the 6 cases of carcinoma colon 4 cases had advancing carcinoma beyond the colonic wall. Among the 4 cases 50 percent ie 2 cases presented with metastasis to distal organs.

Table 9 Extra colonic findings lesion wise distribution

Lesions Types	No of Cases	Percentage
Cysts in solid organs	10	33%
Renal and GB Calculi	8	27%
Vascular calcifications	6	20%
Lymphoma	1	3%
Hydro nephrosis	1	3%
Abdominal aortic aneurysm	1	3%
Local and distal metastasis	3	10%
Total	**30**	**100%**

Graph 10 Extra colonic findings lesion wise distribution

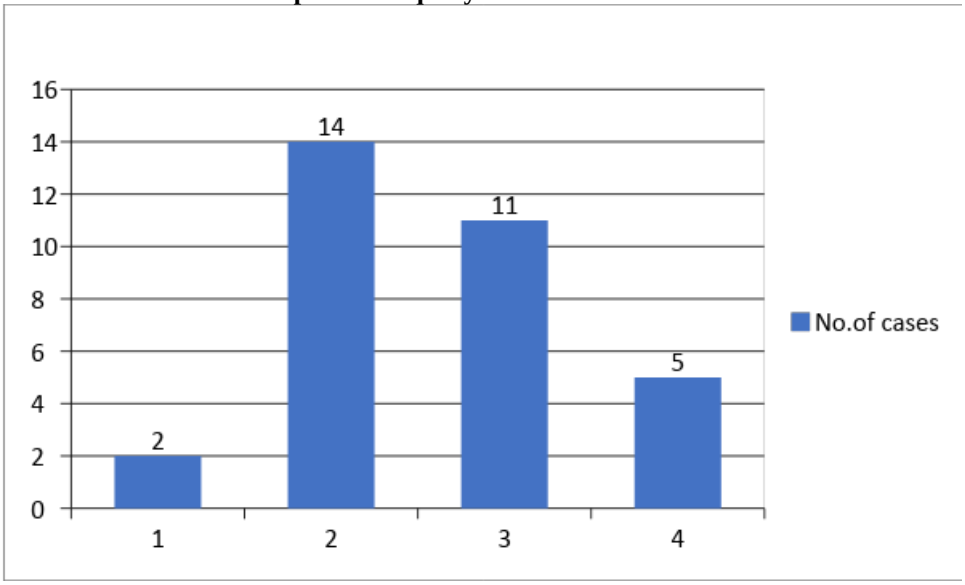


Among the 32 cases 30 ECF's were found with 4 cases with significant findings which have to be reported. 3 cases of complications of malignancy and 1 case of incidental malignancy (Abdominal lymphoma).

Table 10 Adequacy of colonic distension

Satisfactory level	Percentage of distension	No.of cases
Excellent	>90%	2
Good	70-80%	14
Average	<70%	11
poor	<40%	5
Total		**32**

Graph 11 Adequacy of colonic distension

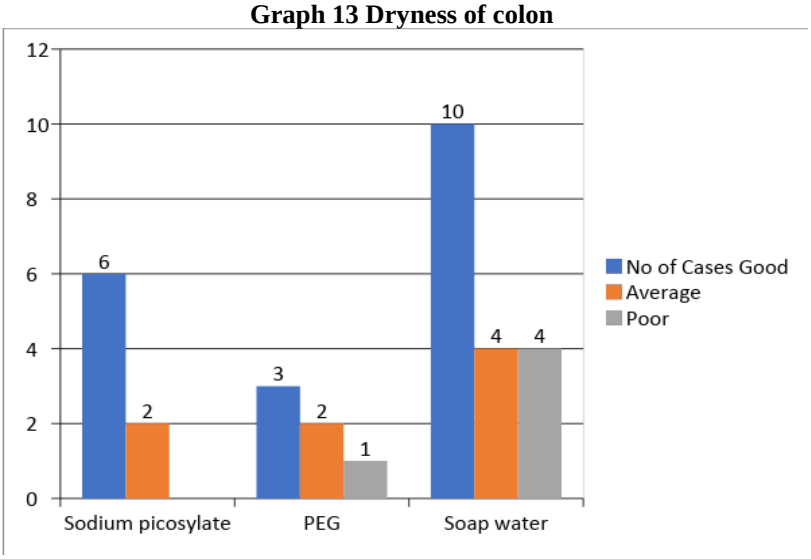


Among the 32 cases 16 cases had very good colonic distension, hence 50 percent cases had excellent quality of study.

Table 11 Dryness of colon

Laxative	No of Cases		
	Good	Average	Poor
Sodium picosylate	6	2	0
PEG	3	2	1
Soap water	10	4	4
Total	**19**	**8**	**5**

Graph 13 Dryness of colon



Among the 8 cases using picosylate 6 cases had good dryness of colon forming 75 percent of cases. While PEG was inferior to soap water with good dryness percentages 50 percent and 71 percent respectively.

Table 12 Position wise colonic distension

Position	Rectum and sigmoid colon	Descending colon	Transverse colon	Ascending colon and caecum
Supine(Distension)	Good	Average	Good	Average
Prone(Distension)	Good	Good	Average	Good

In Prone position colonic distension was good for entire colon except transverse colon, while in supine position descending and ascending colon was average and good distension was achieved for tramsverse colon, rectum and sigmoid colon.

V. Discussion

Colorectal carcinoma is the 3rd most common cancer in the men and 2nd most common among women.This study was carried in the Department of Radiology and Imaging at our Institute Hyderabad over a period of 18 months from January 2016 to September 2017 on 32 patients who complained of colonic symptoms.

The study includes 32 patients with a mixed composition of colonic symptoms undergoing CT Colonography screening. The basic infrastructure and equipment are 128 slice CT scanner (Philips Ingenuity) and findings were correlated with follow-up / Conventional Colonoscopy (CC), biopsy or postoperative where ever possible.In this study the composition of patient groups includes 32 cases with suspected colonic pathologies and known cases of colonic pathologies elsewhere with age wise range of 30 to 80 year. Among them 65% of the cases are from 40 to 60 years which form the most common group.In this study group 65% were male and 35% females with male predominance.

Among the 32 cases 21 cases had colonic findings forming 65% of the cases with positive colonic findings.48% had some kind of polyps while 29% had carcinoma colon.

Among the 10 reported polyps only one case had a > 10 mm polyp forming 10% of the significant polyps, while 9 cases had below 10 mm. 5 cases had polyposis of Distal colon and rectum. Hence 50% of the reported polys in distal colon which is the most common location.

Among the 32 patients, malignancy were detected in 6 cases with 18.7% of the cases. While 67 percent of the carcinomas were in the distal colon.Among the 6 cases of carcinoma colon 4 cases had advancing carcinoma beyond the colonic wall. Among the 4 cases 50 percent ie 2 cases presented with metastasis to distal organs.Among the 32 cases 30 ECF's were found with 4 cases with significant findings which have to be reported. 3 cases of complications of malignancy and 1 case of incidental malignancy (Abdominal lymphoma).Among the 32 cases 16 cases had very good colonic distension, hence 50 percent cases had excellent quality of study.

In Prone position colonic distension was good for entire colon except transverse colon, while in supine position descending and ascending colon was average and good distension was achieved for transverse colon, rectum and sigmoid colon. A study by **Kim et al (2008)**[5] of 241 patients in a single centre in a screening setting with cathartic preparation devoid of any kind of faecal tagging in 2D mode detected only one case of colonic malignancy by CT Colonography. While in our study being a tertiary centre we had a mixed set of cases some of which have been diagnosed outside, hence the high percentage in our study.

More recent study by **Ozsunar et al (2009**)[6] included 48 cases in non-screening setting without faecal tagging concluded with 4 cases of colonic malignancy. This study correlates with our study. CTC has the ability to detect local extension of the of the growth as it is basically on the same protocol as a CT abdomen which can give details about wall irregularity. Among the 6 cases of malignancy detected in this study 2 cases had advanced malignancy with one case showing hepatic metastasis and another case with bilateral pulmonary metastasis. The one case with hepatic metastasis had local bladder wall extension causing severe hydronephrosis.

According to**Kunwarpal Singh et al (2015)**[2] CT colonography is a rapid and accurate non-invasive modality for total colonic examination. It does not require any prior sedation and is relatively better tolerated as compared to conventional colonoscopy. From the study conducted, it was concluded that CT colonography has higher sensitivity than conventional colonoscopy for detection of colorectal carcinoma, including the ability of CT colonography to detect abnormalities proximal to obstructing lesion, accurate segmental localization of abnormalities within the colon, and fairly accurate pre-operative tumour staging. In this study patients though frail tolerated well as the study took no more than 5 minutes to accomplish which includes colonic insufflation and CT scanning in both prone and supine positions. Also the reason includes the non-requirement of sedation to the patient. Kunwarpal singh et al (2015)[2] studied 50 cases with positive colonic finding among which he found 22 annular masses and 4 semi-annular masses. Endo-luminal flythrough was possible in all these masses which was otherwise had the propensity to bleed in Conventional Colonoscopy. While in our study 2 cases out of 6 cases on colonic malignancy had a recto-sigmoid growth and colonoscopy was not possible beyond. CTC was able to evaluate beyond the growth. Total colonic examination even in patients with occlusive masses, is a

major advantage of CT colonography over conventional colonoscopy. Another advantage being that it also gives anatomical information about pericolic fat involvement and local adjacent organ involvement. It also gives information about distant metastasis and lymph node involvement if combined with contrast.

According to **O'Hare et al (2006)**[3]CT can be used in the high risk patients as a 'one-stop' test to detect not only the primary tumour but synchronous colon lesions, and to provide additional information regarding regional and distant metastatic disease, depth of wall invasion and precise localization of the lesion within the colon prior to surgery Which was true in this study where 6 subjects had colonic wall irregularly thickened with two cases with peri-colic fat extension and one case with bladder wall infiltration causing bilateral hydronephrosis. **Yucel C et al. (2008)**[7] stated that even when conventional colonoscopy is performed by experienced endoscopists, approximately 6–26% of colonoscopic examinations are incomplete and fail to reach the level of the cecum. Even in a study by Kunwarpal Singh (2015)[2] et al studied 50 cases and out of them 2 proximal synchronous lesions were missed by conventional colonoscopy. The reason given was may be due to advanced stage of presentation. In our study one case had a synchronous polyp in ascending colon hence correlating with Kunwarpal Singh et al[8] and Yucel C et al. **Laghi A et al.**, **(2013)**[4] stated in their study the current indications of CT colonography which included the evaluation of patients who had undergone a previous incomplete conventional colonoscopy or those who are unfit for conventional colonoscopy (elderly and frail individuals, severe comorbidity, or with contraindication to sedation).

Accordingly in this study we had a case where Video Colonoscopy (VC) was incomplete due to growth causing obstruction for the scope to pass beyond the sigmoid colon. In this case we could do a complete evaluation of the colon including the ascending colon upto the ileo-caecal junction proving the utility of this study. While many frail patients tolerated very well as sedation was not necessary among screening cases.In a study conducted by **Johnson et al (2008)**[8] among asymptomatic adults, CT colonographic screening identified 90% of subjects with adenomas or cancers measuring 10 mm or more in diameter. These findings augment published data on the role of CT colonography in screening patients with an average risk of colorectal cancer. Patients excluded from the study if they had melena or hematochezia on more than one occasion in the previous 6 months. Hence this was a study based on purely asymptomatic adults above 50 years collected from 15 centers. In the above study a total of 128 adenomas or carcinomas were detected which are above 10 mm in size among 2531 participants ie 5% of the subjects. Our study could detect 6 cases of carcinoma with high suspicion based on ultrasound screening and referral from gastroenterologist, surgeons within the hospital and a case who already was diagnosed with carcinoma via failed colonoscopy done elsewhere.

Out of the 6 cases of carcinoma colon detected 4 cases involved the rectum while one case involved the sigmoid and descending colon. While one case involved the ascending colon and cecum. The case involving the sigmoid colon and the descending colon had a failed colonoscopy due to friable mass and profuse bleeding on manipulating the scope. CTC was successfully done and the entire colon was evaluated till caecum which showed a polyp at ileocecal junction 8mm in diameter. Also the size of the mass and the length of stenosis was correctly estimated with CTC in addition to the synchronous poly detected. This study correlates with **Offermans et al (2017)**[9] who concluded that CTC has a lower localization error rate than OC, which is most relevant for tumors located in the descending colon. If there is a doubtful localization on OC, particularly in the left-sided colon, an additional CTC should be performed to choose the best surgical treatment. While in this study we could accurately measure the length of the stenotic segment of the sigmoid colon which otherwise was not possible with video colonoscopy. Hence giving vital information to the surgeon regarding the length segment to be excised also the peri-colonic tissue involvement.

While we had 2 cases with family history of colon carcinoma none of them on CTC screening had any polyps or growth on screening which could not be confirmed by VC. Not correlating with Kunwarpal singh et al (2015)[2] who had diagnosed 4 cases with polyps while 2 cases had family history of polyposis one case had multiple polyposis with a mass hence diagnosed as familial adenomatous polyposis and another case had multiple polyposis with well-defined regular mass which was diagnosed as Vilous adenoma with multiple tubulovillous adenomatous polyps. In our study 2 cases had family history but none of them on CTC or CC showed to have polyposis hence not correlating with Kunwarpal singh et al[8] in this case.

According to **Pickhardt et al (2013)**[10] Residual stool represents a fundamental diagnostic challenge for CTC interpretation, even when cathartic agents are employed. In this study we tried to differentiate stool versus growth or polyp based on the morphology. Almost all cases had some kind of residual stool adherence to the intraluminal wall and it became even more difficult when the colon was incompletely distended in places or sub optimally distended with poor bowel evacuation. Few cases of false positive polys identified which on VC failed to demonstrate suggesting that complete bowel preparation is quintessential for good study results correlating with **Pickhardt et al (2013)**[10]. While faecal tagging and digital cleansing are new evolving techniques this study had these limitations.

According to **Mang et al (2007)**[11] Apart from giving false positive results residual stool can obscure colonic lesions and leads to interpretation or perception errors. In this study we had falsely reported a pseudo-

polypoid formation of stool as polyp and hence turned false positive on VC. Stool collections with bizarre configurations we easily differentiated from growth and polyps. Residual faecal matter had trapped gas morphologically in 2D views with areas of low attenuation HU less than 0 and food particles as areas of high attenuation greater than 40 HU as reference.

VI. Conclusion

1. CT colonography through 128 slice MDCT provides a virtual non-invasive opportunity to visualize the Colon with very good resolution at minimum radiation, in multiple planes in both retrograde and anterograde directions through 3D reconstruction software, hence lumen missed by VC ie behind the haustral folds can be visualised in anterograde direction.
2. In frail and elderly patients where sedation is contraindicated, CTC is useful.
3. It is also useful in Diverticulosis where the chances of perforation are low compared to conventional colonoscopy.
4. Maintaining good distension is prerequisite to good visualization of colon especially in those cases where rectal, ileocecal value incontinence is an issue.
5. CTC can give information about the intraluminal polyps, growth, diverticulosis as well as extra luminal extension i.e. wall involvement and pericolic fat extension which determines the management.
6. Local organ extension and distal metastasis is important information CTC can give as a one stop investigation.
7. Patients who have undergone incomplete colonoscopy CTC can be done in them successfully since air can easily pass through stenosis or stricture while the colonoscopy tube is limited by the size of the tube.
8. All other solid organs which are visualized in normal CT abdomen scan are routinely scanned for extra colonic findings including metastasis and lymph node involvement.

References

[1]. Available at: http://globocan.iarc.fr/factsheets/cancers/colorectal.asp) (2008).
[2]. Kunwarpal Singh et al., Role of CT Colonography in Colonic Lesions and Its Correlation with Conventional Colonoscopic Findings Journal of Clinical and Diagnostic Research. 2015 Apr, Vol-9(4): TC14-TC18
[3]. O'Hare and H. Fenlon Best Practice & Research Clinical Gastroenterology Vol. 20, No. 1, pp. 79–92, 2006
[4]. Laghi A, Rengo M, Graser A, Iafrate F. Current status on performance of CT colonography and clinical indications. Eur J Radiol. 2013;82(8):1192-200.
[5]. Kim YS, Kim N , Kim SH , et al . The efficacy of intravenous contrast-enhanced 16-raw multidetector CT colonography for detecting patients with colorectal polyps in an asymptomatic population in Korea . J ClinGastroenterol 2008 ; 42 (7): 791 – 798 .
[6]. Ozsunar Y , Coskun G , Delibaş N , Uz B , Yükselen V . Diagnostic accuracy and tolerability of contrast enhanced CT colonoscopy in symptomatic patients with increased risk for colorectal cancer . Eur J Radiol 2009 ; 71 (3): 513 – 518
[7]. Yucel C, Lev-Toaff A, Moussa N, Durrani H. CT colonography for incomplete or contraindicated optical colonoscopy in older patients. AJR. 2008;190:145-50.
[8]. . Johnson CD, Chen MH, Toledano AY, et al.Accuracy of CT colonography for detectionof large adenomas and cancers . N Engl JMed 2008 ; 359 (12): 1207 – 1217 .
[9]. Offermans T1, Vogelaar FJ2, Aquarius M3, Janssen-Heijnen MLG4, Simons PCG5 Preoperative segmental localization of colorectal carcinoma: CT colonography vs. optical colonoscopy. Eur J Surg Oncol. 2017 pii: S0748-7983(17)30706-0.
[10]. Perry J. Pickhardt, MD and David H. Kim. CT Colonography: Pitfalls in Interpretation. RadiolClin North Am. 2013 January ; 51(1): 69–88.
[11]. Thomas Mang, Andrea Maier, Christina Plank, Christina Mueller-Mang, Christian Herold, Wolfgang Schima. Pitfalls in Multi–Detector Row CT Colonography. RadioGraphics 2007; 27:431–454

Dr.Pavan."Role of Virtual Colonoscopy in Colonic Pathologies. "IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 11, 2018, pp 22-31.