THE ROLE OF COMPUTED TOMOGRAPHIC COLONOGRAPHY IN PATIENTS WITH INCOMPLETE COLONOSCOPY

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ABSTRACT

Objective: *This study aims to determine the usefulness of computed tomographic (CT) colonography performed for further examination after incomplete colonoscopy and to emphasize the advantages of this technique.*

Material and Method: *Total of 32 patients (18 female, 14 male) who had incomplete colonoscopy were included in this retrospective study. After bowel preparation of the patient, the images were acquired in supine and prone positions. Primarily, colonic segments were evaluated from rectum to cecum and cecum to rectum for four times via virtual colonoscopic images in supine-prone positions. Then, axial images and coronal-sagittal multiplanar reformatted (MPR) images were evaluated. The patients who underwent incomplete conventional colonoscopy and following CT colonography due to inadequate clearance were excluded from the study.*

Results: *In this study, 3 polyps and 1 lipoma were detected with dimension ≤5 mm while 3 polyps were detected 6-9 mm in dimension whereas 1 polyp and 1 lipoma were determined 10-20 mm in dimension by CT colonography. Tumoral wall thickening surrounding the lumen was encountered in the ascending colon of one patient. According to the CT colonography results, verified with repeated conventional colonoscopy (n=4) or surgery (n=2), in lesions which were <10 mm in diameter carcinoma cells were not detected pathologically while two of the lesions with ≥10 mm in diameter were concordant with adenocarcinoma pathologically. Patients who had obstructive tumor and proximal lesion in CT colonography underwent surgery.*

Conclusion: *CT colonography is an adjunct to conventional colonoscopy in colorectal cancer and polyp investigation.*

Key Words: *Colon, colonoscopy, CT colonography, virtual colonoscopy* ***Nobel Med 2014; 10(1): 12-19***

KONVANSİYONEL KOLONOSKOPİSİ TAMAMLANAMAYAN HASTALARDA BİLGİSAYARLI TOMOGRAFİK KOLONOGRAFİNİN YERİ

ÖZET

Amaç: Bu çalışmanın amacı, tamamlanamayan konvansiyonel kolonoskopi sonrası ileri inceleme amacıyla yapılan bilgisayarlı tomografik (BT) kolonografi tetkikinin yararlığının saptanması ve bu tekniğin avantajlarının vurgulanmasıdır.

Materyal ve Metod: Konvansiyonel kolonoskopisi tamamlanamayan 18 kadın, 14 erkek toplamda 32 hasta bu retrospektif çalışmaya dahil edilmiştir. Hasta barsak temizliği sonrası supin ve pron pozisyonlarda çekime alınmıştır. Öncelikle sanal kolonoskopik imajlarda supin ve pron pozisyonlarda rektumdan çekuma ve çekumdan rektuma kolon segmentleri toplam dört kez değerlendirildi. Sonra aksiyel görüntüler ile koronal-sagittal multiplanar reformat (MPR) görüntüler değerlendirildi. Konvansiyonel kolonoskopisi kirlilik nedeniyle tamamlanamayan ve takibinde de BT kolonografisinde yeterli temizlik sağlanamayan hastalar çalışma dışında bırakılmıştır.

Bulgular: Çalışmada BT kolonografi ile boyutları ≤5 mm olan 3 adet polip, 1 adet lipom; 6-9 mm olan 3 adet polip; 10-20 mm olan bir adet polip ve bir adet lipom saptandı. Hastalardan birinde asendan kolonda lümeni çepeçevre saran tümöral duvar kalınlaşması saptandı. BT kolonografi sonucu tekrar konvansiyonel kolonoskopi (n=4) veya cerrahi (n=2) yapılarak doğrulanan lezyonlardan çapı <10 mm olan lezyonlarda patolojik olarak karsinom hücresi görülmezken ≥10 mm çapındaki lezyonların ikisinde patoloji sonucu adenokarsinom ile uyumlu olarak geldi. Obstrüktif tümörü olan ve BT kolonografide proksimalde lezyon saptanan hastalara cerrahi uygulandı.

Sonuç: BT kolonografi, kolorektal kanser ve polip araştırmasında konvansiyonel kolonoskopiyi tamamlayan bir tetkiktir.

Anahtar Kelimeler: Kolon, kolonoskopi, BT kolonografi, sanal kolonoskopi **Nobel Med 2014; 10(1): 12-19**

INTRODUCTION

Life expectancy is increasing worldwide and especially old population is growing in developed countries. Unfortunately advanced age is a major risk factor in cancer development. Colorectal cancer is the third most common malignancy in males and second most common factor in females and second leading cause in cancer-related mortality worldwide.[1]

Conventional colonoscopy is still the standard technique in investigating the colorectal diseases.[2] Although, this technique provides many advantages, sedation is required because of its invasive nature therefore many patients refuse application of this technique. Despite experience of the clinicians; 6-26% of the colonoscopic investigations cannot be completed and cecum cannot be reached.[3] Various techniques have been described to evaluate proximal colon for incomplete colonoscopy in the literature. These are applications of thin colonoscopies, intraoperative colonoscopy, double-contrast barium enema, computed tomography (CT), CT colonography (virtual colonoscopy) and magnetic resonance (MR) colonography.[4]

CT colonography is a technique that can be used in detecting colorectal polyps and colorectal cancers. In high and low risk patient groups, specificity of CT colonography is found similar to conventional colonoscopy in the literature.[5-7] Previous studies emphasized the usefulness of CT colonography in detecting major lesions at colon segments where colonoscope cannot reach.[2]

CT colonography should be preferred as a less invasive technique in patients with risks for sedation or anticoagulation therapy.[3] The factors that prevent completion of the conventional colonoscopy may be associated with patient or the clinician, both or many other factors. Colonic obstruction has been encountered in 15% of the patients with colorectal cancer as another factor. In case of existing synchronous adenoma-carcinoma, preoperative whole colon evaluation is necessary in patients with colorectal tumors. Today, CT colonography guides the clinicians in proximal colon and also extracolonic evaluation.[8]

The purpose of this retrospective study is to determine the usefulness of CT colonography as an advanced examination method after incomplete colonoscopy.

MATERIAL and METHOD

Total of 32 patients (18 female, 14 male) who were referred by general surgery and gastroenterology clinics because of incomplete conventional colonoscopy and who have accepted to undergo CT colonography were included in this retrospective study. Patients were informed about the procedure and informed consents were obtained from all patients. →

Table 1: Frequency of conventional colonoscopy application rationales

Conventional Colonoscopy Application Rationales	n (%)
Familial history of colon cancer	2 (6.3%)
Constipation	12 (37.5%)
Rectal hemorrhage	9 (28.1%)
Fecal occult blood	5 (15.6%)
Anemia	9 (28.1%)
Fatigue	1 (3.1%)
Abdominal pain	8 (25%)
Weight loss	3 (9.4%)
Vomiting	1 (3.1%)
Abdominal distension	5 (15.6%)
Diarrhea	3 (9.4%)
Altered defecation	1 (3.1%)
History of polypectomy	4 (12.5%)

Table 2: Reasons for incomplete colonoscopy

Reasons for incomplete colonoscopy	n (%)
Not able to tolerate	12 (37.5%)
Colonic tortuosity	13 (40.6%)
Severe diverticulosis, diverticulitis	2 (6.3%)
Obstructive tumor	4 (12.5%)
Stricture due to colon surgery	1 (3.1%)
Adhesion due to abdominal surgery	2 (6.3%)
Unknown stricture	2 (6.3%)
External pressure	1 (3.1%)
Spasm	1 (3.1%)
Technical difficulty	2 (6.3%)

Patient exclusion criteria while performing CT colonography were;
-The patients who present intestinal obstruction symptoms or peritonitis,
-The patients who had biopsy or operational procedure in the last few weeks,
-The patients who had acute lower gastrointestinal system bleeding.
The patients who underwent incomplete conventional colonoscopy and following CT colonography due to inadequate clearance were excluded from the study.

Patient Preparation
Polyethylene glycol was used for bowel preparation however patients who had CT colonography just after conventional colonoscopy did not need any additional procedure. Two days bowel preparation protocol was applied for the patients who had conventional colonoscopy an another date and at another hospital. Low fat or fiber diet was allowed on the first day while the patients were permitted to take only liquid food on the second day. The patients were instructed to use 90 ml of sodium phosphate preparation after the meal on the first evening and 45 ml of sodium phosphate preparation twice at noon and following evening meal on the second day.

CT Colonography Technique
CT colonography was performed by a multidetector CT with 40 detectors (Somatom Sensation Siemens 40 Syngo CT 2007S). Scans were performed using parameters of 40x0.6 mm detector collimation, 120 kV, 50 mAs, pitch of 1.4; 0.5 sec gantry rotation time. CT images were reconstructed with 1 mm slice thickness and at 0.6 mm reconstruction intervals. To reduce the radiation exposure; 50 mAs was decreased in prone position during scan (30 mAs).

After the patient was placed in the left decubitus position, a silicone tip catheter was placed into rectum. Simultaneously, 20 mg intravenous (IV) hyoscine-N-butyl bromide was administered. Whole colon was distended with room air as much as the patient can tolerate (30-70 pumps). The patient was then placed in supine position. The silicone tip was left in the rectum and topogram was taken to evaluate the adequate colonic distension. After adequate colonic distension was provided; scanning was performed in supine position from diaphragm to symphysis pubis. Thereafter; scanning was repeated with same parameters in prone position. The patients who revealed air-fluid leveling during scanning in the supine position were administered IV contrast agent in the prone position unless no contraindication was present.

Scan Interpretation
Primarily, colonic segments from rectum to cecum and cecum to rectum were evaluated for four times via three dimensional (3D) images. Then 1-mm-thick axial images and coronal-sagittal multiplanar reformatted (MPR) images were evaluated.

The lesions discovered by CT colonography in colonic segments which couldn't be visualized by conventional colonoscopy were categorized by sizes. Lesions that had sizes >20 mm, 10-20 mm, 6-9 mm and ≤5 mm were classified as a mass, a large polyp, a middle sized polyp and a diminutive (small) polyp, respectively. Lesions were detected involving six segments such as cecum, ascending colon, transverse colon, descending colon, sigmoid colon and rectum. The lesions were analyzed based on their morphologic characteristics (sharp-irregular border), internal structure as either homogeneous or heterogeneous and transposition in supine and prone positions by evaluating via MPR and 3D endoluminal images and changing window settings to distinguish polyps from stool. Linear lesions were defined as folds while round lesions were called as polyps. It has been investigated whether the lesions →

had surrounding tissue invasion, lymph node involvement and intra-abdominal metastasis. Conventional colonoscopy was repeated in the patients who had lesion detected by CT colonography. The follow-up procedures of patients who didn't undergo repeated colonoscopy were performed by the clinicians.

Statistical Analysis

SPSS (Statistical Package for Social Science) for Windows 15.0 was used for statistical analysis. Chi-square test was used in comparison of the qualitative data besides the definitive statistical methods (frequency, percentage, mean, standard deviation). Results were evaluated in 95% confidence interval and significance was accepted as $p<0.05$.

RESULTS

Thirty-two patients who underwent CT colonography following incomplete conventional colonoscopy were included in this retrospective study. Eighteen female (56%) and 14 male (44%) patients had a mean age of 58.90±14.68 (18-85). When the operation history of the patients were investigated; it was determined that 1 (3.1%), 8 (25%) and 7 (21.9%) of the patients underwent colon surgery, pelvic surgery and other surgical procedures (cholecystectomy, stomach operation, etc.) respectively whereas 16 (50%) had no previous surgery. Two patients (6.3%) had familial history of colon cancer. The most common rationales for conventional colonoscopy application were constipation, rectal hemorrhage, anemia and abdominal pain (Table 1). The reasons of incomplete conventional colonoscopy were listed in Table 2 and the segments that could be reached via conventional colonoscopy were listed in Table 3.

The patients were divided into 3 groups with respect to having history of previous abdominal surgery as ones who underwent no surgery, previous pelvic and another surgery. The segments that could be reached in these groups were shown in Table 4. No statistically significant difference was found between the groups with respect to the segments that could be reached (Chi-square=16.57; $p>0.05$).

Of the 32 patients performed CT colonography; 8 (25%) patients were found to have proximal lesions. Two of these 8 patients had two lesions each. The sizes of the detected proximal lesions were ≤5 mm, 6-9 mm, 10-20 mm and >20 mm in 4 (40%), 3 (30%), 2 (20%) and 1 (10%) of the lesions, respectively (Table 5). IV contrast agent was administered in 22 (68.8%) of the 32 patients who participated in the study.

Table 3: Reached segment via conventional colonoscopy

Reached segment via conventional colonoscopy	n (%)
Rectum	2 (6.3%)
Sigmoid colon	8 (25.0%)
Descending colon	2 (6.3%)
Splenic flexure	5 (15.6%)
Transvers colon	3 (9.4%)
Hepatic flexure	11 (34.4%)
Ascending colon	1 (3.1%)

Table 4: Reached segment according to abdominal surgery history

		Abdominal Surgery History		
		No Surgery n=16 (%)	Pelvic Surgery n=8 (%)	Other Surgery n=8 (%)
Reached Segment	Rectum	1 (6.3%)	-	1 (12.5%)
	Sigmoid Colon	3 (18.8%)	4 (50%)	1 (12.5%)
	Descending Colon	1 (6.3%)	-	1 (12.5%)
	Splenic Flexura	5 (31.3%)	-	-
	Transverse Colon	1 (6.3%)	2 (25%)	-
	Hepatic Flexura	5 (31.3%)	2 (25%)	4 (50%)
	Ascending Colon	-	-	1 (12.5%)

Of the cases without any detected proximal lesion by CT colonography; 12.5% underwent repeated conventional colonoscopy due to clinical indication while 87.5% did not undergo repeated conventional colonoscopy. Fifty percent of the patients who had detected proximal lesion by CT colonography underwent repeated conventional colonoscopy whereas 50% of those did not undergo. Rate of repeated conventional colonoscopy was statistically significant with respect to the detection rate of proximal lesion by CT colonography (Chi-square=4.94; $p<0.05$) (Table 6). The lesions were confirmed in 3 of the 4 patients who underwent repeated conventional colonoscopy.

Asymmetric tumoral wall thickening was found through the ascending colon in one of the patients. Linear density increment and millimetric lymph nodes were found in the neighboring fat tissue (Figure 1). The lesion was confirmed by the repeated conventional colonoscopy. The post operative pathology report of the patient, whose treatment plan was altered, has revealed moderately differentiated adenocarcinoma.

Repeated conventional colonoscopy could not be performed due to obstructive tumor in 3 patients. In one of these patients, the tumor, which was detected at splenic flexure by conventional colonoscopy, was detected at proximal descending colon by CT colonography. Also a synchronous tumor in dimension of 1x2 cm was detected at distal transverse colon by CT colonography. The surgical plan of this patient was →

Table 5: Summary of the lesions according to size

Size	Number of the lesions	Localization	Repeated colonoscopy/ surgery	Pathology
≤5 mm	1 (polyp) 1 (polyp)* 1 (lipoma)* 1 (polyp)	Cecum Cecum Cecum Cecum	Colonoscopy - - Colonoscopy	Adenomatous polyp - - No polyp
6-9 mm	1 (polyp)** 1 (polyp)** 1 (polyp)	Cecum Cecum Transvers colon	Colonoscopy Colonoscopy Surgery	Adenomatous polyp Adenomatous polyp Adenomatous polyp
10-20 mm	1 (synchronous tumor) 1 (lipoma)	Transvers colon Ascendingcolon	Surgery -	Adenocarcinoma -
>20 mm	1 (tumor)	Ascendingcolon	Colonoscopy	Adenocarcinoma

*: same patient, **: same patient

Table 6: Repeat conventional colonoscopy according to proximal lesion presence

		Proximal Lesion in CT Colonography			
		N/A		Present	
		n	%	N	%
Repeat Conventional Colonoscopy	No	21	87.50%	4	50%
	Yes	3	12.50%	4	50%

altered due to the tumor localization and synchronous tumor in CT colonography. The postoperative pathology report of the patient with synchronous tumor revealed an adenocarcinoma that arose in the base of tubulovillous adenoma (Figure 2). The other two patients were found to have lipoma and polyp. Pathology report of the polyp demonstrated an adenomatous polyp. It did not cause any alteration in the surgical plan because it was located in the neighborhood of the tumor. The patient who was detected to have a lipoma could not be followed-up since the surgery was performed in another institution.

Of the proximal lesions confirmed by repeated conventional colonoscopy, no carcinoma cells were found in those with <10 mm diameter whereas pathology reports of the ones with ≥10 mm diameter were concordant with adenocarcinoma. One of the patients had a resection history of a rectosigmoid polyp with a pathology report which demonstrated focal intramucosal adenocarcinoma. The patient underwent a CT colonography since follow-up colonoscopy could not be performed due to postoperative stricture. No lesion was found (Figure 3).

Extracolonic findings were encountered in 26 (81.3%) patients. These extracolonic findings included clinically insignificant lesions such as vascular calcifications, degenerative osseous changes, simple renal cysts, hiatal hernia, punctate parenchymal calcifications in the liver and spleen, emphysematous areas in pulmonary parenchyma included in visualized fields of the images and fibrotic changes. Seven patients had significant extracolonic findings clinically in the study. These were pancreatic and ovarian lesions, thickening of gastric wall, porcelain gallbladder, renal and ureteral ectasia and abdominal aortic aneurysm.

CT colonography of one patient revealed wall thickening due to chronic diverticulitis accompanying multiple diverticules at the colonic segments that could be passed by conventional colonoscopy which was initially performed. The 18 mm polypoid lesion in diameter with a pathology report which revealed normal results following biopsy was determined as lipoma by CT colonography. None of the patients had a complication during and/or after the CT colonography.

DISCUSSION

Colorectal cancer is the most frequently diagnosed cancer worldwide. When we consider that colon cancer develops from slowly growing premalignant adenomatous polyps, an efficient scanning program is a requirement. The unreliability and invasive nature of investigation, insufficient instruction of the patient about scanning motivates only half of the moderate risk population to attend the scanning programs.[9]

Conventional colonoscopy is still the standard technique in colon evaluation. Although there is a chance of biopsy-polypectomy during the procedure, the patients do not prefer the procedure due to being invasive. The literature studies about CT colonography and colonoscopy reveal that even there is a 5-17% risk of skipping adenomatous polyps if experienced physicians perform colonoscopy[7,10] Experienced clinicians cannot complete the 6-26% of the colonoscopic investigations and they cannot reach cecum.[3] Incomplete colonoscopy may be related not only to patient factors but also to experience of the clinician and technical equipment. Patient related factors of incomplete colonoscopy are female gender, advanced age, intolerability, insufficient bowel preparation, tortuosity, colon spasm, advanced diverticulitis, obstructive tumor, previous surgery, postoperative stricture-adhesion, external pressure due to mass and hernia.[3,4] Female gender, advanced age and previous surgery (especially abdominal hysterectomy) are found to be related with incomplete colonoscopy.[11,12] In this study, there was no statistically significant difference between number of the male and female participants (p>0.05). In one of the patients conventional colonoscopy could not examine further sigmoid colon due to adhesion after pelvic surgery. CT colonography of this patient revealed asymmetric wall thickening in ascending colon. This explained the clinical symptoms of the patient in the recent one year and affected the survival of the patient by changing the treatment protocol of the patient. →

Double contrast barium enema was preferred in 10-15% of the patients who underwent incomplete colonoscopy.[13] However, double contrast barium enema cannot be tolerated on the same day with conventional colonoscopy.[14] Residual fluid and retained gas prevents the barium to coat the colon wall if performed following colonoscopy. Also, double contrast barium enema cannot be performed on the same day due to perforation risk if polypectomy or ablation was performed during colonoscopy. Previous studies have shown that double contrast barium enema has low accuracy in identifying colonic neoplasm. For example, the sensitivity in identifying adenomas >9 mm has been reported to be 45-50%.[15]

CT colonography has been first defined in 1994 by Vining et al. and has been first used in 1995. When compared with conventional cross-sectional imaging procedures, CT colonography enables endoluminal surface evaluation by colonic distension and 3D reconstruction of the colon anatomy.[3] The important point in dealing with such a highly prevalent malignancy is the sensitivity of the diagnostic test should be high. The accuracy of the CT colonography is associated with sufficient bowel preparation and colonic distension, imaging procedure, evaluation technique, training-experience of the clinician. Multicentered studies have shown that although sensitivity of CT colonography changes depending on various factors, CT colonography has high sensitivity in detecting large adenomas and quite high accuracy in determining colorectal carcinoma.[7,16] Of the 8 patients who had detected proximal lesion by CT colonography; 4 patients has undergone repeated conventional colonoscopy and lesions were confirmed in 3 of those. In 3 of the other 4 patients, conventional colonoscopy could not be performed due to obstructive tumor. Surgical procedure for the tumor confirmed the proximal lesion in 2 of these 3 patients. The other patient with the obstructive tumor went to another institution for surgery. The fourth patient continued his investigations in another institution so accuracy of the proximal lesions could not be evaluated.

In our study, 6 of the 8 patients who had proximal lesion in CT colonography could be followed up and lesions were confirmed by either repeat conventional colonoscopy or surgery in 5 of those (Table 5). The sensitivity of CT colonography in detecting lesions could not be evaluated. However, it is clear that CT colonography has a high accuracy rate. Distal lesion incidence decreased depending on colon cancer screening, use of sigmoidoscopy and performing polypectomy in the second half of the 20th century.[17] As a result, relatively increased right colon cancers can be diagnosed by CT colonography following incomplete colonoscopy.

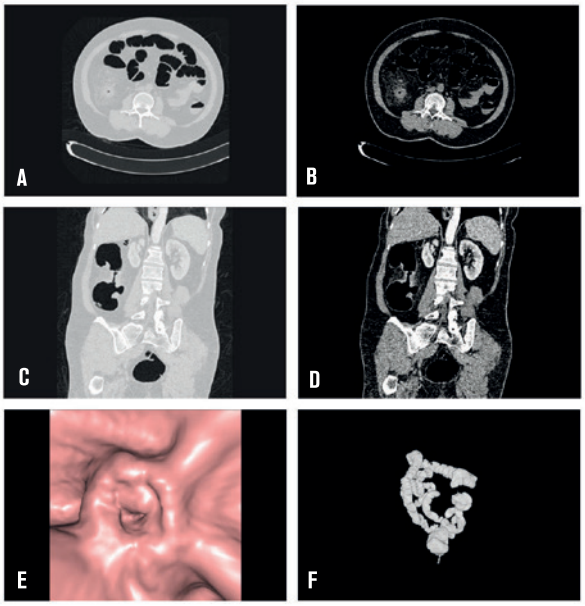

Figure 1: A 54 year-old female patient with pain and anemia underwent incomplete colonoscopy; Axial-coronal MPR images (A-D) show asymmetric tumoral wall thickening at proximal ascending colon leading to remarkable lumen narrowing. Neighboring signal increments and lymph nodes in axial MPR images (B). 3D endoluminal image (E) shows the tumor. Appearance of an eaten apple in CT colonography (F). The pathology report revealed moderately differentiated adenocarcinoma.

Whole colon examination is very important in determining the treatment protocol of the patient with a colorectal cancer. In patients with colorectal cancer, prevalence of synchronous neoplasm has been reported to be 1.5-9% and 27-55% for carcinoma and adenoma, respectively.[18] Obstruction develops in the large bowel in approximately 15% of the patients with colorectal cancer.[12] It is difficult to evaluate whole colon of a patient with distal occlusive cancer. Preoperative barium enema postpones the surgical procedure and the diagnosis which can only be established by an intraoperative colon palpation or colonoscopy is delayed. Routinely, patients with occlusive colorectal cancer have whole colon evaluation with postoperative colonoscopies. This leads to delayed diagnosis of synchronous lesions and a second surgical procedure is needed.[18] In this study one of the three patients who had obstructive tumor found to have 10-20 mm synchronous neoplasm detected in CT colonography and this changed the surgical plan of the patient.Colonoscopy cannot be completed in patients who had stricture due to radiotherapy or surgery. In a study which involved 61 patients who underwent radiotherapy or surgery, the importance of CT colonography was emphasized.[19] CT colonography is a valuable examination method for these patients who require follow-up.

Polyps are classified depending on size by CT colonography; the polyps that are ≥10 mm, 6-9 mm and <6 mm in size were classified as large, middle and diminutive (small) polyps, respectively. Size is the most valuable criterion in demonstrating carcinomatous →

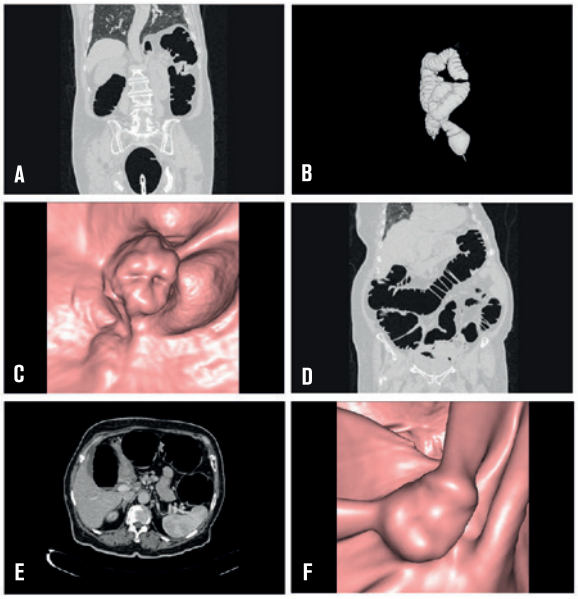

Figure 2: A 79 year-old female patient who had severe abdominal pain and constipation has undergone conventional colonoscopy but splenic flexure could not be passed because of obstructive tumor; coronal MPR (A), CT colonographic (B), 3D endoluminal (C) images demonstrating tumoral wall thickening at proximal descending colon leading to annular narrowing of the lumen; coronal MPR (D), axial (E), 3D endoluminal (F) images demonstrating broad-based synchronous polypoid lesion in dimension of 1x2 cm at distal transverse colon. The pathology report of the synchronous polypoid lesion demonstrated adenocarcinoma arising in base of tubulovillous adenoma.

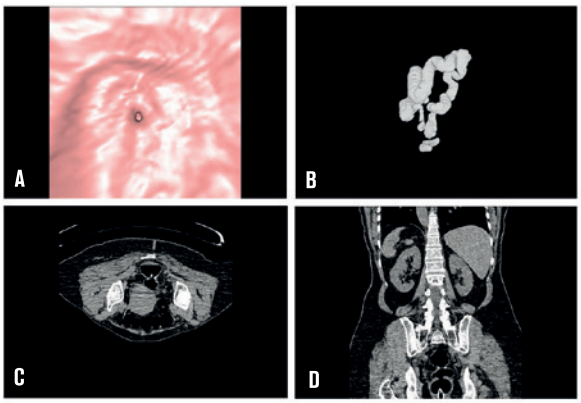

Figure 3: A 52 year-old female patient who underwent segment resection for giant polyp at rectosigmoid junction 2 years ago, the anastomotic junction could not be through passed during follow-up conventional colonoscopy. 3D endoluminal (A) image demonstrating remarkably narrowed lumen at 10th cm from rectum and CT colonographic (B) image demonstrating significant interruption of the air column. Stricture at the anastomosis leading to remarkable narrowed lumen and metallic densities at the wall belonging to clips material seen at axial (C), coronal MPR (D) images. Pathological wall thickening was not detected at this location.

potential of polyp before resection.[20] According to the study conducted by Kim et al., prevalence of advanced-stage neoplasm in diminutive polyps was negligible.[21] The prevalence of advanced- stage neoplasm has been found less than 1% in that study. Therefore, resection of diminutive polyps did not provide a benefit in prevention from cancer.[20] Gastroenterologists and radiologists achieved a consensus about resection of polyps ≥1 cm in size detected by CT colonography because of their potential to include or develop malignancy. Gastroenterologists recommend application of polypectomy if there is a polyp with a dimension ≥6 mm or 3 polyps found in any size whereas radiologists recommend to follow-up patients with polyps ≤9 mm.[9]

In this study of the proximal lesions confirmed by repeated conventional colonoscopy; no pathological carcinoma was detected in those with diameters <10 mm whereas pathology results of the two proximal lesions with diameter ≥10 mm were concordant with pathological adenocarcinoma. Similarly with the previous studies in the literature, malignancy was encountered in only >10mm lesions in diameter of the lesions that were examined with respect to pathology in our study (Table 5). Therefore, lesions <10 mm in diameter were considered appropriate to be followed with noninvasive methods.

As one of the method for colorectal cancer screening American Cancer Society recommend CT colonography every 5 year over the age of 50.[22] American College of Radiology recommendations according to CT colonography findings are as follows;
-Patients with normal colon or benign lesion (<6 mm polyp) should continue routine screening every 5-10 years.
-Patients with intermediate polyp (6-9 mm, <3 in number) or indeterminant findings (cannot exclude polyp ≥6 mm in technically adequate exam) should be under surveillance by CT colonography in 3 years or colonoscopy is recommended.
-Patients with polyp (polyp ≥10 mm or ≥3 polyps, each 6-9 mm), possibly advanced adenoma should be followed-up by colonoscopy.[23]

In the literature it is reported that the estimated mean effective dose per CT colonography screening was 8 mSv for females and 7 mSv for males. It is not more than a routine pelvic CT radiation dosage. In a study of Berrington de Gonzalezl et al., the benefits from CT colonography screening every five years from age 50-80 clearly outweighed the radiation risks.[24] CT colonography evaluates intraabdominal structures besides colon examination. The prevalence of extracolonic findings was 15-85% but clinically important ones were 4.5-13%.[25] In our study, the prevalence of extracolonic findings was 81.3% (26 patients). The high prevalence (21.8%, 7 patient) of extracolonic findings with high clinical importance was due to the advanced-age population in the study. Perforation due to CT colonography is a very rare complication. In a study of Sosna et al., perforation due to CT colonography was encountered in 1 of 1696 patients (0.058%). Perforation rate of conventional colonoscopy was defined as 0.11% and 0.06% for therapeutic and diagnostic colonoscopies, respectively.[26] It may be suggested according to →

the conducted studies that risk of perforation at CT colonography is less than risk at conventional colonoscopy. Data obtained by CT colonography associated with the wall of the accessed segment is also precious as well as the information associated with the proximal segment in the cases with incomplete colonoscopy. In our study, wall thickening due to diverticulitis in the segment accessed by colonoscopy and lipoma were detected by CT colonography in two different patients. These pathologies were overlooked in colonoscopy.

CONCLUSION

As a result, scanning of colorectal cancer requires advanced diagnostic and scanning techniques with high patient compliance. Conventional colonoscopy, being currently used in colonic examination, could not be completed in some patients depending on various reasons beside its invasive character. CT colonography has many advantages over double contrast barium enema and also gives more accurate results. Increased used of CT colonography in patients with incomplete colonoscopy allows evaluation of the right colon, completion of colonic examination and early diagnosis of the important lesions. This becomes increasingly important with respect to evaluation of synchronous tumors in the patients with occlusive colorectal cancer and postoperative stricture which developed due to radiotherapy or surgery. Beside its advantages with respect to patient survival and guiding the clinician in management of pa tients, CT colonography is a complementary technique to conventional colonoscopy in investigating colorectal cancer and polyps.

* None of the authors has conflict of interest with the submission.

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