Role of Abdominal Ultrasound Compared to MDCT in Assessment of Colorectal Cancer

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Received: 5 November 2020

Accepted: 25 January 2021

Abstract:

Background and Aim: Colorectal cancer is the third most common cancer and the fourth most frequent cause of cancer deaths worldwide. The aim of this study to compare the diagnostic performance of abdominal ultrasound and multidetector CT in detection of colorectal cancer. **Methods**: this study included fifty patients were presented to surgical department of Mit Ghamr oncology center. All patients were examined on MDCT to show presence of the cancer. then examined by abdominal ultrasound to evaluate ability of ultrasound to detect the cancer. **Results**: fifty patients were included (28 men and 22 women) had a mean age of 47.5years (range 28-70years). Our study results suggested that abdominal ultrasound had sensitivity and specificity in diagnosis of cancer colon were 82.4% and 87.5 % respectively. The accuracy of US was 84%. For MDCT, sensitivity and specificity of cancer colon were 100% and 93.8 respectively. The accuracy of MDCT was 98%. **Conclusion:** ultrasonography is a useful initial screening tool for colorectal cancer in patients presenting with abdominal distension. Compared with MDCT scanning and other modalities. Ultrasonography is easily available; does not involve radiation, bowel preparation, or sedation; carries no risk of colonic perforation; and is less expensive. Further studies to confirm the usefulness of ultrasonography for diagnosis of colorectal cancer are warranted. CT is valuable in preoperative assessment and staging of colorectal cancer as well as in postoperative surveillance for recurrence. Rapid advances in technology will likely continue to improve the accuracy and usefulness of CT.

keywords: Ultrasound; MDCT; Colorectal Cancer

Introduction

Colorectal cancer is the third most common cancer and the fourth most frequent cause of cancer deaths worldwide. The WHO estimates that 945,000 new cases occur each year, and colon cancer is responsible for 490,000 deaths annually in the world (1).

In Egypt, the Cancer Pathology Registry of National Cancer Institute of Cairo University showed that during the years 2003-2004, colorectal cancer occupied the first rank among digestive system's malignancies (15.78%) and the fifth rank among all total cancers (4.34%) (2).

Preoperative evaluation of the extent of colorectal carcinoma spread indicates the expected prognosis and also assists management. The depth of bowel wall invasion, presence of lymph node metastases and distant metastases are the major factors that affect the prognosis of the patient (3).

Accurate staging of colorectal cancer is important to provide the optimal treatment strategy. Despite preoperative evaluation and staging of colorectal cancer patient is difficult, computerized tomography (CT) scanning has been very often used in preoperative staging of colorectal cancer as a non-invasive instrument with the development of high resolution scanners, technical refinements in obtaining better quality as a result. CT is an excellent imaging tool for screening the distant metastases (4).

Advances in CT technologies have increased interest in the potential role of multi-detector computerized tomography (MDCT) for detection and staging of colorectal cancer (5).

The bowel US examination is a safe, widely available, cheap, noninvasive imaging technique which allows real-time examination of the intestines without the use of ionizing radiation and can be performed at any time (6).

The greatest disadvantage is that the evaluation of the bowel depends more on the operator experience and expertise than the sonographic evaluation of other abdominal organs (7).

Lack of patients' cooperation, body habitus (abdominal obesity, spinal deformity) or the presence of intraluminal bowel gas can make the visualization of the gut difficult. Although the standard transabdominal US

(TAUS) is highly predictive and useful for the diagnosis of bowel processes, it is usually nonspecific, and the negative finding does not exclude the presence of a bowel disease (8).

The study was done to compare the diagnostic performance of abdominal ultrasound and multidetector CT, using histology as the gold standard, with regards to the presence, size and extent of invasive colorectal cancer .

Patients and methods

This cross-sectional study was conducted between may 2018 and october 2019, fifty patients (28 men and 22women) had a mean age of 47.5 years (range 28-70years) were presented to surgical department of Mit Ghamr oncology centre complain abdominal pain with distension , constipation and vomiting .

Patient inclusion criteria:

1. Adult patients .
2. Normal renal function.

Patient exclusion criteria:

1. Pregnancy.
2. Abnormal renal function.
3. Sensitivity to contrast media.

All patients were subjected to the following:

- Full history taking .
- Full clinical examination .
- Pathological evaluation .

Equipment :

MDCT examination:

An MDCT (SIEMENS SOMATOM SENSATION 64 SLICE) scanner. All patients fasted for at least 6 hours before MDCT. Intravenous, oral and rectal contrasts were used in all patients. A total volume of 70 ml non-ionic iodinated contrast was injected into a peripheral vein of the patients at a rate of 2 ml/sec. Volume scan was performed from the diaphragmatic dome to the pubic symphysis, then the images were reconstructed with a slice thickness of 5 mm in axial plane and 3 mm in coronal and sagittal plane.

Trans-abdominal ultrasound examination:

TAUS was carried out by Ultrasound machine (TOSHIBA XARIO) using 3.5 - 5Mhz convex probe and 7 -10 Mhz linear probe. Firstly, the use of low frequency probe is recommended in order to obtain a

panoramic view of the abdomen which could help to localize pathological conditions. Then the standard examination should be followed by high frequency probe which provides detailed information about bowel wall layers and the surrounding tissues. Doppler US is useful for estimating the presence, the density or absence of vascular signals in the large blood vessels, but it is not sensitive enough to detect slow and low-volume flow of smaller vessels of the gastrointestinal organs. All patients fasted for at least 6 hours before ultrasound examination.

Risks and ethical considerations:

- Any expected risk appearing during the course of research was clarified to the participants and the ethical committee on time.

- Adequate provisions to maintain the privacy and confidentiality of the participants were taken in the form of:

1. Putting code for each participant and his address.
2. Results were allowed for research purpose only and not for the media.
3. Name of the patients were hidden when using photos of the patient.
4. All techniques and procedures used in the research had no conflict with religion, law or social rules.
5. All participants in this research were submitted to a clearly informed consent.

The statistical methods:

Data were statistically described in terms of mean ± standard deviation (± SD), and range, or frequencies (number of cases) and percentages when appropriate. Accuracy was represented using the terms sensitivity and specificity.. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Results

Fifty patients (28 men and 22 women) within the study group had a mean age of 47.52 years (range 28-70 years). According to localization, 12 tumors were localized in the ascending colon, 6 tumor were localized in the transverse colon , 7 tumors were localized in the descending colon, and 9 tumors were localized in rectosigmoid colon. By ultrasound 28 patients were correctly diagnosed as cancer colon while 2 patients were incorrectly diagnosed as cancer colon and

6 patients were incorrectly free , the other 14 patients were correctly diagnosed as free . By MDCT, A total of 34 patient was correctly diagnosed as cancer colon in pre and post-operative cases while one case was incorrectly diagnosed as cancer, the other 15 patent were free. Common symptoms associated with abdominal distension were abdominal pain (71%), constipation (41%) and vomiting (22%), patients data in table 1

Comparison between cancer colon cases and control subgroups according to age and gender in table 2 & 3.

ROC curvewas done to predict cancer colon in different sites among case subgroup. regarding the validity of US and MDCT in diagnosis of cancer colon; Sensitivity and Specificity of Cancer colon on transabdominal ultrasound was 82.4% and 87.5 % respectively. The accuracy of US was 84%. Sensitivity and Specificity of cancer colon on MDCT images was 100% and 93.8 respectively. The accuracy of MDCT was 98%. figure 1

CASE (1) 65 year old male with irregular polyploid mass at the descending colon, histopathologically proved adenocarcinoma. **MDCT:** Axial, coronal, and sagittal MDCT showing irregular polypoid mass at the descending colon occluding most of colonic lumen. **By ultrasound**: the mass is well defined hypoechoic with high internal vascularity on color Doppler. **Figure 2**

CASE (2) 51 year old female with ulcerating mass at the ascending colon, histopathologically proved adenocarcinoma. **Radiological interpretation:** Axial, coronal, and sagittal MDCT showing irregular polypoid mass at the ascending colon occluding most of colonic lumen. By ultrasound: the mass is well defined lobulated heterogeneous predominantly hypoechoic with scattered vascularity on color Doppler, Figure 3.

Table 1: Distribution of the studied groups

	No	%
Age		
Mean	47.52	
± SD	10.91	
Range	28.0-70.0	
Gender		
Male	28	56.0
Female	22	44.0
U/S findings		
Positive	30	60.0
Negative	20	40.0
MDCT		
Positive	35	70.0
Negative	15	30.0
Site		
Ascending colon	12	24.0
Descending colon	7	14.0
Recto sigmoid	9	18.0
Transverse	6	12.0
No	16	32.0

Table 2: Comparison between cancer colon cases and control subgroups according to age.

	Cases subgroup (34)	**Control subgroup (16)**	**Statistical test**	**P value**
Age				
Mean	52.32	37.31		
± SD	8.41	8.35	St t=5.9	<0.001**
Range	37.0-70.0	28.0-66.0		

Table 3: Comparison between cancer colon cases and control subgroups according to gender.

	Cases subgroup (34)		**Control subgroup (16)**		**Statistical test (x2)**	**P value**
	No	**%**	**No**	**%**		
Gender						
Male	19	55.9	9	56.2	0.001	0.98
Female	15	44.1	7	43.8		

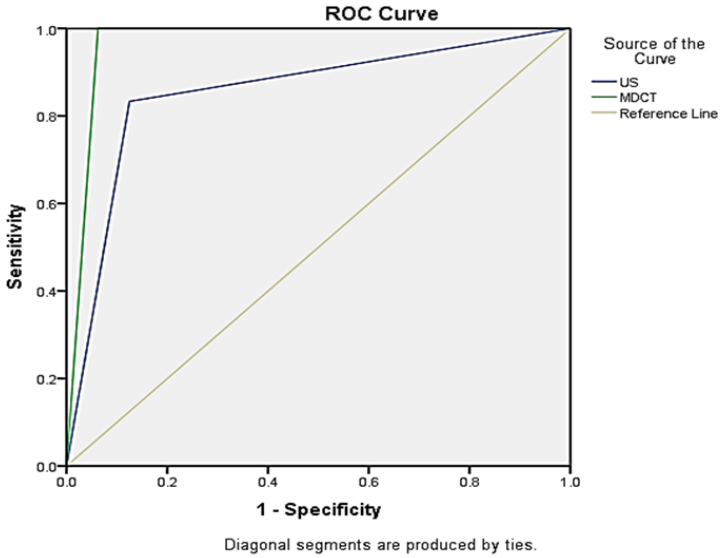
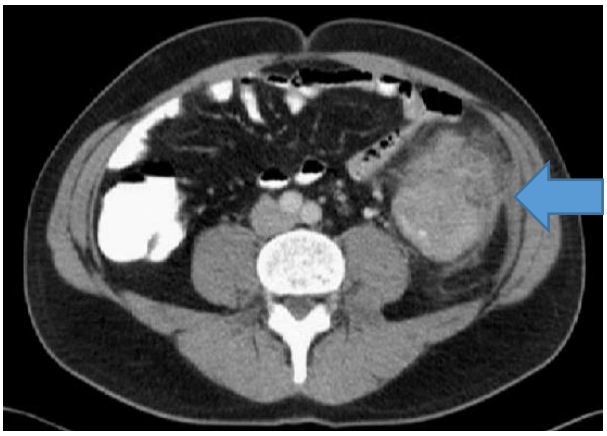
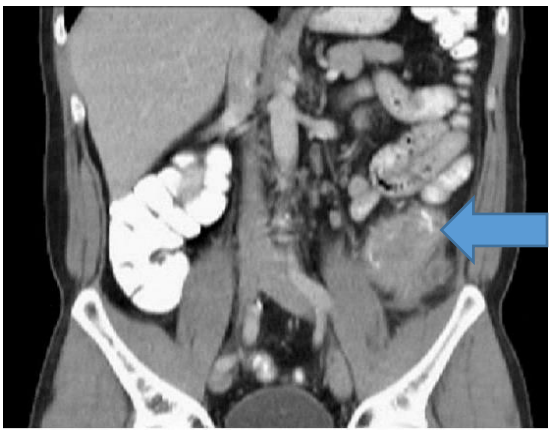


Figure 1: Curve of sensitivity & specificity of abdominal ultrasound and MDCT

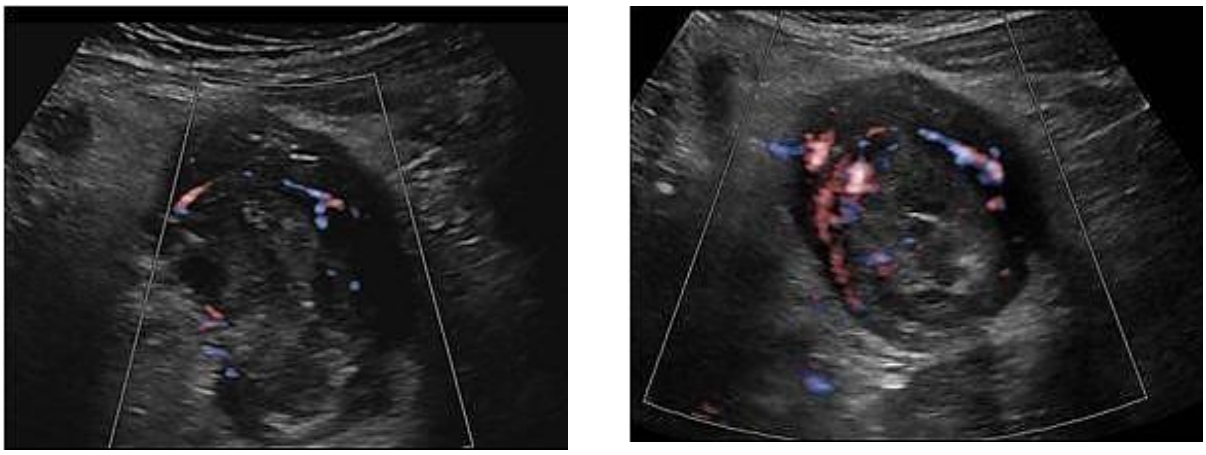


A- Aixal view



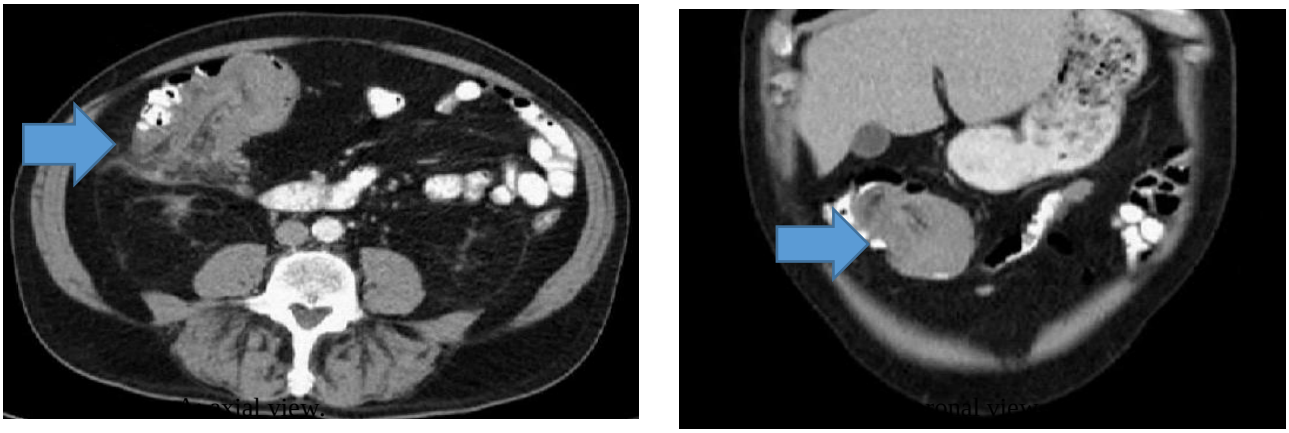
B: coronal view

C: sagittal view



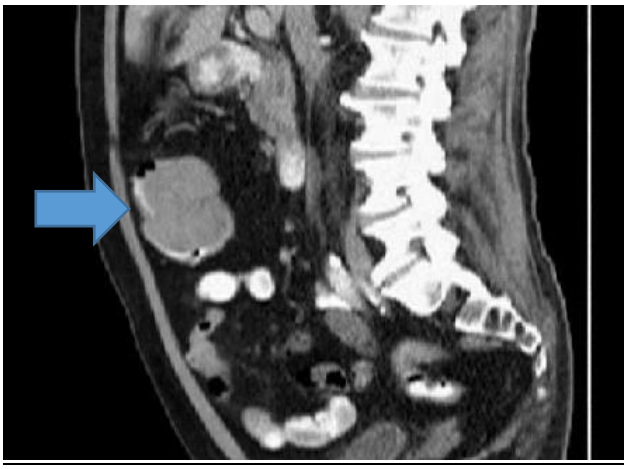
D: ultrasound

Fig. 2 : case no. 1

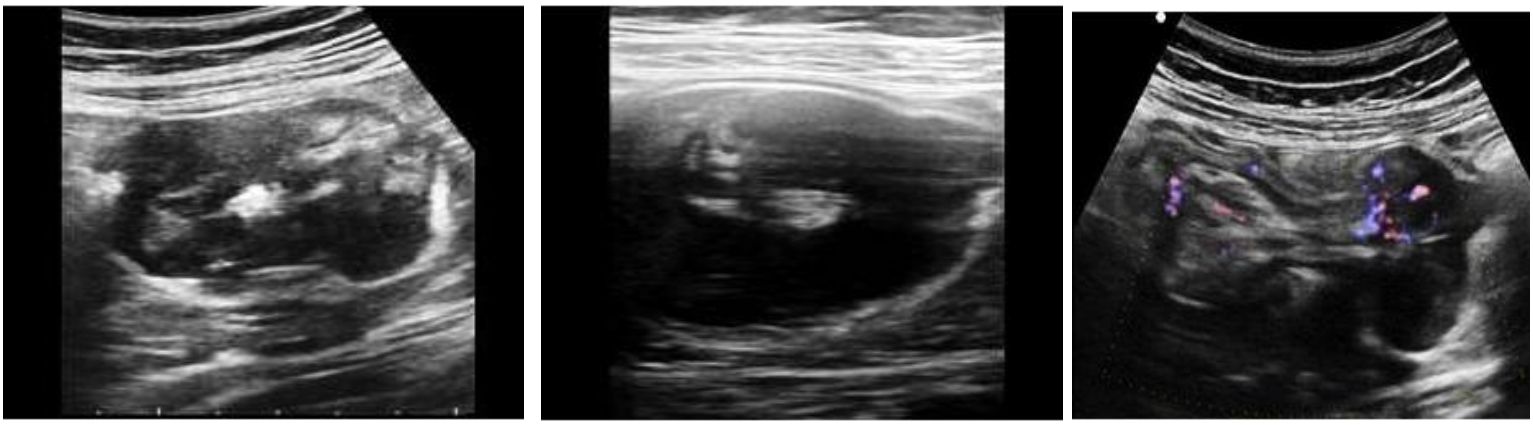


b:axial view.

c:coronal view



c:sagittal view



D: ultrasound

Fig. 3: case no. 2

Discussion

During abdominal ultrasound in patients with colon tumors, the retro-peritoneum must also be assessed. The area between the inferior vena cava and the aorta is the location of metastases in 1–2% of patients with colon cancer. The assessment of this area can be difficult in overweight patients and those with overlap of gas-distended bowel loops. The presence of ascites in a patient with colon tumor raises the suspicion of peritoneal carcinomatosis. The carcinomatosis nodules will be sought mainly in the interhepatophrenic area, at the level of peritoneal recesses, and in the rectovesical space. Searching small-sized carcinoma nodules also requires the assessment of the anterior peritoneum using the high-frequency linear probe.

Although our results showed that ultrasonography had high sensitivity for detecting colorectal cancer, the technique has three important limitations. Firstly, because ultrasound cannot penetrate gas abdominal pathologies can be masked by the presence of gas in the bowel. Thus, repeat ultrasonographic examination is indicated in patients with unclear ultrasonographic findings due to marked bowel gas. Secondly, because ultrasound cannot penetrate bone, colorectal tumours in the middle and lower third of the rectum can be missed. Thirdly, the accuracy of ultrasonographic examination is operator-dependent. An ultrasonographer requires adequate training, skill and experience to

perform ultrasonography and interpret the results accurately (9).

The sensitivity of CT detection depends mainly on the size of the colorectal tumor and the quality of the CT examination. Conventional CT has undergone significant changes with the development of MDCT. The prognosis of CRC is directly related to the extent of colorectal wall invasion, lymph node involvement, and distant metastases (10)

Recent advances in CT and the use of interactive multiplannar CT performed after osmotic bowel preparation will likely improve the sensitivity of CT for smaller lesions.

In patients with colorectal cancer, CT typically demonstrates a discrete soft-tissue mass that narrows the colonic lumen Large masses may undergo central necrosis and thus appear as a soft-tissue mass with central low attenuation or rarely air attenuation. This appearance may resemble that of an abscess. In addition, a significant percentage of colorectal cancers manifest as focal colonic wall thickening and luminal narrowing, an appearance that emphasizes the importance of adequate colonic opacification and distention. In particular, rectal and sigmoid cancers may appear as asymmetric nodular wall thickening that narrows the lumen This appearance may mimic diverticulitis, especially if the tumor involvement of the wall has resulted in infiltration of the pericolic fat.

Complications of primary colonic malignancies such as obstruction, perforation, and fistula can be readily visualized with CT. The sensitivity of CT in detection of bowel obstruction (small intestine and colon) is high, ranging between 90% and 94% (11)**.**

With careful analysis of the images, the exact cause of the obstruction can be identified in more than 70% of cases (11)**.**

At CT, colonic obstruction appears as a dilated colon with a transition to decompressed intestine at the site of obstruction. Identification of this transition point is the key to distinguishing obstruction from ileus. Three-dimensional reconstruction images can demonstrate the transition point well in problem cases .

Intussusception is a complication of colonic neoplasms that may produce obstruction and has a distinctive CT appearance. Intussusceptions can appear as a targetlike mass with alternating rings of soft tissue and fat, which represent the wall of the intussusceptum, mesenteric fat, and the wall of the intussuscipiens (12) .

Perforation is another complication that can result from colorectal carcinoma. CT is

extremely sensitive in detection of free air within the abdomen. Pneumoperitoneum resulting from a perforating colon cancer is not a common complication but does occur. More commonly, small air bubbles with fluid and mesenteric stranding may be detected in the pericolic fat, an appearance that indicates perforation (13).

Occasionally, extravasation of oral contrast material allows exact identification of the site of perforation. Owing to its ability to demonstrate the colon and surrounding structures, CT allows detection of pericolic extension of disease. CT is more accurate than MR imaging in staging the local extent of tumor, particularly for rectal cancers and detection of penetration of the lamina propria (14).

At CT, local extension of tumor appears as an extracolic mass or simply as thickening and infiltration of pericolic fat Extracolic spread of tumor is also suggested by loss of fat planes between the colon and adjacent organs. In general, the lower sensitivity results from the inability to detect microscopic extramural tumor extension with CT. In addition to detection of tumor spread into pericolic fat, a major advantage of performing preoperative CT is the ability to demonstrate tumor involvement of adjacent organs, such as the bladder, vagina, and abdominal or pelvic musculature Multiplanar reconstruction or 3D imaging can be helpful in visualizing tumor involvement of adjacent organs This information is crucial for planning treatment and surgery.

CT also allows reliable detection of enlarged lymph nodes in the abdomen and pelvis (15).

Although the presence of lymph nodes larger than 1–1.5 cm in short-axis diameter is considered pathologic, not all enlarged nodes contain tumor. Conversely, normal-sized nodes may have microscopic tumor involvement. Therefore, although CT has a high specificity (96%) for detection of metastatic lymph nodes, the sensitivity is low (16).

However, in most cases, the low sensitivity is not a significant clinical problem because regional lymph node sampling is routinely performed at surgery. Pathways of nodal metastases can be reliably predicted based on the site of the primary tumor (17).

For example, regional lymph node metastases from cancers located in the left colon will occur along the mesocolic, left colic, and inferior mesenteric artery nodal chains (18).

After curative resection of colorectal cancer, recurrent disease occurs in 37%–44% of patients (19).

Conclusion

Colorectal cancer is a common malignancy that results in significant morbidity and mortality, we believe that ultrasonography is a useful initial screening tool for colorectal cancer in patients presenting with abdominal distension. Compared with MDCT scanning and other modalities , ultrasonography is easily available; does not involve radiation, bowel preparation, or sedation; carries no risk of colonic perforation; and is less expensive. Further studies to confirm the usefulness of ultrasonography for diagnosis of colorectal cancer are warranted.

CT is valuable in preoperative assessment and staging of colorectal cancer as well as in postoperative surveillance for recurrence. Rapid advances in technology will likely continue to improve the accuracy and usefulness of CT.

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To cite this article: Ahmed F. youssef , Hamada M. Khater, Sameh F. Refaat. Role of Abdominal Ultrasound Compared to MDCT in Assessment of Colorectal Cancer. BMFJ 2021;38 (Radiology): 147-159. DOI: 10.21608/bmfj.2021.48809.1338