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Original Article

Evaluation of Colon Cancer by Bowel Ultrasound Compared to Colonoscopy

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ABSTRACT

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Background: Multiple studies have demonstrated that abdominal ultrasonography is useful for the diagnosis of colorectal cancer [CRC]. However, controversy still exists.

The aim of the work: The purpose of the study is to assess the efficacy of bowel ultrasonography in detecting colon malignancies and how it compares to colonoscopy in terms of accuracy.

Patients and Methods: This cross-sectional study included 50 adults referred to the endoscopy unit at Al-Azhar University Hospital [Damietta] for suspected colon cancer. All patients underwent ultrasonography before colonoscopy. Results of the ultrasound and colonoscopy were then compared.

Results: Of the 36 cases diagnosed by US as colon cancer, colonoscopy confirmed 32 as positive. Of the 14 cases diagnosed by US as negative, colonoscopy confirmed 11. Comparing US findings to histopathology, of the 36 US-positive cases, histopathology confirmed 30; of the 14 US-negative cases, histopathology confirmed 12. The sensitivity, specificity, positive predictive value, and negative predictive value of US for CRC diagnosis compared to colonoscopy were 91.4%, 73.3%, 88.8%, and 78.5%, respectively.

Conclusion: A bowel ultrasonography scan can safely and noninvasively detect colorectal cancer.

Keywords: Colon Cancer; Bowel Ultrasound; Colonoscopy; Histopathology.



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INTRODUCTION

The third most common disease overall and the fourth leading cause of cancer-related mortality globally is colorectal cancer [CRC]. Worldwide, 490,000 people lose their lives to colon cancer every year, while the number of new cases is estimated at 945,000 by the World Health Organization [1].

In Egypt, colorectal cancer ranked first among malignancies affecting the digestive tract [15.78%] and sixth overall [4.34%]. To optimize the utilization of health resources and to significantly improve CRC prognosis, two approaches are Strategies for early detection in patients with symptoms and population-based colorectal cancer screening programs [2, 3].

The prognosis is already poor when colon cancer is clinically identified in its advanced stages. As a result, prompt diagnosis is critical. The colonoscopy is still the diagnostic tool of choice at this time; it also has a crucial preventative function by removing precursory lesions [4, 5].

Although helpful for tumor surveillance and family history diagnosis, tumor markers do not add much to the diagnostic process. Endoscopic and radiological evaluation of the entire large bowel is required for CRC diagnosis [6].

Radiological techniques based on image acquisition by CT scan or MRI allow for the study of disease spread. Several investigations have demonstrated the usefulness of abdominal ultrasound in the diagnosis of colorectal cancer [CRC], although these studies only included a small number of patients. Another viable alternative is virtual colonoscopy, which has not been adequately studied for its sensitivity in detecting tiny lesions [7]. The diagnosis is supported by sonographic results, which show an uneven and hypoechoic thickening of the colon wall, an irregular shape, and the lack of stratification in layers of the wall [8].

Bowel ultrasonography [US] is a noninvasive imaging technique that can be done anytime and is safe; it allows for a real-time examination of the intestines without ionizing radiation [9].

The study's objective is to compare the efficacy of US with colonoscopy in diagnosing colon cancer.

PATIENTS AND METHODS

This was a cross sectional study. It included all adult patients who attended Al-Azhar university hospital [Damietta] between January 2023 and February 2024 with suspicion of colon cancer and referred to endoscopy unit for colonoscopy. Finally, fifty patients were included.

We included [inclusion criteria] adult patients who are suspected of having colon cancer for one of the following reasons: 1] Bleeding per rectum, 2] Chronic abdominal pain, 3] Change of bowel habits such as chronic constipation or diarrhea, 4] Significant weight loss, 5] Positive Family history for colorectal cancer, and 6] Inflammatory bowel disease [IBD]. On the other side, the exclusion criteria were 1] Clinically unstable patient such as on vasopressor support, on ventilator support or in hepatic encephalopathy, 2] Recent myocardial infarction and major co-morbidities, and 3] Uncooperative patients or those who do not give the consent to participate in the study.

Ethical considerations

All participants signed an informed consent after explanation of the study aim, with no harm to non-participants. Privacy was guaranteed and collected data were used for the purpose of research only.

Methods

All participants were assessed by detailed history of their condition after collected of demographic data. In addition, any chronic medical diseases were asked for. Then, a full systematic clinical evaluation [local and general] was performed.

The laboratory work-up included complete blood count [CBC], prothrombin time [PT], international normalization ratio [INR], serum creatinine, erythrocyte sedimentation rate [ESR], C-reactive protein [CRP] and random blood sugar [RBS]. Finally, the imaging studies included abdominal ultrasound followed by bowel colonoscopy.

Bowel ultrasonography

We used a high-quality intestinal ultrasonography machine and two highly-experienced radiologists from the Department of radiology-Al-Azhar university hospital, Damietta to conduct the ultrasonography. Both the outpatient and

hospitalized patients underwent their ultrasounds on the same day or during the same stay so that we could compare various procedures before the colonoscopy. The ultrasound machine used was the Aplio 500 from Toshiba in Japan, and it had a convex probe that operated at 5~7Mhz. Following standard protocol, all patients fasted for at least 6 hours before ultrasound examination. An ultrasonography scan of the entire abdomen was performed. In certain areas, the typical picture revealed hypoechoic thickening of the colon wall, an uneven shape, and the lack of stratification in wall layers; this was enough to warrant a positive ultrasonography.

Colonoscopy evaluation

All patients undergo bowel preparation according to the latest European Society of Gastrointestinal Endoscopy [ESGE] recommendations using split dose PEG-based oral regimen [Moviprep powder] combined with oral simethicone and the last dose within 5 hours before procedure. Premedication was given to all the patients. Which consisted of midazolam 2.5-5 mg and pentazocine 15-30 mg in titrated doses. Before, during and after procedure, patients' vital signs were monitored using multi parameter monitor. Digital rectal examination is carried out for all patients before insertion colonoscopy.

The examination was performed with a high-definition video endoscope [Pentax] by an experienced endoscopist. The colon was examined with the washing of any obscured mucosa. After the procedure, patients were closely monitored until they were ready to be discharged.

Histopathological Evaluation

Histopathologic diagnosis was cross-referenced with the findings of ultrasonography and colonoscopy performed on all patients.

Data analysis with statistics

We used the SPSS statistical software, version 26, from IBM in Chicago, Illinois, USA, to conduct the statistical study. The Kolmogorov-Smirnov test was used to check if the data was normally distributed. Quantitative data were shown as means and standard deviations, whilst qualitative data were given as percentages and numbers and compared using the fisher exact test. Therefore, the p-value was deemed significant at the <0.05 level.

RESULTS

In the current work, fifty subjects with colonic cancer were included. They were 26 males and 24 females; the mean age was 57.82 ± 10.73 years. The majority were from urban area [49 subjects] and just one subject come from rural area. The body mass index ranged between 17 and 35 kg/m². Smoking was the commonest special habit, reported by 24 subjects. The most common comorbid condition was diabetes mellitus [DM] followed by hypertension [Table 1].

The results of laboratory work-up showed that, patients were mainly anemic [hemoglobin concentration was 8.62 ± 2.1 , with mainly normal count of platelets and white blood cells. There was slight elevation of serum creatinine, CRP and bleeding indicators. However, ESR and RBS were highly elevated [Table 2].

The commonest presenting manifestation was bleeding per rectum [BPR] followed by constipation [28% and 26% respectively]. Other manifestations included abdominal pain, anemia, diarrhea and weight loss. The commonest site of cancer was ascending colon, followed by descending colon, then rectosigmoid and finally transverse colon [22%, 18%, 16% and 14% successively] [Table 3].

Ultrasound examination was negative in 14 subjects and the commonest finding was the colonic mass [30.0%]. In addition, colonoscopy was negative for 15 subjects and the commonest finding was cauliflower mass [30%]. Finally, the histopathological examination revealed malignant mass among 32 and benign lesion among 18 subjects [Table 4].

The detailed results regarding association between ultrasound and colonoscopy findings were detailed among table [5]. For example, the cauliflower mass by colonoscope was discovered among 15 subjects. The ultrasound finding among the same subjects showed colonic mass in 9, hypoechoic bowel wall thickenings among 4, lack of stratification in bowel wall layers among two [i.e., all subjects with cauliflower mass by colonoscope showed positive findings on ultrasound].

Comparing results of ultrasound and colonoscopy as a gold standard revealed that, it is sensitive among 91.4% and specific for 73.3%. However, when comparing US results to histopathology, the sensitivity increased to 93.7%, but specificity dropped to 66.6% [Table 6].

Table [1]: Characteristic data of the study patients

		Statistic measures
Age [years]	Mean±SD	57.82 ± 10.73
Gender [n, %]	Male	26[52.0%]
	Female	24[48.0%]
Residency [n, %]	Urban	49[98.0%]
	Rural	1 [2.0%]
Body mass index [BMI] [kg/m ²]	Mean±SD	25.3 ± 5.7
	Min. – Max.	17 – 35
Special habits [n, %]	None	23 [46.0%]
	Alcoholic drinking	3 [6.0%]
	Smoking	24 [48.0%]
Associated co-morbid conditions [n, %]	Diabetes mellitus [DM]	9[18.0%]
	DM with hypertension [HTN]	5 [10.0%]
	DM with ischemic heart disease [IHD]	3 [6.0%]
	Hypertension	7 [14.0%]
	Hypertension and Ischemic heart disease	2 [4.0%]
	Ischemic heart disease	4 [8.0%]
	None	20 [40%]

Table [2]: Results of Laboratory work-up among study subjects

		Results [mean± SD]
Hematological data	Hemoglobin [g/dL]	8.62 ± 2.1
	White blood cells [×10 ⁹ /L]	5.14 ± 2.14
	Platelet count [×10 ⁹ /L]	276.04 ± 103.42
Biochemical data	Serum creatinine [mg/dL]	1.15 ± 0.74
	C-reactive protein [mg/ml]	8.31 ± 5.25
	Erythrocyte sedimentation rate [mm/hr.]	71.30 ± 29.41
	Prothrombin time [seconds]	25.21 ± 9.65
	International normalization ratio [INR]	1.78 ± 0.74
	Random blood sugars [mg/dl]	199.44 ± 65.53

Table [3]: The main clinical presenting manifestation and expected site of cancer among study subjects

		Measures
The main presenting clinical manifestation [n, %]	Abdominal pain	5 [10.0%]
	Anemia	8 [16.0%]
	BPR	14 [28.0%]
	Constipation	13 [26.0%]
	Diarrhea	4 [8.0%]
	Recurrent IO	1 [2.0%]
	Weight loss	5 [10.0%]
Sites of cancer [n, %]	Ascending Colon	11 [22.0%]
	transverse colon	7 [14.0%]
	Descending Colon	9 [18.0%]
	Rectosigmoid	8 [16.0%]
	None	15 [30.0%]

Table [4]: Ultrasound, colonoscopy and histopathological findings among study subjects

		Measures
Ultrasound findings [n, %]	Colonic Mass	15 [30.0%]
	Hypoechoic bowel wall thickening	13 [26.0%]
	lack of stratification in bowel wall layers	8 [16.0%]
	Negative	14 [28.0%]
Colonoscopy findings [n, %]	Cauliflower mass	15 [30.0%]
	Infiltrating lesions with Hemorrhage and necrosis	14 [28.0%]
	Ulcerating lesion	6 [12.0%]
	No findings	15 [30.0%]
Results of histopathology [n, %]	Malignant	32 [64.0%]
	Benign	18 [36.0%]

Table [5]: Association between ultrasound and colonoscopy findings

Ultrasound findings	Colonoscopy findings [NO [%]]				
	Cauliflower mass	Infiltrating lesions with Hemorrhage and necrosis	No findings	Ulcerating lesion	Total
Colonic Mass	9 [18.0%]	4 [8.0%]	2 [4.0%]	0 [0.0%]	15 [30.0%]
Hypoechoic bowel wall thickening	4 [8.0%]	8 [16.0%]	1 [2.0%]	0 [0.0%]	13[26.0%]
No findings	0 [0.0%]	0 [0.0%]	11[22.0%]	3 [6.0%]	14[28.0%]
Lack of stratification in bowel wall layers	2 [4.0%]	2 [4.0%]	1 [2.0%]	3 [6.0%]	8[16.0%]
Total	15 [30.0%]	14 [28.0%]	15 [30.0%]	6 [12.0%]	50[100.0%]

Table [6]: Accuracy measures of ultrasound in relation to colonoscope and histopathology among study subjects

Ultrasound		Colonoscopy		P	Histopathology		P
		Positive	Negative	value	Positive	Negative	value
Ultrasound	Positive	32[64%]	4 [8%]	0.03	30 [60%]	6 [12%]	0.0001
	Negative	3 [6%]	11 [22%]		2 [4%]	12 [24%]	
Accuracy measures	Sensitivity	91.4%			93.7%		
	Specificity	73.3%			66.6%		
	Positive predictive value	88.8%			83.3%		
	Negative predictive value	78.5%			85.7%		

DISCUSSION

The colonoscopy is still the most effective technique for detecting colorectal cancer at this time. Multiple studies have demonstrated that abdominal ultrasonography is useful for the diagnosis of colorectal cancer [10]. The primary objective of this research is to determine how well abdominal ultrasonography detects colon cancer and how sensitive it is. In our study out of 36 patients suspected to have colon cancer patients by ultrasound, colonoscopy was able to detect 32 patients with pathological finding and histopathology confirmed 30 patients out of them to have CRC. which indicate that ultrasound can be used as screening tool for CRC due to its high sensitivity compared to both colonoscopy and histopathology [91.4% - 93.7%] respectively.

Despite limited specificity, **Rutgeerts et al.** [11] found a high sensitivity of 95%. Results were comparable when **Richardson et al.** [12] measured sensitivity at 96% and specificity at 67%. Contrarily, a specificity of 90% was achieved by **Shirahama et al.** [13]. In their study, **Martínez-Ares et al.** [10] discovered that the specificity was 92% and the sensitivity was 79%.

The results are consistent with those of **Chen et al.** [14] who found that ultrasonography was 92.8% sensitive, 98.8% specific, 94.7

percent positive predictive, and 98.0 percent negative predictive.

Our findings demonstrated that ultrasonography was quite sensitive in detecting colorectal cancer; however, there are three significant drawbacks to this method. To start with, abdominal diseases can go undetected by ultrasound due to the fact that gas cannot pass into the gut. Patients whose ultrasonographic results are confused owing to noticeable intestinal gas should undergo a repeat ultrasonographic examination. Secondly, colorectal tumors located in the lower and middle thirds of the rectum could go undetected by ultrasound due to its inability to penetrate bone. Thirdly, the reliability of ultrasonographic imaging relies on the skill of the operator. The accurate performance of ultrasonography and interpretation of data depends on the ultrasonographer's level of training, expertise, and experience [15].

Four patients in our study had a false-positive ultrasonography finding compared to colonoscopy. In other hand out of 15 patient who their colonoscopy confirmed absence of colorectal cancer, ultrasound was able to replicate colonoscopy result in only 11 patients with specificity of [73.3%] which indicate that individuals with suspicion of CRC and normal ultrasound finding, colonoscopy is warranted.

Our study's lack of a comparison group and relatively small patient sample size. This was the main limitations of the work.

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.

Declarations: No conflict of interest or financial disclosure

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