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Original article

Utility of Endoscopic Ultrasound in Identification of Rectal and Perirectal Diseases

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Abstract:

Background: Endoscopic ultrasound (EUS) is a new favourable way for evaluation of gastrointestinal (GI) lesions due to its capacity to differentiate between layers of the GI wall. EUS is considered a powerful diagnostic instrument due to the proliferation of image enhancement techniques and the ease of tissue sampling. Aim: This study aims to evaluate role of EUS in clarification of the nature of rectal and perirectal lesions. **Methodologies:** EUS procedure was performed on 25 adult patients in this study. Criteria for inclusion: patients aged 18 years or older who have been diagnosed with rectal and/or perirectal lesions, including a thickened rectal wall, space-occupying mass in the rectum or peri-rectal area, rectal polyps, and rectal submucosal lesions, as determined by imaging and/or colonoscopy. Criteria for exclusion: individuals whose lesions extend more than 20 centimeters from the anal verge, patients who are unable receive propofol injections due to advanced medical conditions, patients whose bleeding tendency. Patients were subjected to (CBC, PT, PTT, INR), (abdominal ultrasound or abdominopelvic CT or MRI), colonoscopy were performed prior to the EUS procedure. Samples from FNB were sent to pathologist. **Result:** The lesions were: rectal, anal adenocarcinoma & rectal adenoma, lipoma, GIST, inflammatory reaction, postoperative sequalae & leiomyoma, EUS and EUS-FNB had sensitivity (100) %, specificity (100) %, area under curve (01), accuracy (100) %, PPV (100) %, NPV (100) % for diagnosis of malignant lesions. P-value for validity of EUS in diagnosis (<0.001). **Conclusion:** EUS considered valid diagnostic method for identification of rectal diseases.

Key words: Endoscopic ultrasound (EUS), EUS-FNB, Rectal cancer.

Introduction

It is imperative to identify pelvic lesions when patients are suspected of having malignancy to determine the most appropriate course of clinical treatment. Although many imaging modalities as positron emission tomography, computed tomography, magnetic resonance imaging, ultrasound (PET/CT/MRI/US) have been utilized to detect potential malignancies, they fail to provide pathologic samples that are required for definitive diagnosis as well as for clinical prognostic management [1]. Endoscopic ultrasound (EUS) is a well-established technique that is frequently employed to diagnose and monitor colorectal malignancies, as well as the prostate, bladder, and ovaries cancers. It is also used to evacuate pelvic abscesses [2]. The five layers of the rectal wall are usually visible from the inside out. First, there is a hyperechoic fibrous band that separates the inner circular hypoechoic layer from the outer longitudinal layer; second, the mucosa-instrument interface is hyperechoic; third, the submucosa is hypoechoic; fourth, the muscularis propria layer is hypoechoic; and fifth, the serosa-perirectal fat interface is hyperechoic [3]. In addition to visualizing abscesses that aren't apparent on clinical examination and detecting fistulae, rectal endoscopic ultrasonography (REUS) can help determine the connection between the anal canal and rectum [4]. The internal opening and fistula tracts can be identified using REUS for fistula [5]. When comparing patients in remission with those with active inflammatory bowel diseases (IBD), A significant predictor of the degree of inflammation was determined to be the total wall thickness as evaluated by EUS. Both the submucosal and mucosal layers thickened significantly in patients with active Crohn's disease (CD) and ulcerative colitis (UC), respectively. It is also possible to diagnose CD rather than UC if para-colonic lymph nodes are seen during REUS [6]. The 2nd most common cause of cancer-related fatalities is colorectal cancer [7]. The most critical and primary factor in the treatment of patients with rectal cancer is the precise staging of the disease [8]. EUS can be employed to monitor the response to therapy and for initial locoregional staging. Additionally, EUS may be more effective than MRI in the detection of small, superficial lesions [9]. The meticulous characterization of rectal wall layers is a critical component of EUS, which can be beneficial in the diagnosis of rectal neuroendocrine tumors (NETs). To ascertain the necessity of subsequent endoscopic or surgical intervention, according to the standards set out by the European Neuroendocrine Tumour Society, EUS is an excellent method for measuring tumour size, invasion depth, and the existence of lymph node metastases, especially outside of the muscularis propria layer [10]. Gastrointestinal stromal tumours (GISTs) are the most common type of mesenchymal neoplasia that arises from the digestive tract [11].

Fine-needle biopsy (EUS-FNB) constitutes the gold standard for making a definitive diagnosis of GIST [12].

Aim

This study aimed to evaluate role of EUS in identification of the nature of rectal and perirectal lesions including polyps, submucosal lesions.

Patients and methods:

The 25 adults participated in this cross-sectional study. They were at Benha University Hospital's Hepatology, Gastroenterology, and Infectious Diseases Department and Kasr EL-Eini Hospital's Tropical Medicine

Department between June 2023 and December 2024. We got the go-ahead from the Benha Faculty of Medicine's committee on research ethics **(Code number MD 15-2-2022).** The procedure of the study was verbally explained to all patients, and all participants in this study provided informed written consent.

Criteria for inclusion: Patients aged 18 years or older who have been diagnosed with rectal and/or perirectal lesions, including a thickened rectal wall, space-occupying mass in the rectum or peri-rectal area, rectal polyps, and rectal submucosal lesions, as determined by abdomino-pelvic CT or MRI and/or colonoscopy.

Criteria for exclusion: individuals whose lesions extend more than 20 centimeters from the anal verge, patients who are unable to undergo endoscopy or receive propofol injections due to advanced medical conditions, patients whose bleeding tendency makes EUS-FNA unsafe, patients who were not followed up, patients whose final diagnosis could not be determined due to a lack of available histological examination.

All patients were subjected to the subsequent procedures: A comprehensive patient history should be taken, paying special attention to any signs of rectal bleeding, changes in bowel habits, rectal pain, loss of weight, or anaemia; a history of this or a similar illness, surgery, or cancer; and a family history of this or a similar illness. Comprehensive medical evaluation, paying close attention to the lymph nodes and the abdomen (particularly the posterior rectal area). Laboratory investigations including (CBC, PT, PTT, INR). Imaging including (abdominal ultrasound, abdominopelvic CT or MRI, as well as a colonoscopy for rectal or perirectal abnormalities) were performed prior to the EUS procedure.

Procedure of EUS:

I-Before EUS: Adherence to a fast of at least eight hours was mandatory for patients prior to the examination. Repeated enemas and polyethylene glycol were implemented to prepare the specimen. Evaluation of the patient's coagulation profile was done. Propofol is the preferred method of sedation for patients who are irritable. A single IV antibiotic injection of third-generation cephalosporin was administered to patients prior to EUS-FNA.

Patients were in a left lateral decubitus position. A compatible ultrasound machine (Hitachi EUB 7000 or Avius) was interconnected with an EUS machine (Pentax EG-3830UT Echoendoscope). All EUS examinations were conducted by a single endo-sonographer. Fine needles (Cook Echotip needle) 22 G were employed to obtain FNB under EUS guidance.

II-During EUS, the rectal wall layers beneath the lesions, as well as all lesions, were meticulously examined. The Research assessed if lymph nodes were in the perirectal region and how deeply the cancer had spread to the surrounding organs, such as the vagina, seminal vesicles, the anal sphincters, and the bladder.

III-If it was feasible and the wall thickness was sufficient for aspiration, linear array echoendoscope's instrument channel was used to insert the FNB needle into the rectal wall after the internal stylet was extracted. A negative vacuum was administered using a 10 mL syringe, and the needle was subsequently introduced into the lesion and reciprocated back and forth. Prior to its removal from the scope, the needle was retracted and subsequently inserted into the sheath.

Following the insertion of the internal stylet, the tissue sample was

transferred to a slide by injecting it with air through a syringe. Once it was confirmed that the tissue sample was sufficiently large, the needle was utilized to penetrate the lesion once more. The procedure was repeated 1-4 times to obtain an adequate number of samples.

Processing of cytological samples:

Proficient pathologist analyses and interpret all cytological samples. Samples were deemed adequate when they contained enough representative cells. Smears were prepared and the aspirated samples were transferred to slides. Afterwards, the specimens that were collected from subsequent passes were prepared for cell-block analysis.

Statistical analysis

Two programs created by STATA Corporation in College Station, Texas—MS Excel and STATA/SE version 11.2 for Windows—were used to analyse the data. Measures of central tendency, dispersion, and frequency were employed in descriptive statistics when appropriate. To compare data across the various research groups, suitable univariate tests were used, including the Chi-square test (X2), the Fisher Exact Test (FET), the test of proportion (Z), and the student t-test (t). The agreement between the final diagnosis and the different diagnostic tools was examined using the Kappa test. Accuracy, specificity, sensitivity, positive predictive value, and negative predictive value of each diagnostic instrument were assessed through a diagnostic performance analysis. To ascertain statistical significance, a two-way p-value of less than 0.05 used.

Results

Rectal and perirectal diseases were higher in patients with mean age (47.4+14.35), males gender represent (72) %, patients from urban area (72) %, smokers (32) %, patients with history of rectal cancer (12) %, patients with family history of cancer (12) %, patients with past history of previous operations (24) % of the studied patients. None of the studied patients had IBD **(table 1).**

The most common symptoms were chronic constipation and bleeding per rectum (40%) for each followed by anaemic manifestations (32%), recurrent abdominal pain & loss of weight (28%) for each, chronic diarrhoea (24%). None of the studied patients had faecal incontinence **(table 2).**

Haemoglobin level mean was (9.98+ 1.91 gm/dl) and that of ESR was (71.96+ 31.71 ml/hr). They were the most prominent laboratory abnormalities in the studied patients **(table 3).**

The commonest lesions were rectal adenocarcinoma & tubule-villous adenoma (20%) for each, followed by lipoma, (16%), GIST, inflammatory reaction, postoperative sequalae & leiomyoma (4%) for each **(table 4).**

Validity of EUS was 100% for diagnosis of both benign and malignant lesions in the studied patients compared to histopathology **(table 5).**

EUS and EUS-FNB had sensitivity (100) %, specificity (100) %, area under curve (01) for diagnosis of malignant lesions, in comparison with colonoscopy & colonoscopy and imaging **(table 6), (Figure 1).**

Table 1: Demographic characteristics and medical history of the studied patients.

Variable (n.=25)		**No.**	**%**
Age (years)	Mean ±SD	47.4±14.35	
	Range	20-70	
Sex	Female	7	28.0
	Male	18	72.0
Residence	Rural	7	28.0
	Urban	18	72.0
Special habits	Smoking	8	32.0
	No	17	68.0
History of IBD	Yes	0	0.0
	No	25	100.0
History of rectal cancer	Yes	3	12.0
	No	22	88.0
Systemic disease	Hypertension	1	4.0
	IHD	3	12.0
	DM	1	4.0
	No	20	80
Bilharziasis	Yes	1	4.0
	No	24	96.0
Family history of cancer	Yes	3	12.0
	No	22	88.0
Previous operation	Appendectomy	2	8.0
	Cesarian section	3	12.0
	Surgical excision of retroperitoneal liposarcoma	1	4.0
	No	19	76.0

Table 2: Clinical presentation of the studied patients.

Symptoms (n.=25)		**No.**	**%**
Recurrent abdominal pain	Yes	7	28.0
	No	18	72.0
Chronic diarrhoea	Yes	6	24.0
	No	19	76.0
Chronic constipation	Yes	10	40.0
	No	15	60.0
Bleeding per rectum	Yes	10	40.0
	No	15	60.0
Loss of weight	Yes	7	28.0
	No	18	72.0
Anaemic manifestations	Yes	8	32.0
	No	17	68.0
Faecal incontinence	Yes	0	0.0
	No	25	100

Table 3: Laboratory data of the studied patients.

Laboratory data (n.=25)	Mean ±SD	Min.	Max.
Hb (gm/dl)	9.98±1.91	7	13
PLT*10^3/ml	240.48±51.65	150	340
TLC*10^3/ml	6.13±2.21	4	14
INR	1.00±0.16	0.8	1.4
ESR (mm/hour)	71.96±31.71	20	120

Hb: haemoglobin. PLT: platelet.
TLC: total leucocytic cont. INR: international normalized ratio.
ESR: erythrocyte sedimentation rate.

Table 4: Final diagnosis of the patients studied according to histopathology.

Diagnosis (n.=25)	No.	%
Anal adenocarcinoma	1	4.00
GIST	2	8.00
Inflammatory reaction	1	4.00
Lipoma	4	16.00
Postoperative sequalae	1	4.00
Rectal adenocarcinoma	5	20.00
Rectal adenocarcinoma for ESD	2	8.00
Rectal adenocarcinoma for surgery	3	12.00
Tubulo-villous adenoma with LGD	5	20.00
Leiomyoma	1	4.00

GIST: gastro-intestinal stomal tumor.
ESD: endoscopic mucosal dissection.
LGD: Low grade dysplasia

Table 5: Validity of the EUS for diagnosis of benign and malignant lesions.

EUS diagnosis	Final diagnosis by histopathology				Total	
	Benign		Malignant			
	No.	%	No.	%	No.	%
Benign	12	100.0	0	0.0	12	48.0
Malignant	0	0.0	13	100.0	13	52.0
Total	12	100.0	13	100.0	25	100.0
Kappa agreement & p value	1 & p<0.001					

A kappa of 0.81-1=perfect agreement, 0.61-0.80=good agreement, 0.41-0.60=moderate agreement, 0.21-0.40=fair agreement, 0.01-0.20=no/slight agreement, EUS: Endoscopic Ultrasound.

Table 6: Diagnostic performance of various diagnostic tools for diagnosis of rectal malignancy.

Diagnostic tools	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
EUS	100.0	100.0	100.0	100.0	100.0
EUS-FNB	100.0	100.0	100.0	100.0	100.0
Colonoscopy	92.31	27.27	60.0	75.0	62.5
Imaging + colonoscopy	38.46	91.67	83.33	57.89	64.0

NPV: Negative Predictive Value, PPV: Positive Predictive value
EUS- FNB: endoscopic ultrasound fine needle biopsy.

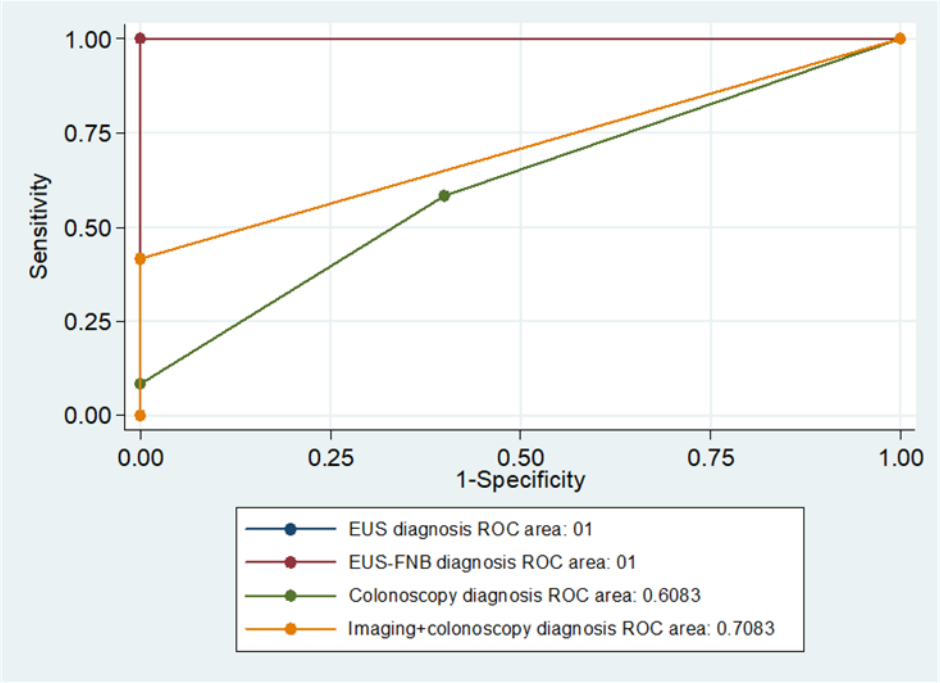

Figure 1: Diagnostic performance of EUS, EUS-FNB, colonoscopy, and imaging+ colonoscopy for diagnosis of rectal malignancy.

Discussion

In this study rectal and perirectal diseases were higher in patients with mean age (47± 14.35) which came in agreement with Zeeneldin et al, [13] who identified 293 cases of colorectal cancer (CRC). And found that the median age of these patients was 53 years, with a range of 21 to 81 years, also Xiao et al, [14] who examined 21 patients with rectal GIST to identify clinicopathological features and prognostic factors. The participant's ages ranged from 36 to 66 years at the time of diagnosis, with an average age of 51.

This current study showed that percentage of male with rectal & peri-rectal diseases was (72) % which is higher than female. This was in line with El-Moselhy et al, [15] who conducted case-control study on 160 patients with CRC and 300 healthy subjects & found that CRC was 69.4% in males and 33.6% in females compared to (48%) male, (52%) female in control group. Additionally, this was in concordance with MA et al, [16] who discovered that GIST was more prevalent in male than female (55.1% vs. 46.9%).
The present study found that patients from urban area were (72%) & those from rural

area were (28%) which was in the same side of Veruttipong et al, [17] who found that CRC more common in patients from urban areas than in rural areas (55% vs. 45%).

This study showed that smokers represent (32) % of the studied patients which was in concordance with Gram et al, [18] who discovered that smokers represent (45%) in patients with CRC. At the same line Figueiredo et al, [19] found that smokers represent (39%) in patients with adenoma and serrated polyps.

This current study found that patients with hypertension represent (4) % of the studied patients which supported by Xuan et al, [20] who worked on the meta-analysis that investigated the link between hypertension and CRC. They found a positive association between hypertension and CRC risk. Oxidative stress and chronic inflammation may account for this.

The present study showed that patients with IHD represent (12) % of the studied patients that supported by Hee et al, [21] who found the relation between colorectal neoplasm and ischemic heart disease (IHD) which are both caused by chronic inflammation.

This study showed that patients with DM represent (4) % of the studied patients which supported by Guraya et al, [22] Several systematic reviews found a link between type 2 diabetes and colorectal cancer risk. Colorectal cancer (CRC) develops when hyperinsulinemia, in a dose-dependent way, stimulates cell proliferation and DNA synthesis in normal intestinal epithelial cells and CRC cells. In contrast, persistent hyperglycemia is associated with the generation of reactive oxygen species (ROS), chronic oxidative stress, and the clear activation of inflammatory pathways. It is possible that insulin resistance development is at the center. Tumors may be more likely to be malignant if they are influenced by illness.

In the current study patients with bilharziasis represent (4) % of the studied patients which was in the opposite side of Darre et al, [23] According to a study that looked at 814 cases of colorectal cancer, they found that 0.4% of those cases were related to schistosomiasis. The researchers concluded that the rates of association were too low to establish a causal relationship between the two diseases. The smaller sample size of this study compared to the one conducted by Darre et al, [23]. This could account for this discrepancy.

The present study found that patients with family history of rectal cancer represent (12) % of the studied patients which came in agreement with El-Moselhy et al, [24] who conducted study on 200 patients with colorectal cancer and an equal number of healthy controls. He found that only 6% of the studied patients had history of colorectal cancer in their family. This could be explained by lower number of the studied cases in this study compared to cases in the study done by El-Moselhy et al, [24].

In the present study: the most common symptoms were chronic constipation and bleeding per rectum (40%) for each, followed by anaemic manifestations (32%), recurrent abdominal pain & loss of weight (28%) for each. chronic diarrhoea (24%), and these results came in agreement with El-Moselhy et al, [24] who discovered that the most prevalent symptoms of CRC were chronic severe constipation and/or diarrhoea (38.5%), abdominal pain or spasms (39.5%), and rectal bleeding (RB) (56.0%). Also, Xiao et al, [14] found that the most common initial presentation was haematochezia.

In the current study, the commonest detected lesions were: rectal adenocarcinoma & tubule-villous adenoma 20%, followed by lipoma, 16%, GIST 4%, inflammatory reaction 4%, postoperative sequalae 4%, leiomyoma 4% and these results came in disagreement with Tao et al, [25] who found that neuroendocrine tumors (12/56, 20.3% of the total lesions) were the most common types of rectal lesions in the study. additional frequent

types were rectal cancer (7/56, 11.9%), extraluminal compression (8/56, 13.6%), and lipoma (8/56, 13.6%). In addition to polyps, inflammation, endometriosis, and varices were found. This difference in result could be explained by lower number of the studied cases in this study & different ethnicity between population compared to the studied cases in the study done by Tao et al, [25].

The results of this investigation agreed with previous research showing that EUS and EUS-FNB were highly accurate in diagnosing benign and malignant lesions, with a sensitivity and specificity of 100%, a positive predictive value (PPV) of 100%, and a negative predictive value (NPV) of 100% Mahran et al, [26]. who performed a cross-sectional study on seventy adult patients with rectal and/or perirectal lesions and discovered that EUS and EUS-FNB had a pinpoint accuracy (100%) for rectal and perirectal lesion diagnosis, together with a positive predictive value (PPV) of 100 and a negative predictive value (NPV) of 100, Boo et al, [27] who found EUS to be effective in rectal or perirectal lesions, with good diagnostic accuracy (91.70%), Amin et al, [28]2013 found that EUS had a sensitivity and specificity of 91% and 100% for detecting malignant rectal/perirectal lesions, respectively and Maleki et al, [29] evaluated the use of rectal EUS to assess perirectal lesions and found that it had 87% sensitivity, 100% specificity, 90% diagnostic accuracy, 100% positive predictive value (PPV), and 77% negative predictive value (NPV).

Conclusion

EUS considered a valid diagnostic method for identification of rectal diseases, superior to imaging and colonoscopy.

Conflict of interest

None declared any conflict of interest

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