



## Endoscopic Ultrasonography in aTertiary Level Hospital: a single-centre experience / Üçüncü Basamak Hastanede Endoskopik Ultrasonografi: Tek merkez deneyimi

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### Öz

**Giriş:** Endoskopik ultrasonografi (EUS), üst gastrointestinal sistemin subepitelyal lezyonlarına ek olarak hepatobiliyer sistem, pankreas, mediasten ve rektumdaki lezyonların karakterini belirlemek ve lezyondan örneklemeye ek olarak evreleme yapmak için yaygın olarak kullanılmaktadır. **Amaç:** Bu çalışmanın amacı kliniğimizin son bir yıldaki endoskopik ultrasonografi deneyimini sunmaktır. **Gereç ve yöntemler:** EUS endikasyonu iki gastroenterolog tarafından Pentax EPK-i5000 video işlemcisi ve lineer ve radyal ekoendoskoplar kullanılarak anestezi uzmanının rehberliğinde sedoanaljezi altında yapıldı. Veriler tanımlayıcı istatistikler kullanılarak analiz edildi. Çalışma sonuçları SPSS v. 22.0 software kullanılarak analiz edildi. **Bulgular:** Endoskopik ultrasonografi yapılan 155 hastanın analizinde 88'i (%56.8) kadın, 67'si (%43.2) erkek olmak üzere, yaş ortalaması 56.3±14.2 (dağılım: 19-91) idi. Pankreas lezyonu nedeniyle EUS prosedürü uygulanan 41 hastanın 24'ü (%59) erkek, 17'si (%41) kadındı ve ortalama yaşları 54.3±17.1 yıldır. 74 hastaya üst gastrointestinal sistemin subepitelyal lezyonları nedeniyle EUS uygulandı. Bu hastaların 39'u (%52.7) kadın, 35'i (%47.3) erkek olup yaş ortalaması 55.2±13.5 yıl idi. **Sonuç ve öneriler:** Bu çalışmanın sonuçları, EUS'nin özellikle gastrointestinal sistem, pankreas ve ampulla patolojilerinin subepitelyal ve malign lezyonlarının değerlendirilmesinde uygun endikasyonlarda güvenilir ve çok kullanışlı bir araç olduğunu göstermektedir. Endoskopik ultrasonografi; gastrointestinal sistemin submukozal lezyonlarının teşhisinde, malign lezyonlarının evrelemede ve pankreasın kistik ve solid lezyonlarının tanısında uygulanan etkili ve yol gösterici bir yöntemdir.

**Anahtar kelimeler:** Endoskopik ultrasonografi, Pankreatik hastalıklar, Pankreas

### Abstract

**Introduction :** Endoscopic ultrasonography (EUS) is widely used to determine the character of lesions in the hepatobiliary system, pancreas, mediastinum, and rectum, in addition to subepithelial lesions of the upper gastrointestinal tract and for staging in addition to sampling from the lesion. **Aim:** The aim of this study is to present the endoscopic ultrasonography experience of our clinic over the last year. **Material and Methods:** EUS indications were performed by two gastroenterologists using a Pentax EPK-i5000 video processor and linear and radial echoendoscopes, under the guidance of an anesthesiologist under sedoanalgesia. Data were analyzed using descriptive statistics. The study results were analyzed using SPSS v. 22.0 software. **Results:** Evaluation was made of 155 patients who underwent endoscopic ultrasonography, comprising 88 (56.8%) females and 67 (43.2%) males with a mean age of 56.3±14.2 years (range: 19-91 years). The 41 patients who underwent the EUS procedure for pancreatic lesion comprised 24 (59%) males and 17 (41%) females with a mean age of 54.3±17.1 years. EUS was performed in 74 patients due to subepithelial lesions of the upper gastrointestinal tract. These patients comprised 39 (52.7%) females and 35 (47.3%) males with a mean age of 55.2±13.5 years. **Discussion** The results of this study show that EUS is a reliable and very useful tool in appropriate indications,



especially for the evaluation of subepithelial and malignant lesions of the gastrointestinal tract, pancreas, and ampulla pathologies. Conclusion and suggestions: Endoscopic ultrasonography; It is an effective and guiding method used in the diagnosis of submucosal lesions of the gastrointestinal tract, staging of malignant lesions, and the diagnosis of cystic and solid lesions of the pancreas.

**Keywords:** Endoscopic ultrasonography, Pancreatic disease, Pancreas

## 1.Introduction

Since its introduction into clinical practice in the early 1980s, endoscopic ultrasonography (EUS) has become an indispensable tool for imaging the gastrointestinal wall and surrounding structures. It is a highly effective and efficient method to evaluate benign and malignant gastrointestinal diseases (Sooklal & Chahal, 2020). Imaging with EUS is performed with radial or linear endoscopes. While the radial scope is used for diagnostic imaging only, the linear scope is also used for image-guided tissue sampling and therapeutic procedures. With the introduction of fine-needle aspiration biopsy in the 1990s, the fields of use for EUS expanded greatly, and although initially used as a diagnostic tool, it is now also widely used in therapeutic procedures (Papanikolaou, Fockens, Hawes, & Rösch, 2008; Wiersema et al., 1992).

Subepithelial lesions of the gastrointestinal tract are usually defined as a mass in the lumen lined with mucosa of normal appearance. These lesions, which are detected incidentally during gastroscopy, are mostly benign, and early detection of lesions that may be malignant is of vital importance. EUS is the primary imaging method used for this purpose (Moon, 2012). Information about the layer from which the subepithelial lesion originates is provided by EUS, and the echogenic features and size also provide the possibility of fine-needle aspiration biopsy for lesions > 1 cm (Sakamoto, Kitano, & Kudo, 2010).

EUS is widely used to determine the character of lesions in the hepatobiliary system, pancreas, mediastinum, and rectum, in addition to subepithelial lesions of the upper gastrointestinal tract and for staging in addition to sampling from the lesion. Due to the widespread use of dynamic imaging methods, there has been an increase in the detection of cystic lesions of the pancreas in recent years, and EUS can evaluate character, size, and malignancy potential of these.

The aim of this study was to present the endoscopic ultrasonography experience of our clinic over the last year.

## 2.Material and Methods

**2.1 Type of research:** A descriptive cross-sectional study

**2.2 Research Place and Time :** Van Training and Research Hospital, March 2021

**2.3 Universe, Sample and Sampling Research Method:** The study included patients who presented at the Gastroenterology Clinic of Van Training and Research Hospital between January 2020 and March 2021 and underwent endoscopic ultrasonography. In addition to demographic data such as age and sex of the patients, comorbidities, the location, diameter, character, and echogenic characteristics of the lesion evaluated in endoscopic ultrasonography, Fine needle aspiration (FNA) biopsy results, and the treatment performed as a result were analyzed in detail.

**2.4 Data Collection Tools:** Patient files and hospital record system

**2.5 Data Collection:** As the result of the evaluation with upper gastrointestinal system (GIS) endoscopy, computed tomography (CT), and magnetic resonance imaging (MRI), the procedures of the patients with EUS indication were performed by two gastroenterologists using a Pentax EPK-i5000 video



processor and linear and radialechoendoscopes, under the guidance of an anesthesiologist under sedoanalgesia. After 8 hours fasting, the patients were monitored throughout the procedure, with propofol, midazolam, and ketamine administered by the anesthesia team. FNA biopsies were taken with a 22 G CookEchoTip brand needle as standard and sent to the pathology department under appropriate conditions.

**2.6 Ethical approval and informed consent:** Approval for this study was obtained from the hospital Ethics Committee (approval no:2022/04-03, dated:23.02.2022). All procedures were in accordance with the ethical standards of our institution's human experiment committee and the Helsinki Declaration. Written informed consent forms were obtained from all the study participants.

**2.7 Statistical analysis :** Data were analyzed using descriptive statistics. The study results were analyzed using SPSS vn. 22.0 software (Statistical Package for the Social Sciences, IBM Corpn, Armonk, NY, USA).

Categorical data were stated as number (n) and percentage (%), and continuous variables were stated as mean and standard deviation values.

### 3. Results

Evaluation was made of 155 patients who underwent endoscopic ultrasonography, comprising 88 (56.8%) females and 67 (43.2%) males with a mean age of  $56.3 \pm 14.2$  years (range: 19-91 years). The indications for the procedure were classified as the upper and lower gastrointestinal tract, and 96.1% of cases were performed for lesions in the upper gastrointestinal tract (Table-1).

**Table 1: Study Population and Indications For EUS**

	n	%
Age (years) (Mean $\pm$ SD, Range)	56.3 $\pm$ 14.2 (19-91)	
Sex (Male/Female)	67 / 88	43.2/56.8
Indications for EUS [n (%)]		
Upper-GI EUS	149	96.1
1: Esophageal subepithelial lesion	36	23.2
2: Esophageal malignancy	8	5.1
3: Gastric subepithelial lesion	36	23.2
4: Duodenal subepithelial lesion	4	2.6
5: Gastric malignancy	11	7.0
6: Pancreatic lesion	38	24.5
7: Chronic pancreatitis	3	1.95
8: Ampulla lesion	7	4.5
9: External pressure	5	3.2
10: Choledocholithiasis	1	0.64
Lower-GI EUS	6	3.8
Sphincter Dysfunction	3	1.9
2: Malignancy staging	3	1.9

The 41 patients who underwent the EUS procedure for pancreatic lesion comprised 24 (59%) males and 17 (41%) females with a mean age of  $54.3 \pm 17.1$  years. The linear scope was used in all pancreatic lesions, most of which were found to be in the head-neck part (65.8%) and solid (46.3%). The mean size of the lesions detected in the pancreas was  $4.1 \pm 2.1$  cm, and 40 FNA biopsies were taken. In 1 patient, a biopsy could not be taken due to the risk of bleeding, as there were vascular structures around the lesion. Pancreatic adenocarcinoma was diagnosed in 16 (40%) of the biopsies taken, and the biopsy of 1 patient



was reported as non-diagnostic. Surgery was applied to 17.1% of the pancreatic lesions and 43.8% were followed up with chemotherapy. The 7 patients who underwent EUS for ampullar lesion comprised 4 (57.1%) males and 3 (42.9%) females with a mean age of 66.1±10.7 years. Most of the lesions were infiltrative (71.4%), and 4 of 6 FNA biopsies were diagnosed as adenocarcinoma (57.1%). Ampullectomy was performed in 2 patients (28.6%) and treatment with chemotherapy was applied to 42.9% of the ampullar lesions (Table-2).

**Table 2: EUS Findings, Histopathology and Treatment Features**

	Pancreatic lesionN:41		Ampullar lesionN:7		External pressureN:5	
	n	%	n	%	n	%
Age (years)(Mean, SD)	54.3±17.1		66.1±10.7		50.6±13.6	
Sex (Female)	17	41.5	3	42.9	2	40.0
Comorbidities						
Diabetes Mellitus	5	-	1	-	1	-
Hypertension	7		4		1	
Coronary artery disease	5		2		0	
COPD/Asthma	0		0		0	
MEN-1	1		0		0	
Hypothyroidism	0		0		1	
Alzheimer's- epilepsy	0		0		0	
EUS scope						
Linear	41	100	7	100	5	100
Radial	0	0	0	0	0	0
The location of the lesion						
Head-neck	27	65,8	-		-	
Corpus	8	19,5	-		-	
Tail	6	14,7	-		-	
Ampulla	-	-	7	100	-	
Mediastinum	-	-	-		3	60
Abdomen	-	-	-		2	40
The character of the lesion						
Solid	19	46,3	2	18,6	5	100
Cystic	9	22	0	0	0	0
Solid-cystic	11	26,8	0	0	0	0
Infiltrative	2	4,9	5	71,4	0	0
Echogenicity						
Hypochoic	37	92,5	7	100	5	100
Isochoic	2	5	0	0	0	0
Hyperechoic	1	2,5	0	0	0	0
Size of the lesion (cm)	4.1±2.1		2.86±0.6		3.4±1.6	
FNA						
Yes	40	97,5	6	85,7	3	60
No	1	2,5	1	14,3	2	40
FNA Pathology						
Adenocarcinoma	16	40	4	57,1	1	20
Chronic pancreatitis	4	10	0	0	0	0



Serous cyst	2	5	0	0	0	0
IPMN	3	7,5	0	0	0	0
Serous cystadenoma	1	2,5	0	0	0	0
Mucinous cystadenoma	1	2,5	0	0	0	0
Pseudocyst	2	5	0	0	0	0
Pseudopapillary	2	5	0	0	0	0
Autoimmune pancreatitis	2	5	0	0	0	0
Tubular adenoma	0	0	1	14,3	0	0
Tubulovillous adenoma	0	0	1	14,3	0	0
Hydatid cyst	2	5	0	0	0	0
Tuberculosis	1	2,5	0	0	0	0
Neuroendocrine	3	7,5	0	0	0	0
Lymphoma	0	0	0	0	2	40
Spleen compression	0	0	0	0	1	20
Non-diagnostic	1	2,5	1	14,3	1	20
Surgical treatment						
Yes	5	12,2	1	14,3	0	0
No	36	87,8	6	85,7	5	100
Treatment						
Surgical	7	17,1	1	14,3	0	0
Medical treatment	18	43,9	3	42,9	2	40
Ampullectomy	0	0	2	28,6	0	0
Cystogastrostomy	1	2,4	0	0	0	0
Follow-up	15	36,6	1	14,3	3	60

EUS was performed in 74 patients due to subepithelial lesions of the upper gastrointestinal tract. These patients comprised 39 (52.7%) females and 35 (47.3%) males with a mean age of  $55.2 \pm 13.5$  years. While 72 patients were operated on with a linear scope, 2 procedures were performed with a radial scope. Localisation of the lesions was determined to be in the esophagus in 34 (45.9%) cases, and most of the subepithelial lesions in the stomach were found in the antrum (25.6%). When evaluated in terms of the layers from which the lesions originated, most of the lesions were determined to have originated from the submucosa (40.5%) and muscularis propria (37.8%). The mean size of the lesions was  $2.78 \pm 1.8$  cm. While gastrointestinal stromal tumor (GIST) (16.1) and leiomyoma (25.8) were seen predominantly in the FNA biopsies taken, the biopsies of 10 patients were non-diagnostic. Surgery was applied to 7 patients during follow-up, and 89.2% of the patients were followed up endoscopically (Table-3).

**Table 3: EUS Findings, Histopathology And Treatment Features**

	Subepithelial lesion N:74		Malignant lesions N:24	
	n	%	n	%
Age (years)(Mean, SD)	55.2±13.5		60.1±8.9	
Sex (Female)	39	52.7	5	20.8
<b>Comorbidities</b>				
Diabetes mellitus	4	5.4	2	8.35
Hypertension	4	5.4	6	25.0
Coronary artery disease	3	4.1	1	4.1
COPD/Asthma	1	1.3	0	0
Hypothyroidism	2	2.6	1	4.1
Alzheimer's-epilepsy	2	2.6	0	0
<b>EUS scope</b>				
Linear	72	97.3	22 (91.7%)	91.7
Radial	2	2.7	2 (8.3%)	8.3
<b>The location of the lesion</b>				
Esophagus	34	45.95	10	41.6
Cardia	13	17.5	5	20.8
Corpus	4	5.4	3	12.5
Antrum	19	25.6	2	8.3



<b>Duodenum</b>	4	5.4	1	4.1
<b>Rectum</b>	3	4.1	3	12.5
<b>Linitis plastica</b>	-		3	15.5
<b>The layer from which the lesion originated</b>				
<b>Mucosa</b>	2	2.7	0	0
<b>Muscularis mucosa</b>	8	10.8	0	0
<b>Submucosa</b>	30	40.5	0	0
<b>Muscularispropria</b>	28	37.8	0	0
<b>Full floor</b>	0	0	24	100
<b>Not able to be visualised</b>	6	8.1	0	0
<b>The character of the lesion</b>				
<b>Solid</b>	65	87.8	1	4.2
<b>Cystic</b>	2	2.7	0	0
<b>Solid-cystic</b>	1	1.4	0	0
<b>Infiltrative</b>	0	0	23	95.8
<b>Not able to be visualised</b>	6	8.1	0	0
<b>Echogenicity</b>				
<b>Hypoechoic</b>	66	89.2	24	100
<b>Isoechoic</b>	0	0	0	0
<b>Hyperechoic</b>	2	2.7	0	0
<b>Not able to be visualised</b>	6	8.1	0	0
<b>Size of the lesion (cm)</b>	2.78±1.8		2.55±0.9	
<b>FNA</b>				
<b>Yes</b>	31	41.9	17	70.8
<b>No</b>	43	58.1	7	29.2
<b>FNA Pathology</b>				
<b>Adenocarcinoma</b>	1	3.2	12	70.5
<b>Squamous cell carcinoma</b>	1	3.2	4	23.5
<b>GIST</b>	5	16.1	0	0
<b>Leiomyoma</b>	8	25.8	1	5.8
<b>Neuroendocrine</b>	5	16.1	0	0
<b>Non-diagnostic</b>	10	32.2	0	0
<b>Duplication cyst</b>	1	3.2	0	0
<b>Surgical treatment</b>				
<b>Yes</b>	6	8.1	13	54.2
<b>No</b>	68	91.9	11	45.8
<b>Treatment</b>				
<b>Surgical</b>	7	9.5	13	54.2
<b>Medical treatment</b>	1	1.4	10	41.7
<b>Follow-up</b>	66	89.2	1	4.2

The 24 patients who underwent EUS for malignant lesions comprised 19 (79.2%) males and 5 (20.8%) females with a mean age of 60.1±8.9 years. Most of the malignant lesions were in the esophagus(41.6%), and of the malignant lesions in the stomach, most were in the cardia (20.8%). The mean lesionsize was 2.55±0.9 cm and 23 were infiltrative. Surgery was performed on 13 patients (54.2%) during the follow-up, and 10 patients (41.7%) were treated with medical therapy.



#### 4. Discussion

Due to the widespread use of endoscopy and dynamic imaging methods, the use of endoscopic ultrasonography has increased in recent years for the diagnosis of subepithelial lesions, pancreatic cysts, and mediastinal masses, which are often detected incidentally. If imaging of the surrounding organs and tissues adjacent to the gastrointestinal tract is required, tissue sampling simplifies the diagnosis for these patients.

Due to the complexity of the regional anatomy of the pancreas, the diagnosis of lesions can be difficult. Traditionally, transabdominal ultrasound, computed tomography (CT), or EUS-guided FNA have been used to obtain pancreatic biopsies (Noh & Wallace, 2005). Since the introduction of EUS in the 1980s, it has found widespread use in the evaluation of suspected pancreatic cysts and staging of pancreatic cancer.

Compared with CT and MRI, EUS is better able to detect pancreatic lesions smaller than 3 cm in size. EUS, which is used in the staging of pancreatic cancer, also provides the opportunity for biopsy for cytopathological diagnosis. Previous studies have shown EUS to be superior to CT and MRI in the detection of pancreatic lesions (Horwhat et al., 2006; Volmar, Vollmer, Jowell, Nelson, & Xie, 2005; Will, Mueller, Topalidis, & Meyer, 2010). In this study, FNA biopsy was performed in 40 (97.5%) of 41 patients with pancreatic lesions, and a diagnosis was made in 39 patients. As it is non-invasive, MR cholangiography is used more frequently in the evaluation of the hepatobiliary system. However, the sensitivity of MRCP is decreased especially for choledochal stones smaller than 5 mm. Evaluation with endoscopic ultrasonography before Endoscopic Retrograde Cholangiopancreatography (ERCP) reduces the risk of later complications, especially in patients who do not have common bile duct dilatation (Karakan et al., 2009). In the current study, EUS was performed in 1 patient due to choledocholithiasis, stones <5 mm were detected, and then ERCP was performed.

EUS is extremely important in terms of determining the location, size, the character of subepithelial lesions, the source layer, and treatment plan (Guo et al., 2013; Jenssen & Dietrich, 2008). Especially for lesions >1 cm, the diagnosis can be made from FNA biopsy. Zhang et al. demonstrated the efficacy of FNA biopsy in a meta-analysis of seventeen studies which included 978 EUS-guided needle sampling trials, and reported that the diagnosis rate with EUS FNA was 59.9% (Zhang et al., 2016). In the current study, diagnostic accuracy of 67.8% was found in FNA biopsies taken from subepithelial lesions. There were no complications related to either the procedure or the anesthesia in the patient group included in this study. Likewise, the complication rate of EUS-guided FNA in previous studies has been reported to be 0.1-1% (Rösch, 2003)

The limitations of this study were primarily the retrospective nature and lack of long-term follow-up. However, strengths can be said to be that a sufficient number of patients were included with different indications to enable homogenous sub-group evaluations and analyses, all procedures were performed by the same gastroenterologists, and that the samples taken were evaluated by the same pathologists.

#### 5. Conclusion and Recommendations

The results of this study show that EUS is a reliable and very useful tool in appropriate indications, especially for the evaluation of subepithelial and malignant lesions of the gastrointestinal tract, pancreas, and ampulla pathologies

#### Declarations

No financial support was received. Not produced from thesis work. The authors have no conflict of interests to declare. **Ethical approval** : Approval for this study was obtained from the hospital Ethics Committee (approval no:2022/04-03, dated:23.02.2022). All procedures were in accordance with the



ethical standards of our institution's human experiment committee and the Helsinki Declaration. Written informed consent forms were obtained from all the study participants. **Author Contributions:**

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