Endoscopic Ultrasonography in Staging of Upper Gastrointestinal Malignancy with Linear Array Transducer

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Introduction :-

Ultrasound scanning under endoscopic guidance called endoscopic ultrasonography "EUS" .

The use of high frequency ultrasound to image the gut wall results in 5 or more endosonographic layers these echo layers loosely correspond to the histological layers of the wall .(1,3)

The first two bright and dark echo layers correspond to the mucosa, the third bright layer is the sub mucosa, and the muscularis propria and serosa or adventitia are the fourth dark and fifth bright echo layers respectively .(2,3)

Since the (T) staging of gut malignancy depends on the depth of penetration through the histologic layers of the gut wall, penetration of gut malignancy through the various echo layers correspond closely to the histologic penetration of tumor. (3,4)

Like other malignancy, gut tumors are staged using "TNM" system (T)= tumor, (N)=node, (M)=metastasis .

EUS is the most accurate non-invasive technique available for both (T) and (N) staging of gastrointestinal malignancy using TNM system. (2,3,4)

However, other imaging techniques such as CT and MRI are better for detecting distant metastasis .

The depth of penetration of tumor through the gut wall determines the 'T' stage of tumor .(6,7,8,9)

(T1) lesion confined to the mucosa and sub mucosa .

(T2) lesion penetrate into but not through musculoris propria .

(T3) lesion penetrate the serosa or adventitia layer .

(T4) invade vital surrounding structures such as major vessels or organs .(2,5,10,11,12)

Generally EUS is more accurate in evaluation (T3) and (T4) lesions . Yet it is difficult for EUS to differentiate (T1) from(T2) tumors .(2,6,7)

(T) staging of pancreatico-billiary malignancy is different form luminal malignancy. In pancreatic carcinoma the (T) stage is determined by the extent of tumor invasion into the surrounding structures .(5,14)

'T1' (<2 cm) and 'T2' (> 2cm) lesions are totally confined to the pancreas. 'T3' lesion invade the distal common bile duct and/or duodenum., 'T4' lesions invade major vessels such as the portal or superior mesenteric veins or other organs such as stomach or colon.(15,16,17)

'T' staging of ampullary tumor is also unique, the 'T' stage determine by the depth of invasion into duodenal and pancreatic parenchyma.

'T1' lesion is confined to the ampulla, 'T2' lesion penetrate the duodenal wall, 'T3' ampullary lesions invade into pancreas less than 2 cm, while 'T4' lesion invade over 2 cm into the pancreas.(1)

It is difficult to distinguish between advanced ampullary carcinoma from carcinoma of the head of pancreas.

Aim of study:

The am of the study is to evaluate the accuracy of EUS in the staging of upper gastrointestinal tract malignancy using curved array transducer .

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Patients and methods:

This study was conducted on 74 patients with upper gastrointestinal malignancies referred to the gastroenterology and hepatology teaching hospital between April 2002 and March 2004, and were submitted to the EUS examination for staging of these malignancies before surgery .

According to the site of tumor, these patients had been divided into four groups :

Group 1: Esophageal tumors (19)

Group 2:Gastric tumors (32)

Group 3:Panceatic tumors (14)

Group 4:Ampullary tumors (9)

All these patients were evaluated by Pentax-Hitachi-FG34UX unites .

Prior to the EUS study, esophageal and gastric malignancies were diagnosed by upper endoscopy and confirmed by histopathology.

Patients with impassable esophageal tumors were excluded from this study because proper and complete staging is difficult,also patients who were receiving induction chemotherapy prior surgery were excluded .

Pancreatic and Ampullary tumors were suspected by abdominal ultrasound, CT scanning and/or by endoscopic retrograde cholangiopancreaticography (ERCP) and then referred for EUS evaluation for confirmation of diagnosis and for staging .

All these patients underwent surgical/ pathological staging after EUS staging .

Results:

Seventy-four patients with upper gastrointestinal tract malignancies (esophageal, gastric, pancreatic and ampullary) were included in our study.

In table (1):(19) patients with esophageal tumors were studied .The accuracy of staging was high in advance malignancies (T3,T4), but it is less in early malignancies ..

Descending aorta and pleura were invaded by tumors in two patients .

The same findings were seen in the patients with gastric malignancies (table2) .

In table (3) :(14) patients with pancreatic tumor were evaluated . Approximately 3/2 of these patients had advanced malignancies (T3 and T4). Portal vein was invaded by malignancies in two patients .

More than half of patients with ampullary tumors were found to have (T1) by pathological staging. The difficulty was located in assessing the invasion of duodenal wall by ampullary tumor (differentiation between T1 and T2) .

Table (1) Esophageal tumors

EUS staging	Total no.	Pathological staging			
		T1	T2	T3	T4
T2	5		4	1	
T3	12		3	9	
T4	2				2

The accuracy rate for (T2): 57 %
The accuracy rate for (T3): 90 %
The accuracy rate for (T4): 100 %

Table (2)Gastric tumors

EUS staging	Total no.	Pathological staging			
		T1	T2	T3	T4
T2	2	2			
T3	11		2	9	
T4	19			3	16

The accuracy rate for (T2) :50 %
The accuracy rate for (T3)-(T4) : 89 %

Table (3) Pancreatic tumors

EUS staging	Total no.	Pathological staging			
		T1	T2	T3	T4
T2	5		4	1	
T3	6				1
T4	3			5	3

The accuracy rate for (T2): 100 %
The accuracy rate for (T3)- (T4): 80 %

Table (4) Ampullary tumors

EUS staging	Total no.	Pathological staging			
		T1	T2	T3	T4
T1	7	5	2		
T3	2			2	

The accuracy rate for (T2): 72 %
The accuracy rate for (T3):100 %

Discussion:

This study is the first one achieved in Iraq regarding the EUS staging of upper gastrointestinal tract malignancy.

EUS correctly staged most of the advance esophageal tumors (T staging). Similar results were observed in study done in Cleveland Clinic by G. Zuccarro.(11)

Those patient with stenotic lesion were excluded from this study, but in study done in Mumbai, India by Viny Dhir using miniprobe MH908 for staging of stenotic tumor of esophagus reveal the miniprobe is superior to helical CT for staging of stenotic tumor. (9)

Most of advanced gastric malignancies were staged correctly by EUS. However, the differentiation between T2 and T3 (invasion of serosa) by EUS remained problematic in this study. This was comparable to study done by Peter Vilman in Copenhagen including 7 patients with gastric tumors .(2)

EUS staging of pancreatic cancer was highly accurate in both early and advance tumors (T3,T4) .

Similar results were found in study done in Brazil by Jose Cellso .(14)

In study done in India by Pankaj J.Patel reveal that EUS is most accurate modality for T staging and predicting vascular invasion .(18)

Most of ampullary tumors were limited to the ampulla (T1), and was ended with surgical resection of ampulla .In study done in India by Julia Kim appears that EUS is safe, impact in the management of ampullary tumors particularity in the patients undergoing endoscopic resection (19)

Conclusion:

EUS is highly accurate in staging of upper gastrointestinal tract malignancy .

Although the differentiation between T2 and T3 staging by EUS in luminal malignancies still problematic, but EUS is highly accurate in staging of advance malignancy (T4).

EUS is accurate in detecting the invasion of major vessels (portal and splenic) by pancreatic tumors .

EUS is very useful for evaluation of therapeutic options of ampullary tumors (endoscopic or surgical) .

Summary:

Since the echo layers of gastrointestinal wall are corresponding to the histological layers, EUS is the most accurate method for locoregional staging of upper gastrointestinal malignancy .

This study include 74 patients with upper gastrointestinal malignancy (esophageal (19),gastric (32), pancreatic (14), ampullary (9)) referred to the gastroenterology and hepatology teaching hospital between April 2002 and March 2004 were submitted to the EUS examination by linear array echoendoscope to assess the accuracy of EUS staging of these malignancies before surgical/pathological staging .

In the luminal malignancy (esophageal and gastric) the result between EUS staging and surgical/pathological staging were similar. Although EUS is highly accurate for T staging of locoregionaly advance disease, but is far less accurate in T staging of locoregionaly limited disease.

In pancreatic malignancy (14 patients), EUS (T) staging was compatible with that of surgical/pathological staging. However, EUS is highly accurate for detecting the invasion of major vessels (portal and splenic)by tumors .

Regarding the ampullary tumors (9 patients), EUS is accurate in T staging , and it is safe, impact on management of ampullary tumors .

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