Original Article

Iraqi Journal of Gastroenterology

Endoscopic ultrasonography in staging of gastric carcinoma

***Deyar A. Talabani**
****Rayadh A.Zaydan**
*****Hadi A. Sayah**

ABSTRACT

Background: Endoscopic ultrasound is new diagnostic technique for staging of gastric cancer .**Patients and methods:** Forty-two Iraqi patients with adenocarcinoma of the stomach were studied from June 2003 to April 2005 all the patients were submitted to upper endoscopy and forceps biopsy ,EUS and surgical staging.
Result: the most common clinical presentation was weight loss ,the most common physical finding was epigastric mass , the most common histopatholo -gical type was moderately differentiated adenocarcinoma .Pre-operative EUS staging had accuracy rate of 75-95% regarding (T) and (N) staging in comparison to post operative staging .**Conclusion** :this study concluded that EUS is accurate diagnostic technique in staging gastric carcinoma and it is highly recommended in evaluation and preoperative staging of gastric carcinoma
Keyword: EUS gastric carcinoma

Introduction:

Gastric cancer remains a major cause of mortality in the world despite declining rate of incidence in many industrialized countries.

It was the leading cause of cancer mortality in the world as recently as 1980, and in 1996, gastric cancer still remained the second leading cause of cancer death in the world. Resulting in 628,00deaths per year[1]

. The result of Iraqi cancer registry shows that the stomach (3.2%) is the most common site of gastrointestinal malignancy[2]

There is a definite geographical variation for gastric cancer with highest rates seen in Far-East and low incidence in North America, Australia, Western Europe and Africa.

Gastric cancer can be subdivided into two distinct pathologic entities that have different epidemiological and prognostic features. The diffuse form is more poorly differentiated and lacks any glandular structure, it is found in the same frequency throughout the world, occur at younger age and is associated with a worse prognosis than the intestinal form. The intestinal form is characterized by the formation of gland like tubular structures mimicking intestinal glands, and this form is more closely linked to environmental and dietary risk factors, tends to occur at high proportional rate in regions with high incidence of gastric cancer and is the form of cancer that is now declining world wide.

Both genetic and environmental factors are involved in the pathogenesis of gastric cancer[3].

The diagnosis of gastric cancer depends on many options, the gastric carcinoma associated antigen MG7-Ag has been reported present in the serum of 82% of gastric cancer patients [1].Endoscopy is the procedure of choice for diagnosis with tissue biopsy. Endoscopic ultrasound (EUS) is the best imaging modality to determine depth of invasion (T stage).with an 80% accuracy rate reported[4]. The use of high frequency ultrasound to image the stomach wall results in five endosonographic layers that are loosely corresponding to the histological layers of the wall [5,6]. The first two bright and dark echo layers correspond to the mucosa, the third bright layer is the submucosa, the fourth dark layer is the muscularis propria and the fifth bright layer is serosa or adventitia[7]. Since the (T) staging of gut malignancy depends on the depth of penetration through the histological layers of the gut wall, penetration of gut malignancy through the various echo layers corresponds closely to the histological penetration of tumors[8]

.Gastric 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 and is valuable form of assessment to evaluate gastric cancer staging before surgery [9](T1) lesions are confined to the mucosa and submucosa,(T2)lesions penetrate into but not

*FICMS(med),FICMS(G&H)
**(FICMS, GE&H)
*** FICMS(med),FICMS(G&H)

through mucsularis propria, (T3) lesions penetrate the serosa. And (T4) lesions invade vital surrounding structures, such as major vessels or organs [7,10,11,12,13] .Generally EUS is the most accurate at staging (T3) and (T4) lesions and it is 90-99% accurate at distinguishing between stage (T1) and stage (T2) which is an important criterion for the determination of early gastric cancer. EUS is excellent modality in differentiating early from advanced gastric cancer [14] other modalities include upper GIT series, CT and MRI. Helical hydro-CT is recommended as the method of choice for pre-operative imaging of gastric carcinoma [14]

Aim of the study:

The aim of this study is to assess the accuracy and, limitations of EUS in diagnosis and staging of gastric carcinoma, in comparison. With surgical staging, using curved array transducer.

Patients and methods:

This study was done in the Gastroenterology and Hepatology teaching hospital from June 2003 to April 2005; forty two patients (42) with gastric adenocarcinoma confirmed by histopathological examination were submitted to the endoscopic ultrasonography (EUS) for staging of this tumor before surgery. All the patients were studies by full history and clinical exam

ination, all these patients were evaluated by Pentax-Hitachi. FG34UX unites.Prior to the EUS examination, the gastric tumors were visualized by upper endoscopy and the patients were divided into three groups according to the endoscopic findings: gastric mass, gastric ulcer and thick gastric folds. Histopathological confirmation of malignancy was done by conventional forceps biopsy. Patients with obstructive lesions were excluded from this study because of difficult staging.

All these patients underwent surgical/pathological staging after EUS staging.For purpose of strict comparison, EUS findings were correlated with surgical and histopathological results according to TNM criteria [15]

.but only T and N staging were carried out in this studyThe EUS study was carried by DR.Rayadh A.Zaydan (FICMS, GE&H)

Results:

1.Age and gender distribution :

Total number of fourty two patients with gastric carcinoma was studied, total males were 27(64.2%), total females were 15(35.8%), and male/female ratio was 1.8:1.

.The range of age was 20-72 years, the mean age of total sample was 52.1 years.[male=37-72 years, mean 53.7 years and females 20-71 years, mean 50.6 years.].Table(1)

Table (1): Age and gender distribution

Gender	Number	Age range	Mean
Male	27 (64.2%)	35-72 years	53.7 years
Female	15 (35.8%)	20-71 years	50.6 years
Total	42 (100%)	20-72 years	52.1 years
Male/Female	1.8:1		

1.Clinical presentation

The most common clinical presentation was weight loss, found in 38 cases (90.5%), anorexia in 36 cases (85.7%), abdominal pain in 31 cases (73.8%),anemia in 30 cases (71.4%), vomiting in 25 cases (59.5%), hematemesis and melena in 12 cases (28.5%), dysphagia in 8 cases (19%), and heartburn in 6 cases (14.2%) .Table (2).

2.Clinical presentation

The most common clinical presentation was weight loss, found in 38 cases (90.5%), anorexia in 36 cases (85.7%), abdominal pain in 31 cases (73.8%),anemia in 30 cases (71.4%), . vomiting in 25 cases (59.5%), hematemesis and melena in 12 cases (28.5%), dysphagia in 8 cases (19%), and heartburn in 6 cases (14.2%) .Table (2).

Table (2): Clinical presentation of 42 cases

Clinical presentation	Male	Female	Total
Weight loss	25 (59.4%)	13 (31.1%)	38 (90.5%)
Anorexia	23 (54.8%)	13 (30.9%)	36 (85.7%)
Abdominal Pain	20(47.6%)	11 (26.2%)	31 (73.8%)
Anemia	18 (42.8%)	12 (28.6%)	30 (71.4%)
Vomiting	15 (35.7%)	10 (23.8%)	25 (59.5%)
Hematemesis and melena	7 (16.6%)	5 (11.9%)	12 (28.5%)
Dysphagia	5 (11.9%)	3 (7.1%)	8 (19%)
Heartburn	4 (9.4%)	2 (4.8%)	6 (14.2%)

3. Physical examination

Epigastric mass was the most common physical finding, it was found in 12 cases (28.5%), followed by hepatomegaly in 10 cases (23.8%), Ascites in 5 cases (11.9%), left supraclavicular lymph node in two cases (4.7%), and splenomegaly in one cases (2.3%). Table(3).

Table (3): physical findings in 42 cases with gastric cancer

Physical finding	Male	Female	Total
Epigastric mass	7 (16.7%)	5 (11.8%)	12 (28.5%)
Hepatomegaly	6 (14.2%)	4 (9.6%)	10 (23.8%)
Ascites	4(9.6%)	1(2.3%)	5 (11.9%)
Left supraclavicular lymph node	1 (2.3%)	1(2.3%)	2 (4.7%)
splenomegaly	1 (2.3%)	0	1 (2.3%)

4.Upper endoscopy

All the 42 cases were submitted to upper endoscopy examination (OGD), the findings were classified into three groups: gastric mass found in 23 patients (54.7%), thick gastric folds in 11 cases (26.2%), and gastric ulcer in 8 cases (19.1%). Table (4).

Table (4): Upper endoscopic findings in 42 cases of gastric cancer

Upper endoscopic finding	Male	Female	total
Gastric mass	14 (33.3%)	9 (21.4%)	23 (54.7%)
Thick gastric folds	7 (16.6%)	4 (9.6%)	11 (26.2%)
Gastric ulcer	5 (11.9%)	3 (7.2%)	8 (19.1%)

5. Histopathology

The histopathological findings of forceps biopsy specimens before surgery were confirmed in the post surgical specimens as cases of adenocarcinoma, and the differentiation of the tumor were as follows according to the endoscopic finding groups:
In the gastric mass group: 9 cases were moderately differentiated. 7 cases were poorly differentiated and 6 cases were well differentiated and one case of anaplastic type.
In thick gastric folds group: 6 cases were poorly differentiated,5 cases were moderately differentiated. In gastric ulcer group: 3 cases were poorly differentiated, 3 cases were moderately differentiated and 2 cases were well differentiated . Table (5).

Table No. 5: histopathology of 42 cases of gastric cancer

Endoscopic group	Poorly differentiated	Moderately differentiated	Well differentiated	Anaplastic	Total
Gastric mass	7	9	6	1	23
Thick gastric folds	6	5	0	0	11
Gastric ulcer	3	3	2	0	8

6. EUS staging of 42 cases

In the gastric mass group (No. =32), the EUS (T) staging was: T2= 7 cases, T3= 12 cases, T4= 4 cases while the surgical staging was, T2 = 6 cases, T3=13 cases, T4= 4 cases, the accuracy rate is 95%. The EUS (N) staging was N0= 2 cases, N1= 10 cases, N2= 11 cases. The surgical staging was N0= one case, N1=11 cases, N2=11 cases. The accuracy rate is 95%. Table(6-1).

Table 6-1: EUS staging in the gastric mass group

EUS* staging	Total number (N=23)	Surgical staging					
		T2	T3	T4	N0	N1	N2
T2	7	6					
T3	12		13				
T4	4			4			
N0	2				1		
N1	10					11	
N2	11						11

* EUS= Endoscopic ultrasound

In the thick gastric folds group (N=11), the EUS (T) staging was: T2=5 cases, T3= 4 cases, and T4= 2 cases. The surgical staging was: T2= 3 cases, T3= 6 cases, T4= 2 cases: the accuracy rate is 90%. The EUS (N) staging was: N0=zero, N1=5 cases, N2=6 cases.The surgical (N) staging was N0= zero, N1= 5 cases, N2= 6 cases. Accuracy rate is 100%. Table(6-2).

Table 6-2: EUS staging in thick gastric folds group

EUS* staging	Total number (N=11)	Surgical staging					
		T2	T3	T4	N0	N1	N2
T2	5	3					
T3	4		6				
T4	2			2			
N0	0				0		
N1	5					5	
N2	6						6

* EUS= Endoscopic ultrasound

In the gastric ulcer group (N=8): the EUS (T) staging was: T2= 3 cases, T3= 4 cases, T4= one case. The surgical staging was: T2= 2 acses, T3= 4 cases, T4= 2 cases. The accuracy rate is 87%. The EUS (N) staging was: N0=one case, N1=4 cases, N2=3 cases. The surgical staging was: N0=zero, N1=5 cases, N2= 3 cases. The accuracy rate is 75%. Table (6-3).

Table 6-3: EUS staging in the gastric ulcer group

EUS* staging	Total number (N=8)	Surgical staging					
		T2	T3	T4	N0	N1	N2
T2	3	2					
T3	4		4				
T4	1			2			
N0	1				0		
N1	4					5	
N2	3						3

* EUS=Endoscopic ultrasound

Discussion:

In this study, the accuracy of new imaging method (EUS) was evaluated in staging 42 cases of gastric carcinoma before surgery and was compared with results of surgical staging.

In this study cases of gastric carcinoma showed a male to female ratio of 1.8:1, and the most common age group was middle age group (mean age:52.1 years) this is in agreement with that reported by Elia et al (2000)[16](Table 1).

Gastric cancer is difficult to diagnose at an early stage because there are no identifying signs and symptoms [7,17]. This study has demonstrated the most common clinical presentations which included in order of frequency: weight loss, anorexia, abdominal pain, anemia, vomiting, hematemesis and melene, dysphagia, and heartburn. This is in agreement with findings of other studies like Meyers.M and Gossios K,[15,18,19]

The most common physical findings were epigastric mass, hepatomegaly, and ascites (Table 3) all these findings may indicate more advanced disease at time of diagnosis, single patient may have more than one finding; this is comparable to another study done in Iraq by Shawki Yousif 2002[20]
.The most common endoscopic findings were gastric mass, thick gastric folds, and gastric ulcer; (Table 4). This is in agreement with other studies by Mori.M,Sugimachi K. [21]
.The most common histopathological type of gastric carcinoma was moderately differentiated, poorly differentiated and well differentiated types respectively. (Table5), this was comparable to other study by Dupont J ,Lee J., Burton G et al 1978 [22]
.The EUS was very useful and accurate in staging the gastric carcinoma, in the gastric mass group, the accuracy rate was 95%, table (6-1). In the thick gastric folds group the accuracy rate for EUS staging was 83% (table 6-2) and in the gastric ulcer group, the accuracy rate was 87% (Table 6-3).
Most gastric tumors were correctly staged by EUS; similar findings were obtained by study carried by Peter-vilmann in Copenhagen, including 7 patients with gastric tumors [7]. This is also comparable to a study done by Perng-DS-Jan-cm- et al in 1996, in this study, EUS was more accurate for serosal cancer, and displayed a tendency to overstage (T) categories and understage (N) categories [9]
.In another study by Mossari-M et al, the (T) parameter was correctly defined by EUS (accuracy rate 89%), the (N) parameter accuracy rate was 86%, which is nearly similar to this study[23]
. In another study by Muller-C et al 2000, EUS sensitivity of preoperative staging of gastric carcinomas was 80-92% [18].The results of this study are comparable to another study carried in Iraq by Makki H-F&Rayadh-A-Z(2003)[24].
EUS by virtue of its considerable accuracy has become the method of choice for regional staging of gastric cancer. EUS is unique in its ability to image the gastric wall as a 5-layer structure that correlates with actual histological layers, thus tumor depth can be imaged precisely [25]
.

Conclusion and Recommendations :

From this study it is concluded that

1. staging of gastric carcinoma carried accurately by EUS.
2. EUS has high diagnostic potential regarding staging of gastric carcinoma.
3. EUS is highly accurate modality in (T) staging (wall invasion) and (N) staging (lymph node involvement).
4. EUS is valuable for evaluation of gastric masses, hypertrophied gastric folds and gastric ulcers.
5. EUS as diagnostic technique has a positive impact on therapeutic decision of gastric carcinoma.
6. EUS is highly recommended diagnostic modality in diagnosis, evaluation and pre-operative staging of gastric carcinoma.

References:

1. Sleisenger&Fordtrans.Gastrointestinal and liver disease; 7th edition,Vol.2;44,829-41.2002.
2. Elhassani M.Results of Iraqi cancerregistry 1999;13.
3. Kasper-HU;Schneider-Stock-R;Mellin-W;Gunther-T;Roessner-A;Pathol-Res-Pract.1999;195(12):815-20.
4. Colin Jones-DG;Staging of gastric cancer Endoscopy;1993:25.
5. T.Rosch and U-Will;Longitudinal endosonography.Atlas and manual for use in the upper gastrointestinal tract:2001.
6. T-L-Tio and G-N-J.TY Lgat.Atlas of transintestinal ultrasonography.
7. Peter-Vilmann.Endoscopic Ultrasonography: 1997.
8. Ian-D;Penmann-EUS in the advanced cancer-Gastrointestinal Endoscopy:1990;vol.36:no:2.
9. Perng-Ds;Jan-Cm;Wang-Wm;Chen-LT;Su-YC;Liu-GC;Lin-HJ;Huang-TJ;Chen-CY;J-Formos-Med-Assoc.1996 May;95(5):378-85.
10. Greg-A.Boyce.EUS in the diagnosis of pancreatic tumors;Gastrointestinal Endoscopy;1990;vol.36:no2.
11. E.Santo.staging odf esophageal cancer using linear array;Endoscopy;2002,vol.:56.
12. G.Zuccaro.Accuracy of endoscopic ultrasound staging of esophageal cancer;Gastriontestinal Endoscopy;2000;vol.52:no:6.
13. Mineapolis Minnoesota.EUS in the evaluation of esophageal carcinoma. Gastrointestinal Endoscopy;2000;vol.52:no:6.
14. Dux-m;Richter-GM;Hansmann-J;Kuntz-Cl;Kaufmann-GW-J.comput-Assist-Tomogr;1999 Nov-Dec;23(6):913-22.
15. Meyers M;Gastric carcinoma:Imaging staging and management. In neoplasim of digestive tract, imaging,staging and .Management. Philadelphia: Lippincot-Raven,1998:93-10
16. Elia F;Zingarelli A;Palli D etal Hydrodynamic CT preopative staging of gastric cancer correlation with pathjological findings.Eur.Radiol 2000;1877-1885.

17. Y-Murata;B-Napoleon;High Frequency EUS in the evaluation of superficial esophageal cancer.Endoscopy.Endoscopy.2003;vol:35.
18. Muller-C;Kahler-G;Scheele-J.Surg.Endosc.2000 Jan;14(1):45-50.2.
19. Gossios K;Katsimbri P;Tsianos E;CT features of gastric lymphoma.Eur Radiol.2000;10:425-430.3.
20. Shawki-Y-F;Riota-L.B;Inaam-A-K;the role of spiral CT in detection and staging of gastric malignancy.Iraqi-J. of Gastroenterology,Issue 5;Jan 2005:18-27.4.
21. Mori M;Sugimachi K: Clinocopathologic studies of gastric carcinoma.Semin Surg Oncol.6:19.1990.5.
22. Dupont J:Lee J;Burton G; et al:Adenocarcinoma of the stomach:Review of 1.497 cases.Cancer 41:941.1978.6.
23. Massari-M;Cioffi-U;De-Simone-M;Bomavina-L;D elia-A;Rosso-L;Ferro-C;Montorsi-M;Hepatogastroenterology.1996.Mayu-Jun;43(9)542-6.7.
24. Makki:HF;Rayadh A.Z.;Endoscopic ultrasonography examination of (100) Iraqi patients with curved array transducer. Iraqi J. of Gastroenterology Issue 5,Vol.;(1).Jan. 2005. 68-74.8.
25. Pollock-BJ;Chak-A;Sivak-MV;Semin-Oncol.1996 Jun;23(3):336-46.