Esophageal carcinoma: Clinical TNM staging with endosonography and computed tomography

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ABSTRACT: The prognosis of esophageal carcinoma has remained poor despite improvement of diagnostic modalities. Endosonography and computed tomography were performed for preoperative TNM staging (clinical TNM) of esophageal carcinoma. Endosonography was superior to computed tomography for diagnosing early stages and nonresectability of carcinoma. Endosonography was also superior to computed tomography in diagnosing regional lymph node metastases. For diagnosing nonmetastatic lymph nodes, however, computed tomography was superior. Endosonography was superior for diagnosing celiac lymph node metastases but less accurate in detecting liver involvement. Endosonography was accurate for clinical TNM staging of esophageal carcinoma. The possibility of performing cytology and biopsy will further enhance the diagnostic value of endosonography. **Can J Gastroenterol 1990;4(9):603-607**

Key Words: *Clinical TNM staging, Computed tomography, Endosonography, Esophageal carcinoma*

Le rôle de l'endosonographie dans le cancer de l'oesophage: La classification TNM clinique

RESUME: Le pronostic du cancer de l'oesophage reste mauvais malgré l'amélioration des modalités diagnostiques. L'endosonographie et la tomographie assistée par ordinateur ont été effectuées pour la classification pTNM (TNM clinique) des cancers de l'oesophage. L'endosonographie s'est avérée supérieure à la tomographie assistée par ordinateur dans le diagnostic des cancers aux stades précoces et de la non-résécabilité des tumeurs. L'endosonographie était également supérieure à la tomographie assistée par ordinateur pour diagnostiquer

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ESOPHAGEAL CARCINOMA IS USUally diagnosed in late stages. The prognosis of advanced carcinoma is poor. Early stages of the disease are incidentally found in the evaluation of patients with dysphagia. Early esophageal carcinoma is defined as carcinoma localized in the mucosa or submucosa with no evidence of lymph node involvement. A large series of patients with early esophageal cancer was reported in China and Japan (1-5). TNM classification has been widely used for staging esophageal carcinoma (6-8). The depth of tumour infiltration is used as the criterion for staging tumour categories. The definition of regional lymph nodes has been modified and lymph node classification simplified. Computed tomography is widely used for staging esophageal carcinomas. The accuracy of computed tomography, however, is variable (9,10).

Endosonography – endoscopic and nonoptic sonography via the gastrointestinal lumen – has been reported to be accurate for staging esophageal carcinoma because of its ability to image the individual layers of the gastrointestinal wall structure (11-19). The

les métastases des ganglions lymphatiques. Pour le diagnostic des ganglions lymphatiques non métastasiques, toutefois, la tomographie assistée par ordinateur était supérieure. L'endosonographie était supérieure pour le diagnostic des métastases des ganglions lymphatiques céliaques mais moins efficace dans la détection de l'atteinte hépatique. L'endosonographie s'est avérée efficace dans la classification TNM clinique des cancers de l'oesophage. La possibilité de procéder à une cytologie et à une biopsie augmente encore la valeur diagnostique de l'endosonographie.

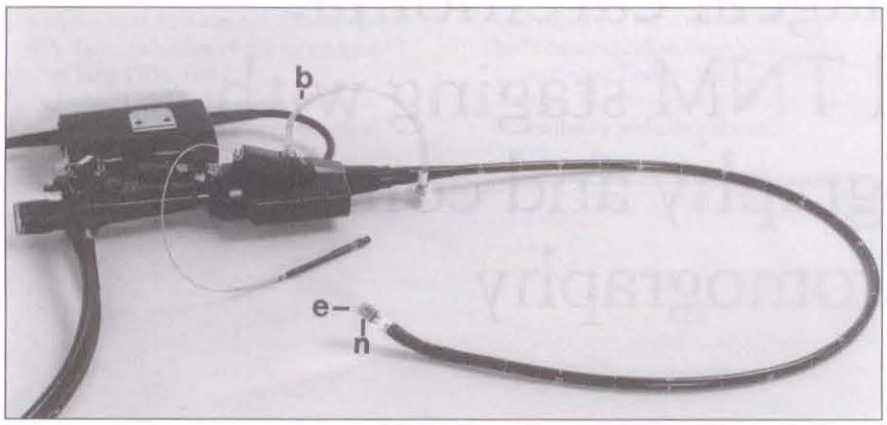

Figure 1) *An Olympus echoendoscope (EU-M3) loaded with a small echoprobe (e) and a switch for changing the ultrasound frequency from 7.5 to 12 MHz. A sclerosing needle (n) passes through the instrumental channel for aspiration cytology. b Channel for filling the balloon with water*

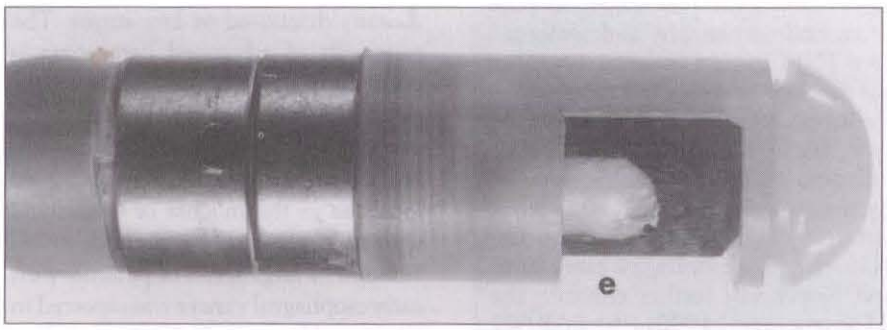

Figure 2) *A flexible nonoptic Aloka ultrasonic instrument with a small echoprobe (e) at the tip*

authors have been using Olympus echoendoscopes EU-M2 and EU-M3 (Figure 1). The latter emits a biopsy channel for cytologically guided puncture or biopsy. For a nonoptic flexible instrument, the authors have been using an Aloka prototype (Figure 2). Recently, a small catheter echoprobe became available (Figure 3). Table 1 summarizes the specifications of these instruments.

TECHNIQUE OF INVESTIGATION

The investigation technique is comparable to gastroscopy after local oropharyngeal anesthesia and intravenous sedation with midazolam. Sedation is necessary because of the discomfort of introducing the rigid tip of the instrument into the pharynx and insufflating the balloon fixed at the echoprobe with water. The patient is lying in the left lateral decubitus position. The instrument has to be introduced blindly because side-viewing optics do not allow endoscopic visualization of the esophagus. The instrument should be introduced into the stomach whenever possible to visualize the perigastric lymph nodes, particularly the celiac lymph nodes (M=Distant metastasis). Images comparable to cross sectional computed tomography cuts are used for standardization of endosonography investigation. The instrument is slowly withdrawn until the infiltrating abnormality with adjacent lymph nodes is imaged sonographically. In the case of severe stenosis, which does not allow passage of the echoendoscope, a flexible

TABLE 1
Technical data of the Olympus echoendoscopes used for clinical TNM staging of esophageal carcinoma

	EU-M2	EU-M3	VU-M2 (video)	Catheter echoprobe
Endoscope	Side-viewing	Side-viewing	Side-viewing	Forward-viewing (GIF-IT10/GIF-IT20)
Echoprobe	Mechanical sector or radial scanning (180° or 360°)	Mechanical sector or radial scanning (180° or 360°)	Mechanical sector or radial scanning (180° or 360°)	Catheter echo- probe (360° radial scanning)
Length (mm)	42	42	44	In total 140 cm with the catheter
Diameter (mm)	13	13	10.4	3
Frequency (MHz)	7.5	7.5/12*	7.5	7
Depth of penetration (cm)	10	10/3	10	3
Axial resolution (mm)	0.2	0.2/0.12	0.2	?
EUS-guided puncture/biopsy	No	Yes	No	No

**Switchable frequency. EUS Endoultrasonography*

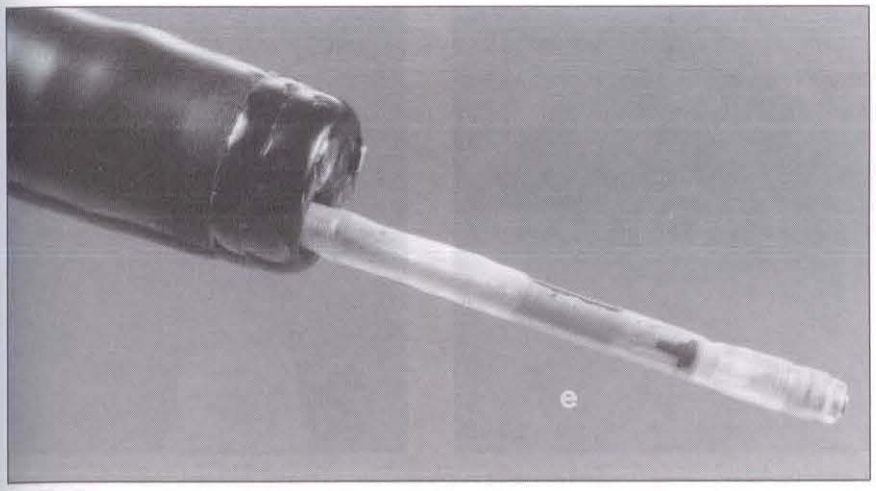

Figure 3) *A minicatheter echoprobe (e) passing through the instrumental channel of a large calibre gastroscope for endoscopic-guided sonography*

nonoptic instrument or an endoscopic-guided catheter echoprobe can be used.

INTERPRETATION OF ENDOSONOGRAPHIC IMAGES

Sonographic interpretation of gastrointestinal wall structure and perigastrointestinal lymph nodes is based on results obtained through detailed examination of resected specimens and autopsy materials. In essence, endosonography visualizes a five layer structure, which shows close correlation with wall histology. An esophageal carcinoma is imaged as a hypoechoic echo pattern with partial or total destruction of the normal architecture. Endosonography criteria for assessment of the depth of tumour infiltration are summarized in Table 2.

Criteria for assessing lymph node metastases are as follows: Lymph nodes with hypoechoic patterns and clearly delineated boundaries are suspicious of malignancy. Direct extension of mural abnormalities into adjacent lymph nodes is highly suspicious of malignancy (pathognomonic). Lymph nodes with hyperechoic (echogenic) patterns and indistinctly demarcated boundaries are indicative of benignancy.

COMPUTED TOMOGRAPHY IMAGES

For computed tomography staging pT1 and pT2 are grouped together because computed tomography is not able to image the muscularis propria (Table 3). Thus, distinction between these two groups is not possible.

TABLE 2
Endosonographic criteria for assessment of depth of esophageal tumour infiltration

ES-T1	Hypoechoic tumour localized in mucosa or submucosa
ES-T2	Hypoechoic tumour penetrating muscularis propria
ES-T3	Hypoechoic tumour with penetration into adventitia
ES-T4	Hypoechoic tumour with penetration into adjacent structures, eg, aorta, pericardium, trachea, diaphragm, liver

TABLE 3
Computed tomography criteria for the assessment of depth of esophageal tumour infiltration

CT-T1 (pT1 + pT2)	Wall thickness approximately 10 mm
CT-T2 (pT3)	Wall thickness greater than 10 mm with no evidence of invasion into adjacent structures (presence of fat plane)
CT-T3 (pT4)	Wall thickness greater than 10 mm with evidence of invasion into adjacent structures (no fat plane)

For computed tomography staging, pT1 and pT2 are grouped together because computed tomography is not able to image the muscularis propria

COMPARISON BETWEEN ENDOSONOGRAPHY, COMPUTED TOMOGRAPHY AND HISTOLOGY

Recently, a prospective study was performed with endosonography and computed tomography in 74 patients with esophageal carcinoma (20). The results of this preoperative study were correlated with the histology of resected specimens according to the new (1987) TNM classification.

In the assessment of the depth of tumour infiltration, endosonography is more accurate than computed tomography in diagnosing early stages (T1 + T2) and nonresectability (T4) of disease (Figures 4,5). The accuracy of endosonography in diagnosing T1 carcinoma was 88% and T2 carcinoma 78%. The overall accuracy of endosonography and computed tomography for diagnosing early stages (T1 and T2) were 82% and 12%, respectively. The accuracy of endosonography and computed tomography in diagnosing T4 carcinoma was 90% and 64%, respectively. In diagnosing T3 carcinomas the accuracy of endosonography was 93% versus 88% for computed tomography. This difference was not significant (P=0.48).

Endosonography is more accurate than computed tomography in diagnosing metastatic involvement of regional lymph nodes versus nonmetastatic lymph nodes (Figure 6). In contrast, computed tomography is more accurate in determining the presence of benign

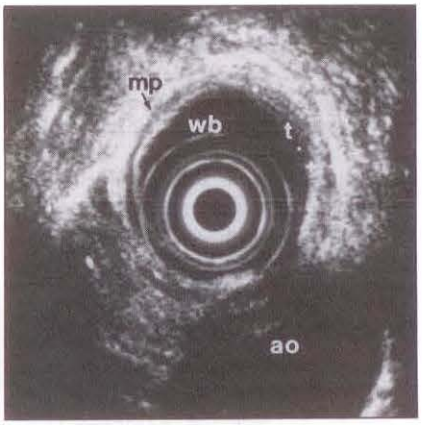

Figure 4) *Endosonogram of a small intramural esophageal carcinoma (t) penetrating into the muscularis propria (mp) localized ventrally. wb Water-filled balloon; ao Aorta*

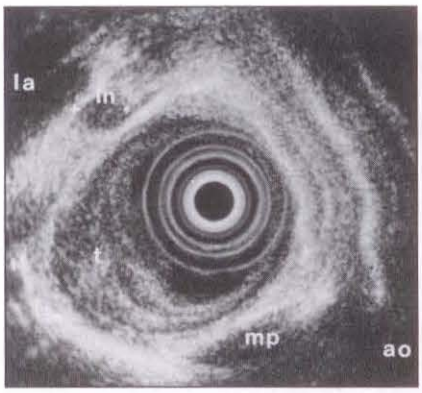

Figure 5) *Endosonogram of a transmural carcinoma (t) with penetration through the muscularis propria (mp) into the adjacent adventitia, and a hypoechoic, clearly demarcated lymph node (ln) (diameter 8 mm) suspect for metastatic involvement. la Left atrium*

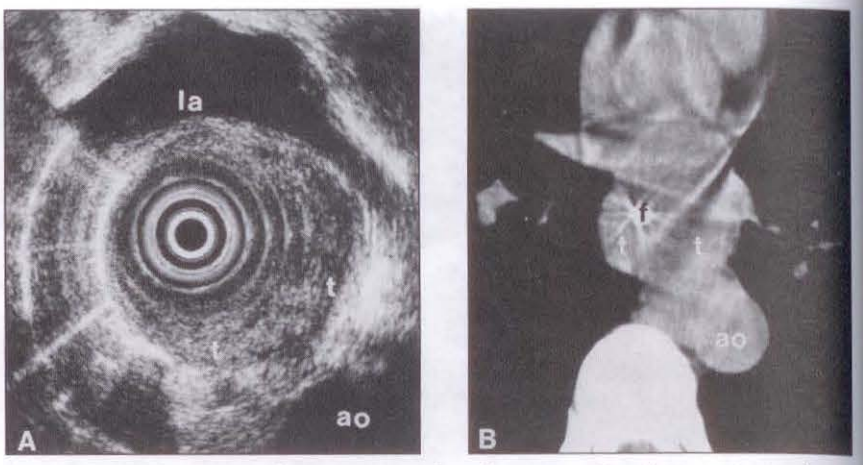

Figure 6) A *Endosonogram of an extensive esophageal carcinoma (t) with penetration into the aorta (ao). la Left atrium.* **B** *Corresponding computed tomography shows some thickening of the esophageal wall (t) adjacent to the aorta with a feeding tube (f) in the esophagus*

lymph nodes. Clinically, the diagnosis of lymph node metastasis is essential to selection of appropriate patients for surgery (Figure 6).

Endosonography is more accurate than computed tomography in diagnosing celiac lymph node metastasis (distant metastasis). Computed tomography, however, is more accurate than endosonography in diagnosing liver metastasis because of the limited penetration depth of ultrasound.

In another study with a more extensive series of patients (n=91) the accuracy of endosonography in diagnosing T1 carcinomas was 82%, T2 carcinomas 85%, T3 carcinomas 94% and T4 carcinomas 92%. Overstaging occurred in 6% and understaging in 4% (21). The results of staging regional lymph nodes and distant metastasis were comparable to those of the previous study.

CONCLUSIONS

Endosonography is more accurate than computed tomography in the preoperative TNM classification of esophageal carcinoma. However, inadequate examination of endosonography can occur in the presence of severe stenosis. Such obstructive tumours do not limit the role of computed tomography scanning. The recently available catheter echoprobe is promising for the staging of severe obstructed esophageal carcinoma. Moreover, endosonography staging can be performed during a routine endoscopic procedure.

Endosonography is accurate for staging esophageal carcinomas independent of their localization. Computed tomography is not as reliable for staging carcinoma at the esophagocardial junction as for staging esophageal carcinoma. The routine use of endosonography-guided cytology for tissue diagnosis, particularly lymph node metastasis, will further enhance the diagnostic value of endosonography. Moreover, the combination of endosonography and Doppler probe, which has already been introduced in cardiology, will further increase the value of endosonography in assessing vascular abnormalities (22,23).

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