Pancreatic endosonography: Clinical TNM staging compared to histology

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ABSTRACT: Endosonography has been reported to be effective in the staging of gastrointestinal carcinoma. Pancreatic carcinoma is included in the new (1987) TNM classification. Resectability is abandoned in favour of depth of tumour invasion. In the author's preoperative study, endosonography was accurate for staging of tumour categories, and early stages of disease could be distinguished from advanced carcinomas. The presence or absence of regional lymph nodes can be detected. Tissue diagnosis by biopsy and endosonography-guided cytology is now possible. This imaging technique will become the standard procedure for the staging of pancreatic carcinoma. *Can J Gastroenterol* 1990;4(9):572-575

Key Words: Endosonography, Histology, Pancreatic carcinoma, TNM staging

L'endosonographie pancréatique: La classification TNM clinique comparée à l'histologie

RESUME: On a rapporté l'efficacité de l'endosonographie dans la classification des cancers gastro-intestinaux. Le cancer du pancréas relève maintenant de la nouvelle classification TNM (1987). La résecabilité a été abandonnée et fait place à la profondeur de l'invasion tumorale. Dans notre étude préopératoire, l'endosonographie a permis la classification exacte des catégories de tumeurs; elle a également aidé à distinguer les cancers aux premiers stades de leur évolution, des cancers avancés. La présence ou l'absence d'extension aux ganglions lymphatiques a été décelée. Le diagnostic portant sur les tissus prélevés par cytoponction à l'aiguille échoguidée est désormais possible. Cette technique d'imagerie deviendra la procédure standard dans la classification des cancers du pancréas.

CONVENTIONAL ABDOMINAL Ultrasound is a standard imaging technique for evaluation of patients with pancreatic diseases. This procedure, however, is often hampered by the presence of bowel gas and adipose tissue. Endoscopic retrograde cholangio-

pancreatography (ERCP) is accurate for the detection and staging of pancreatobiliary abnormalities. Endoscopic ultrasonography, generally known as endosonography, was developed to improve sonographic images by direct approach to the target of

interest via the gastrointestinal lumen (1-9). Recently, staging of pancreatic carcinoma has been included in the new (1987) TNM classification (10,11). In a prospective study, endosonography was performed preoperatively to assess the accuracy and limitations of endosonography in the TNM staging of pancreatic and ampullary carcinoma.

INSTRUMENTS

For pancreas endosonography the author has been using Olympus echoendoscopes EU-M2 and EU-M3. The latter emits a switchable frequency of 7.5 or 12 MHz and a biopsy channel for endosonography-guided cytology or biopsy or videoechoendoscope (VU-M2) (Figure 1). Recently, a small catheter echoprobe which can be introduced into the biopsy channel of a forward-viewing large calibre gastroscope became available (Figure 2). The specifications of these instruments are summarized in Table 1.

INVESTIGATION TECHNIQUES

The transgastric approach allows clear imaging of the body and tail of the pancreas because of the topographic anatomical relationship between the stomach and pancreas (Figure 3). For examination of the entire head of the pancreas, a transduodenal approach is usually necessary. The configuration of the stomach plays a crucial role for imaging of the pancreas. A long extended

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Figure 1) An Olympus prototype videoechoendoscope (VU-M2) with a small echoprobe (e) attached at the tip of a side-viewing duodenoscope (v). Note the smaller diameter of the echoprobe compared to the gastroscope

Figure 2) An Olympus prototype catheter echoprobe (e), which can be introduced through the instrumental channel of a large calibre gastroscope

TABLE 1
Technical data of various Olympus echoendoscopes

Echoendoscope	EU-M2	EU-M3	VU-M2 (video)	Catheter echoprobe
Endoscope	Side-viewing	Side-viewing	Side-viewing	GIF-IT10 / GIF-IT20
Echoprobe length	42 mm	42 mm	44 mm	140 cm (catheter)
Diameter	13 mm	13 mm	10.4 mm	3 mm
Frequency	7.5 or 10 MHz	7.5 MHz / 12 MHz*	7.5 MHz	7 MHz
Depth of penetration	10 cm	10 cm / 3 cm	10 cm	3 cm
Axial resolution	0.2 mm	0.2 mm / 0.12 mm	0.2 mm	-0.2-0.3

The catheter echoprobe is radial scanning, while all echoendoscopes are mechanical radial scanning (180° or 360°). Only the EU-M3 has capability for endoultrasonography-guided puncture or biopsy. *Switchable frequency

Figure 3) Anatomic scheme (posterior view) shows the relationship between the stomach and the surrounding organs. sp Spleen; lk Left kidney; P Pancreas; l Liver

Figure 4) Endosonogram of a hypoechoic pancreatic carcinoma (t) obstructing the common bile duct (cbd) and pancreatic duct (pd), a 'double duct lesion'. ln Lymph nodes suspected of metastases

total gastrectomy should not undergo endosonography because the pancreas cannot be visualized sonographically.

The most important landmark for a transgastric approach is the splenic vein, which is localized dorsally adjacent to the body and tail of the pancreas. The entire splenic vein can be followed from the splenoportal con-

fluence to the splenic hilum. By the transduodenal approach, the head of the pancreas is imaged between the duodenal wall and the mesenteric vessels. Cross-sectional images analogous to computed tomography should be made for standardization of endosonography images.

INTERPRETATION OF ENDOSONOGRAPHIC IMAGES

The interpretation of pancreatic carcinoma is comparable to transcutaneous ultrasonography. For classifying ductular abnormalities, criteria used for the interpretation of ERCP must be incorporated. A pancreatic carcinoma is imaged as a hypoechoic tumour usually obstructing the main Wirsung duct associated with a pres-tenotic dilatation of the pancreatic and common bile ducts. Thus, the cause and extent of the 'double duct lesion' can be imaged (Figure 4). Occasionally intraductal tumours originating from the wall of the pancreatic duct can be found. The intraductal polypoid pat-

stomach provides clear imaging of the entire pancreas. In the case of stomach after partial resection (Billroth I or II), adequate imaging of the pancreas is difficult or impossible. Patients after a

TABLE 2
Endosonography criteria for 1987
TNM classification of pancreatic carcinoma

T	Primary tumour
T1	Hypoechoic tumour limited to the pancreas
T1a	Tumour 2 cm or less in greatest dimension
T1b	Tumour more than 2 cm in greatest dimension
T2	Hypoechoic tumour extends directly to any of the following: duodenum, bile duct, peripancreatic tissue
T3	Hypoechoic tumour extends to any of the following: stomach, spleen, colon, adjacent large vessels
Tx	Primary tumour cannot be assessed
N	Regional lymph nodes
N0	No regional lymph node metastasis
N1	Regional lymph node metastasis
Nx	Regional lymph nodes cannot be assessed
M	Distant metastases
M0	No distant metastases
M1	Distant metastases: Hepatic metastasis, peritoneal dissemination
Mx	Distant metastases cannot be assessed

Figure 5) Endosonogram of an early pancreatic carcinoma (T) extended into the dilated pancreatic duct (PD). P Pancreas; SV Spleen vein

tern may represent proliferation of the epithelium of the pancreatic duct or the carcinoma itself. Recently, pancreatic carcinoma was incorporated into the new (1987) TNM classification (Table 2).

Staging of distant metastases, however, should be excluded due to the limited penetration depth of ultrasound. Therefore, liver metastases and peritoneal dissemination may not be imaged.

Figure 6) A Endosonogram of extensive pancreatic carcinoma (t) with retroperitoneal extension adjacent to the aorta (ao). cv Caval vein; In Lymph nodes suspected of metastases. B Corresponding computed tomography shows a tumour mass (t) extending to the aorta (ao). cv Caval vein; msa Mesenteric superior artery; st Stomach; d Duodenum

CLINICAL TNM STAGING

Pancreatic head carcinoma usually causes obstruction of the common bile duct. Thus, obstructive jaundice is the most common clinical symptom. The prognosis, however, remains poor despite advantages of diagnostic modalities (12-14). The size and extent of pancreatic carcinoma may play an important role in the prognosis (15,16). In contrast, obstructive jaundice due to carcinoma of the body and/or tail of the

pancreas is rare except when there is a very extensive tumour mass. Ampullary carcinomas, however, may cause obstructive jaundice even in the early stage of disease (17). The new (1987) TNM classification should be used for staging carcinomas of the head of the pancreas. Therefore, the common bile duct and duodenum are used as demarcation marks for T2 carcinoma. Early carcinomas are therefore more frequently expected to be found in the

junction between the head and body of the pancreas, or a distance from the common bile duct without symptoms of jaundice, eg, uncinate process. Infiltration into the stomach is classified as a T3 carcinoma. Moreover, infiltration into the adjacent major blood vessels (splenic vein, portal vein, splenoportal confluence, mesenteric vessels, etc) can be clearly imaged because of the real-time character of ultrasound and the ability to position the echoprobe towards the target of interest.

Occasionally, portal hypertension with the presence of gastric varices because of splenic or portal obstruction can be found, which is usually a contraindication for tumour resection. Early pancreatic carcinoma is defined as a T1 carcinoma (diameter less than 2 cm) with no evidence of lymph node involvement. Such small carcinomas are rare and can be found incidentally during evaluation of patients with abdominal discomfort (Figure 5). In patients with obstructive jaundice, the stage of pancreatic carcinoma is usually

already advanced. In the author's clinical experience of more than five years, the incidence of lymph node involvement in T1 carcinoma is approximately 40% (9). This has also been reported elsewhere (14), and may reflect the highly malignant nature of disease (13,14). The incidence of lymph node metastasis increases with the depth of tumour infiltration. In contrast, the incidence in T1 ampullary carcinoma was 0% (9).

The accuracy rate of endosonography in diagnosing regional lymph nodes and distant metastases is comparable with that of esophagogastric carcinoma (18,19). Endosonography is more accurate in diagnosing metastatic involvement than nonmetastatic lymph nodes. This is of utmost importance from the clinical point of view because of the poor prognosis of the disease. For the assessment of liver metastasis, transcutaneous sonography is necessary to assess metastases in the right liver lobes and to confirm diagnosis by cytological puncture.

CONCLUSIONS

Endosonography will become an important diagnostic procedure for staging pancreatic cancer. In the near future, tissue diagnosis by endosonography-guided cytology of lymph nodes will play an important role in planning treatment strategies. In the case of positive cytology, surgery will become unfavorable. Moreover, ampullary carcinoma can be distinguished from a pancreatic carcinoma, especially in the early stages of disease.

The clinical role of endosonography in the detection of early pancreatic carcinomas in a nonselected population is still unknown. At present, introduction of endosonography as a screening diagnostic modality appears to be utopic because of the invasive nature of the procedure and the cost-benefit ratio. Endosonography will become the imaging technique of choice for staging pancreatic carcinomas because of its ability to discriminate early stage carcinomas from advanced stages of disease.

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