JOP. J Pancreas (Online) 2004; 5(4):253-257.

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Pancreatic Cancer Imaging: Which Method?

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Summary

Pancreatic cancer is the 10th most common malignancy and the 4th largest cancer killer in adults. Surgery offers the only chance of curing these patients. Complete surgical resection is associated with a 5-year survival rate of between 20 and 30%.
The challenge is how to best select those patients for curative surgery.
Early studies demonstrated excellent sensitivity of EUS in detecting pancreatic tumors in comparison to CT. Similarly, EUS showed an 85-94 % accuracy rate for T staging and 70-80 % accuracy rate for N staging. Later studies report on substantially less TN staging accuracy for EUS. Possible explanations and the problem of vascular involvement assessment by EUS will be provided. Considering the role of EUS in M staging and a comparison between EUS, MRI, and positron emission tomography, scanning will be presented.
A diagnostic algorithm for the evaluation of patients with a suspected pancreatic mass will be offered, stressing the pivotal role of EUS.

Introduction

Pancreatic cancer is the 10th most common malignancy and has a dismal prognosis, for which reason surgical resection is the only chance for cure.
The patient with suspected pancreatic malignancy poses several challenges. First, identification of a pancreatic lesion (tumor detection) is necessary. Second, accurate preoperative tumor staging is imperative for the optimal selection of patients for curative surgery.
Since its introduction in the 1980s, endoscopic ultrasound (EUS) rapidly proved to be the most sensitive and accurate tool for pancreatic tumor detection and staging.
In recent years, we witnessed a rapid improvement in the sensitivity and accuracy of the radiological and nuclear imaging techniques: multidetector, multiphasic CT with pancreatic protocols, magnetic resonance imaging (MRI) and positron emission tomography (PET) scans.
In this presentation, the performance of the various imaging modalities in the detection and staging of pancreatic cancer will be examined. A flow diagram for the evaluation of the patient with suspected pancreatic lesions will be used to conclude.

EUS

Detection

Numerous early publications indicated that EUS is highly sensitive for the detection of pancreatic tumors with rates higher than 90% [1, 2, 3].
There was no difference between the accuracy of the radial and the linear array instruments in the assessment of pancreatic neoplasms [4].
The advantage of EUS over classical CT was especially evident for lesions less than 3 cm

in size: sensitivity of EUS 99%, CT 55% [1]. This advantage of EUS continued when compared to helical CT for lesions up to 1.5 cm: EUS 100 %, CT 67% [5].
In a recent review of the literature by Hunt and Faigel [6], EUS had a clearly superior rate in the detection of pancreatic tumors: EUS 97%, helical CT 73%. A newly published retrospective study [7] evaluated the sensitivity and specificity of multiphasic thin slice helical CT in the detection of cancers 2 cm or smaller at pathological examination. The sensitivity was 97% and specificity 100%.

Staging

Staging is based on the TNM classification. T stage reflects tumor characteristics and invasion into neighboring structures. N stage assesses regional lymph node involvement and M stage assesses metastatic spread. A T4 lesion usually means vascular involvement, namely portal vein, splenomesenteric confluence, superior mesenteric vein and/or artery, splenic vein and/or artery, hepatic artery or celiac trunk [8].
Assessing vascular involvement is a difficult and problematic issue because it was defined differently in the various studies.
The most specific criteria were formulated by Snady *et al*. [9] and Brugge *et al*. [10]: 1) loss of interface between the tumor and the vessel wall; 2) a tumor within the vessel lumen; 3) collateral circulation; 4) an irregular vessel wall. The specificity of these criteria is 85-100% with an accuracy of 55-94%.
It is accepted that EUS is most accurate for diagnosing portal venous and splenic venous involvement with an accuracy up to 90% [1, 10]. EUS is less accurate in visualizing superior mesenteric vein/artery invasion.
A tumor size greater than 3 cm hinders accurate vascular invasion assessment. In earlier reports, T stage accuracy varied between 74-94% and N stage accuracy between 74-80% [11, 12, 13, 14]. In several recently published studies, a significantly lower performance of EUS in TN staging was observed: T stage 64-73% and N stage 56-69% [15, 16, 17].
There are several possible explanations for these differences. Most of the earlier studies were based on small sample size (40 patients or less), and most patients underwent surgery. In recent studies, only a minority of patients went to surgery, the rest being excluded because of advanced disease on initial imaging studies. Finally, there were the problems of large tumor size and the criteria used for vascular involvement.
In conclusion, although EUS is not meant to be an appropriate tool for assessing M stage because of its limited penetration, it can detect small liver metastases and ascites not visualized by other imaging modalities [18, 19].

EUS guided fine needle aspiration (FNA)

EUS guided FNA has been established as a sensitive, specific and safe tool for acquiring a histological diagnosis in pancreatic tumors: sensitivity 75-90%, specificity 94-100%, complication rate about 1% [20, 21, 22, 23].
A distinct advantage of EUS guided FNA over US/CT guided FNA is that the first is performed at the initial examination and it is possible to biopsy lesions not detected by CT. A shorter needle trajectory and the use of smaller needles might reduce the danger of tumor seeding.
The main debate in EUS guided FNA concentrates on proper patient selection. It is generally accepted that patients with unresectable tumors should have FNA as a prerequisite for oncological treatment.
Many experts (especially surgeons) argue that FNA is not necessary for resectable tumors. On the other hand, not all pancreatic tumors are adenocarcinomas. Lymphomas, islet cell tumors, metastases and other rare tumors may require a different management approach. Cost effective analyses also favor the use of EUS guided FNA in the diagnostic algorithm [24].
There is also the benefit of performing celiac plexus neurolysis in the same session in

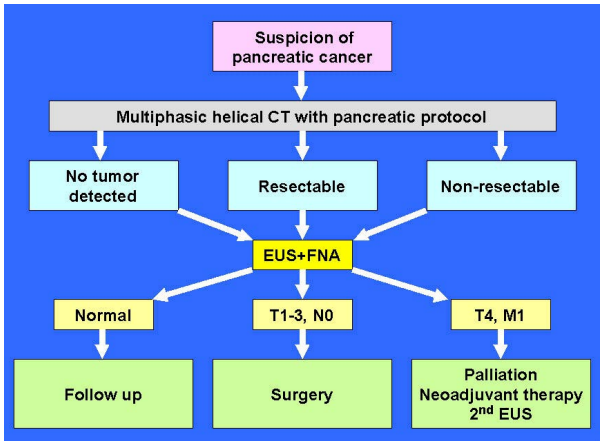

Figure 1. Evaluation of suspected pancreatic mass lesion.

patients having advanced disease with severe pain.
Last but not least, an important consideration should be the patient's desire (and his physician's as well) to positively diagnose cancer before embarking on radical surgery.
EUS guided biopsy of all pancreatic lesions has been the accepted policy at our institution for several years and it seems that the community is close to a consensus on this issue.

EUS, CT, MRI

Older studies have indicated that CT and MRI perform equally in assessing the resectability of pancreatic cancer [25]. In a recent comparative study, MRI had a 96% accuracy versus 81% of helical CT in predicting resectability of pancreatic cancer [26]. Contrast enhanced MRI was found to be as accurate as contrast enhanced helical CT in the detection and staging of pancreatic cancer. MRI was more sensitive in the detection of small liver metastases [27].
Initially, EUS was found to be superior to MRI for the detection and staging of pancreatic tumors. In a recent publication, EUS had a positive predictive value (PPV) of 69 % versus 77% for MRI. In evaluating resectability, when both EUS and MRI agreed on resectability, PPV was 89% and the negative predictive values (NPV: prediction of unresectability) was 76% [28].
EUS was more accurate than helical CT and MRI in assessing the T stage of ampullary tumors (EUS 78%, CT 24%, MRI 46%) with no difference in N stage [29]. The main limitations of CT and MRI are that they both are also operator dependent tests and both have low sensitivity for the detection of small liver metastases (MRI is better than CT).

PET

EUS and PET were found to be more sensitive in the detection of pancreatic cancer than CT (EUS 93%, PET 87%, CT 53%). The main advantage of PET is in the detection of metastatic disease and clarifying uncertain CT findings in the liver [30].

Conclusions

1. Advances in CT/MRI/PET improved their locoregional staging performance relative to EUS;
2. The main role of these modalities is in the detection of distant metastases;
3. EUS can detect tumors not imaged by other modalities;
4. EUS can clarify locoregional spread when CT/MR are equivocal;
5. M staging detects liver metastases and ascites;
6. Improved N staging with EUS guided FNA;
7. EUS guided celiac plexus neurolysis.

In summary, the combination of superior detection, good staging, tissue diagnosis and potential therapy makes EUS guided FNA a cost-effective modality.
An outline of the approach to the patient with suspected pancreatic neoplasm is presented in Figure 1.

Keywords Diagnostic Imaging; Endosonography; Pancreatic Neoplasms

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