

Role of three-phase contrast-enhanced multislice helical CT in evaluating resectability of pancreatic carcinoma

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Abstract

Background: Because of its biological property, early diagnose of pancreatic carcinoma is very difficult. It has a potential of early extrapancreatic tissue invasion. Only 5 – 10% of such tumors have the opportunity for surgical removal. We analyzed CT manifestations of the patients with pancreatic carcinoma confirmed operatively and pathologically at two medical centers between May 2004 and November 2007.

Methods: 136 pancreatic adenocarcinoma patients were reviewed retrospectively. Their intravenous and oral contrasted three-phased multislice helical computerized tomographic examinations were assessed for the power of predicting the resectability of the tumor.

Results: We found the negative predictive value as 93%, and positive predictive value as 90%. In 93 patients judged unresectable before operation, 70 showed tumor involvement of more than one vascular vessel or distant metastasis.

Conclusion: can easily suggest that three-phase contrast-enhanced multislice helical CT is a very effective diagnostic tool to evaluate the resectability of pancreatic carcinomas.

INTRODUCTION

Because of its biological property, early diagnose of pancreatic carcinoma is very difficult. It has a potential of early extrapancreatic tissue invasion. Only 5 – 10% of such tumors have the opportunity for surgical removal. Computerized tomography (CT) diagnosis of pancreatic carcinoma can not meet the clinical needs to assess preoperative resectability so as to choose appropriate therapeutic method and avoid unnecessary laparotomy.

Multislice CT -which permits the acquisition of three instinct circulatory phases (consisting of the arterial, pancreatic and portal venous phases) in the pancreatobiliary region, is a complete diagnostic tool the evaluation of patients with pancreatic and biliary diseases. In this study, we analyzed CT manifestations of the patients with pancreatic carcinoma confirmed operatively and pathologically at two medical centers between May 2004 and November 2007.

METHODS

PATIENTS

Among the 136 patients, 98 were men and 38 women, ranged in age from 46 to 91, averaging 64.5. Ninety-seven patients had tumors in the pancreatic head and neck, 7 in the body, and 32 in the tail. The interval between CT examination and operation varied from 1 to 14 days. Forty-nine patients were subjected to exploratory operation and biopsy, 38 cholangioenterostomy, 37 Whipple surgeries and 12 resections of the pancreatic tail and spleen. All patients' diagnoses were proved pathologically. The patients who have not been proved pathologically were excluded.

EXAMINATION METHOD

After fasting for 12 hours the patients received 800ml 2.5% angiografin at 30 minutes before examination and 200ml 2.5% angiografin in attempt to fill the stomach and duodenum before scanning.

A-four detector- HiSpeedQX (GE Medical Systems, Milwaukee) CT scanner was used with scanning parameters of 120 kv, 165 mA, and pitch 1.0. The position of pancreas was first determined by using plain scanning series with a

slice of 5 mm thickness on the upper abdomen. After intravenous injection of 2 ml/kg of contrast material (300 mg/ml omnipaque) at 3ml/s using a high pressure injector (MCT-plus), a total dose of approximately 70-120 ml, all patients received pancreas scan in the arterial phase, pancreatic phase and portal phase with a delay of 30 s, 50 s and 70 s respectively, with a slice of 2.5 mm thickness. At last liver scans were performed with a slice of 5mm thickness. Each was completed within one breathhold.

CT CRITERIA FOR JUDGING UNRESECTABLE PANCREATIC TUMOR

The criteria for unresectability included involvement or encasement of major peripancreatic vessels; involvement of adjacent tissues and organs; diameter larger than 5 cm; distance less than 3 cm between tumor and the porta hepatic; ascites or distant metastasis.

RESULTS

The results of preoperative judgement of pancreatic carcinoma resectability were compared with those of surgery (Table.1).

Figure 1

Table 1: Preoperative judgment of resectability.

CT results	Surgical Results	
	Resectable	Unresectable
Resectable	40	3
Unresectable	9	84
	49	87

In fact, in 43 patients judged resectable preoperatively, one had portal venous cancerous embolus and two with pancreatic tail tumor involving the splenic artery with local lymph node metastasis underwent palliative resection of the pancreatic tail and spleen. We found the negative predictive value as 93%, and positive predictive value as 90%. In 93 patients judged unresectable before operation, 70 showed tumor involvement of more than one vascular vessel or distant metastasis. A thrombus at inferior vena cava can also be seen at CT (Figure.1) but it is nearly impossible to see a splenic venous thrombus except multislice helical CT (Figure.2).

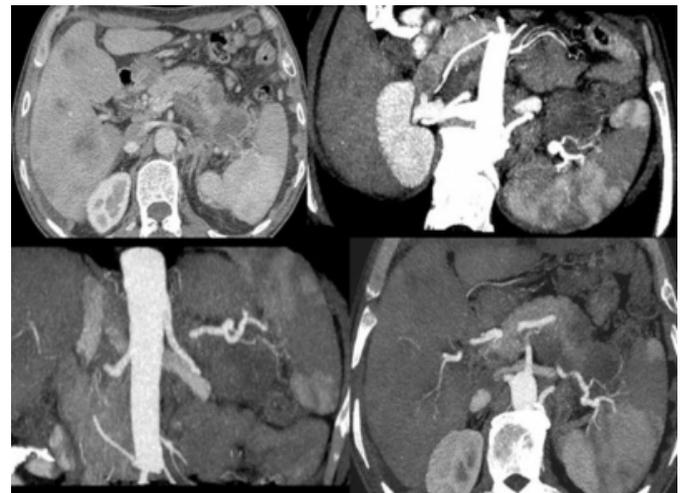
Figure 2

Figure 1: Venous phase axial reformatted visions. Vena cava inferior and duodenum was invaded by a malign tumor which arises at the head of pancreas.



Figure 3

Figure 2: Axial reformatted visions. Splenic venous thrombus can be seen.



DISCUSSION

Adenocarcinoma of the pancreas presents a number of therapeutic challenges. On presentation, 80%–90% of patients have locally advanced or disseminated disease, precluding “curative” resection. The 5-year survival rate after resection is 10%–20% in larger series₃. The illusion of “localized” disease is betrayed by the high frequency of regional (46%–83%)₃ and distal (15%–30%)₄ nodal involvement, positive pancreatic and/or retroperitoneal margins following resection (20%–36%)₃, and the presence of distant micrometastases that frequently become clinically apparent shortly after resection. The high rate of positive

resection margins reflects the frequency of tumor extension beyond the pancreatic capsule to adjacent retroperitoneal soft tissue. Resection of adenocarcinoma of the pancreatic head typically requires a pancreaticoduodenectomy (PD). Standard PD usually includes resection of the gallbladder, lower common bile duct, pancreatic head, duodenum, and distal stomach (variably), and extirpation of soft tissue including lymph nodes associated with the lower bile duct, pylorus, and anterior and posterior surfaces of the pancreatic head.

Today, CT is the most commonly used imaging method in the assessment of pancreatic tumors. The sensitivity of CT in detection of pancreatic tumors is more than 90% when direct and indirect signs are used for diagnosis⁵. However, the potential to differentiate exocrine (non-endocrine) tumors of the pancreas is limited. CT is used in these lesions to perform an adequate staging, especially for surgical purposes. The operative resectability, primarily in regard to vessels, lymph node metastasis and hepatic metastasis, has to be assessed. Keeping in mind the limitations of this macromorphological imaging procedure, CT has the best reproducibility and overall accuracy of all imaging methods. However, a substantial number of patients exist for whom CT suggested potential resectability but inoperable tumor was found at laparotomy⁶. Much of the problem has been the difficulty in detection of more subtle, yet real, invasion of the peripancreatic vessels because of the inherent small size of the vessels relative to slice width (5-10 mm). A thrombus at inferior vena cava can also be seen at CT (Figure.1) but it is nearly impossible to see a splenic venous thrombus except multislice helical CT (Figure.2).

Using multislice CT it is possible to perform non-axial reconstructions with high resolution. Multislice helical CT with its multidetector technology and faster rotation times has led to new dimensions in spatial and temporal resolution in CT imaging. In contrast to single-slice CT, smaller slice collimations can be applied that lead to almost isotropic voxels and allow high quality multiplanar and 3-D image reconstructions. The high speed of multislice CT can be used to reduce the time needed to cover a given volume, to increase the spatial resolution along the z-axis by applying thinner slice collimations, and to cover longer anatomic volumes. The speed of Multislice helical CT allows organ imaging in clearly defined perfusion phases⁷.

Lepanto et al found that the accuracy of helical CT with CT angiography in identifying venous invasion at periampullary

neoplasms was higher than transverse CT imaging alone⁸. The relation of pancreatic carcinoma to vessels is characterized by; obliteration of fat between the tumor and vessels, without vessel deformation and shift, especially in the venous system – can not be taken as a criterion for unresectability- ; obliteration of fat between the tumor and artery system, peripancreatic vessel shift or encasement - should be considered as a sign for unresectability-(splenic artery is an exception); small peripancreatic vein dilation-received no resection-. There is no visualization of the small peripancreatic vein at routine CT.

We found at our series the negative predictive value as 93%. This result is similar to Huang et al found. Also, we found positive predictive value as 90% which is better than Huang et al did.

CONCLUSION

As a conclusion we can easily suggest that three-phase contrast-enhanced multislice helical CT is a very effective diagnostic tool to evaluate the resectability of pancreatic malign tumors.

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Role of three-phase contrast-enhanced multislice helical CT in evaluating resectability of pancreatic carcinoma

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