Original Research Article

Role of computed tomography in the determination of resectability of carcinoma pancreas

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ABSTRACT

Background: Pancreatic cancer is one of the most aggressive neoplastic processes. Inspite of progress in the diagnosis and treatment of malignancies, the resectability and survival rates for pancreatic cancer are very poor. This study aims to determine the accuracy of computerised tomography in assessing the resectability of carcinoma pancreas.

Methods: 66 patients with carcinoma pancreas, who were judged fit for surgery were studied. All cases had undergone preoperative contrast enhanced triphasic computed tomography (CT) for assessing the resectability. Radiological data was compared with per operative findings for assessments regarding vascular invasion and resectability.

Results: Of the 66 cases, resectability reported by CT was 59 (89.4%). The rest of 7 (10.6%) cases were reported as unresectable. Per operatively vascular involvement was found in 14 (21.2%) cases and with no vascular invasion in 52 (78.8%) cases. All the unresectable cases reported in CT (7 cases) turned out to be unresectable. Out of 59 cases reported as resectable, 43 (65.2%) cases under went Whipples procedure, while rest of the 23 (34.8%) cases underwent palliative procedures. Out of these 23 cases, 14 (21.2%) cases were unresectable due to vascular involvement.

Conclusions: The study has shown that CT does assess the operability in carcinoma pancreas, assessing mainly unresectability though less effective in assessing resectability. The role of endoscopic ultrasound and laparoscopic ultrasound in aiding CT in further assessment of resectable and borderline resectable cases are to be considered for further research.

Keywords: Carcinoma pancreas, Computed tomography, Resectability, Vascular invasion

INTRODUCTION

Pancreatic adenocarcinoma is the most common non-endocrine malignancy of the pancreas and is the 4th leading cause of death is the United States. Most tumors arise in the head of the pancreas, and account for between 60 and 70% of cases. Despite the recent advances, pancreatic adenocarcinoma continues to be a lethal disease. Most tumors are diagnosed late and approximately 85% of tumors are unresectable at the time of diagnosis. Accurate assessment of tumour resectability based on computed tomography (CT) criteria is needed to avoid non-therapeutic laparotomy and it is equally important to ensure that no patient with resecetable tumour is denied surgery because of a false positive evaluation of arterial invasion

Pancreatic cancer remains one of the most aggressive neoplastic processes, and most of the cases are detected late with vascular invasion and metastasis. Inspite of progress in the diagnosis and treatment of malignancies, the resectability and 5-year survival rates for pancreatic

cancer are very poor. Resection offers potential cure for pancreatic cancer, and it can prolong survival in patients compared to those who do not undergo resection.

However, only minorities of patients are candidates for surgery at diagnosis, and only a minority of patients who undergo surgery survive beyond 5 years. The decision "to resect or to palliate" depends on the clinical staging system, which is based on the results of pre-surgical imaging studies. Preoperative evaluation: The two fundamental goals of initial evaluation of a patient are:

- To secure or verify the histo-pathological diagnosis of cancer
- To accurately determine whether the primary cancer is anatomically resectable or unresectable.

Multidetector CT is the imaging study of choice for evaluation of lesions arising in the pancreas. CT allows for an accurate determination of the level of biliary obstruction, the relationship of the tumour to critical vascular anatomy and presence of regional or metastatic disease.[1] For suspected periampullary pathology, a three phase (non-contrast, arterial and portal venous) CT scan with 3 mm slices and coronal and three dimensional reconstruction should be done. Other imaging studies include ERCP, MRCP and endoscopic ultrasound (EUS). EUS may be beneficial for identifying small tumours that do not appear on CT scans and to delineate more clearly suspicious lesions smaller than 2 cm, it therefore plays an important complementary role. Following CT imaging, patients are classified into resectable, borderline resectable and unresectable. Resectable tumours are defined as localized to the pancreas with no evidence of SMV or portal vein involvement i.e. no abutment, distortion, thrombus or encasement and a preserved fat plane surrounding the SMA and celiac artery branches, including hepatic artery. Patients with imaging consistent with resectable disease should proceed with operative resection.[1]

In the absence of metastatic disease, assessment of vascular invasion is key in evaluation of resectability for pancreatic cancer. Surgical exploration with pathological examination remains the "gold standard" in terms of evaluationof resectability. The salient sign of unresectability is the superior mesenteric and celiac arteries encasement, signaling vascular invasion. The decision "to resect or to palliate" depends on the clinical staging system, and is based on the results of pre-surgical imaging studies. Assessment of vascular invasion is the key in the evaluation of resectability for pancreatic cancer.[2] Loyer et al noted that the presence of a fat plane between tumour and vesses is agood prognostic sign of resectability.[3] Phoa et al noted that in vessel embedment into tumour or vessel's circular encasement, the rate of vessel invasion was 88% and resectability 7%. It was noted that the sensitivity of CT for the detection of unresectability of pancreatic carcinoma reached 60%, and

specificity reached 90% if contact of a vessel with tumors was noted over at least 90° degrees of its circumference.[4]

METHODS

Type of study: Diagnostic test evaluation

Study population

66 cases with pancreatic carcinoma that presented to Department of General Surgery, Government Medical College, Kottayam from February 2014 to January 2015 (12 months)

Inclusion criteria

All patients with pancreatic carcinoma or Periampullary carcinoma, who are judgedfit for surgery

In our study we have taken into consideration of 66 patients with carcinoma pancreas who hd been admitted in the Department of General Surgery, Medical College Kottayam. All of the patients underwent preoperative, contrast-enhanced triphasic computed tomography as preoperative workup for planning the surgical intervention. Data was collected regarding CT and intra operative findings of- site of tumour, locoregional extension, lymphnode involvement, vascular invasion,distant metastasis and tumour resectability. Radiological datas obtained from preoperative CT were compared with intraoperative findings, and validity of CT in accurately assessing the tumor resectability is studied.

RESULTS

Total number of cases of Ca Pancreas studied -66. No of males-38 (57.6%) and no of females-28 (42.4%). Statistical analysis did not show any significant relation between sex and incidence of Ca pancreas. There was no significant relation between sex and other variables like site, vascular invasion and resectability.

Analysis showed that the mean age in males is 58.4, and in females is 57.3.

No significant relation between age and resectability in CT as the p value is 210. Out of 66 patients, CT reported resectability in 59 case and unresectable in 7 cases. CT reported vascular involvement in 7 cases, which where operated, and of these 5 turned out to be uresectable due to vascular involvement, as reported by CT(p value of 0.024) (Table 1). Out of the 59 cases reported as un-involvement of vascular structures, 50 cases were found uninvolved, 9 cases showed vascular involvement (Table 1). Out of 59 cases, 43 underwent resection and rest of 23 underwent palliative procedures. The CT findings of resectability and the procedure underwent was found to be statistically significant, with a p value of 0.000 (Table 1).

Table 1: CT reported resectability and procedure.

| | | | Procedure | | Total |
			Whipple	Palliative	
CTVAS	Present	Count	2	5	7
		% of Total	3.0	7.6	10.6
	Absent	Count	41	18	59
		% of Total	62.1	27.3	89.4
Total		Count	43	23	66
		% of Total	65.2	34.8	100.0

Table 2: Non parametric tests analysed the proportions of cases in each group of variables and found the statistically significant.

		Category	N	Observed prop.	Test prop.	Exact Sig. (2-tailed)
Sex	Group 1	Male	38	0.58	0.50	0.268
	Group 2	Female	28	0.42		
Site	Group 1	Periampullary	25	0.38	0.50	0.064
	Group 2	Head Of Pancreas	41	0.62		
CTLN	Group 1	Present	30	0.45	0.50	0.539
	Group 2	Absent	36	0.55		
CTVAS	Group 1	Absent	59	0.89	0.50	0.000
	Group 2	Present	7	0.11		
CT	Group 1	Resectable	59	0.89	0.50	0.000
	Group 2	Unresectable	7	0.11		
PO	Group 1	Resectable	44	0.67	0.50	0.009
	Group 2	Unresectable	22	0.33		
POVAS	Group 1	Absent	52	0.79	0.50	0.000
	Group 2	Present	14	0.21		
Procedure	Group 1	Whipple	43	0.65	0.50	0.019
	Group 2	Palliative	23	0.35		
	Total		66	1.00		

Non parametric tests analysed the proportions of cases in each group of variables and found the statistically significant variables in the study, with significant p values (Table 2).

DISCUSSION

The decision "to resect or to palliate" depends on the clinical staging system, and is based on the results of pre-surgical imaging studies. Assessment of vascular invasion is the key in the evaluation of resectability for pancreatic cancer.[2] Surgical exploration with pathological examination remains the "gold standard" in terms of evaluation of resectability, especially from the point of view of vascular involvement. Unresectability in pancreatic adenocarcinoma is encasement of the superior mesenteric and celiac arteries, indicating vascular invasion. Loyer et al noted that the presence of a fat plane between tumour and vesses is agood prognostic sign of resectability.[3] Phoa et al noted that in vessel embedment into tumour or vessel's circular encasement, the rate of vessel invasion was 88% and resectability 7%. It was noted that the sensitivity of CT for the detection of unresectability of pancreatic carcinoma reached 60%, and specificity reached 90% if contact of a vessel with tumors was noted over at least 90° degrees of its circumference.[4] A relatively reliable sign of vein intergrowth by a tumor is contact of more than 5 mm in length (78% for PV and 81% for SMV). This sign was not proved for arteries; however, it was shown that surrounding of the vascular wall by more than 180° of the tumor's circumference was correlated with unresectability, with a sensitivity of 84%, specificity of 98%, positive predictive value (PPV) of 95%, and negative predictive value (NPV) of 93%.[5] The criteria developed by Li et al for arterial invasion during pancreatic carcinoma are embedment of vessels in the tumor or a combination of the tumor surrounding no less than a half of a vessel's circumference with stenosis of the artery (sensitivity of 79%, specificity of 99%) or with irregularity of the arterial wall (sensitivity of 45%, specificity of 99%).[6] House et al, using 3D CT for detection of arterial invasion, showed sensitivity of 86%-87% and specificity of 97%-99%.[7] At Anderson et al, C T has sensitivity and specificity of 93% and 72% respectively, and a positive and negative predictive value of 95% and 65% respectively, for detection of pancreatic cancer of any size. CECT has a sensitivity of 92% for identifying locally advanced or metastatic disease with a

specificity of 91% and an overall accuracy of 92%. False neative generally reflect occult vascular involvement or small liver or peritoneal metastases.

CONCLUSION

The decision of surgical intervention to be planned depends on the results of pre surgical imaging studies. In the absence of metastatic disease, assessment of vascular invasion is a key aspect in the evaluation of resectability of pancreatic carcinoma. In our study we assessed the resectability of carcinoma pancreas depending on the CT findings and compared it with the intraoperative findings.

The study has shown that CT does assess the operability in carcinoma pancreas with adequate statistical significance, assessing mainly unresectability though less effective in assessing resectability. The role of endoscopic ultrasound and laproscopic ultrasound in aiding CT in further assessment of resectable and borderline resectable cases are to be considered for further research.

REFERENCES

1. Townsend C, Beauchamp RD, Evers BM, Mattox K. Sabiston textbook of surgery. 19 editon. Elsevier; 2016: 1534-1545.
2. Egorov VI, Petrov RV, Solodinina EN, Karmazanovsky GG, Starostina NS, Kuruschkina NA. Computed Tomography-based diagnostics might be insufficient in the determination of pancreatic cancer respectability WorldJGastrointestSurg.2013Apr27;5(4):83-96.
3. Loyer EM, David CL, Dubrow RA, Evans DB, Charnsangavej C. Vascular involvement in pancreatic adenocarcinoma: reassessment by thin-section CT. Abdom Imaging. 1996;21:202-6.
4. Phoa SS, Tilleman EH, van Delden OM, Bossuyt PM, Gouma DJ, Laméris JS. Value of CT criteria in predicting survival in patients with potentially resectable pancreatic head carcinoma. J Surg Oncol. 2005;91:33-40.
5. Ichikawa T, Erturk SM, Sou H, Nakajima H, Tsukamoto T, Motosugi U, et al. MDCT of pancreatic adenocarcinoma: optimal imaging phases and multiplanar reformatted imaging. AJR Am J Roentgenol. 2006;187:1513-20.
6. Li H, Zeng MS, Zhou KR, Jin DY, Lou WH. Pancreatic adenocarcinoma: signs of vascular invasion determined by multi-detector row CT. Br J Radiol. 2006;79:880-7.
7. House MG, Yeo CJ, Cameron JL, Campbell KA, Schulick RD, Leach SD, et al. Predicting resectability of periampullary cancer with three-dimensional computed tomography. J Gastrointest Surg. 2004;8:280-8.