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Role of dynamic computed tomography in diagnosis and characterisation of pancreatic neoplasms

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ABSTRACT

BACKGROUND -Pancreatic malignancy is twice as common in men as women. Pain is most common symptom in body. Increased Serum alkaline phosphatase & serum bilirubin are seen. The liver represents the first capillary bed that pancreatic venous drainage encounters.

Objective -To assess the role of dynamic computed tomography in diagnosis and characterisation of pancreatic neoplasms

METHODS- Our cross sectional study included 30 cases who were investigated during January 2016 to January 2017.

Patients referred to Radiology department of Sree Mookambika Institute of Medical Sciences with clinical suspicion of pancreatic mass were scanned sonographically. Convenient sampling was used. Data was entered in Microsoft excel 2013 and analysed using SPSS 20.0 trail version.

RESULTS- mean age was 52.7 years. There is a slight male preponderance. Serum alkaline phosphatase in 70% of the patients. Dynamic computed tomogram accurately diagnosed the mass or change in the contour of pancreas in 100%. More than 80% of our patients had an isodense mass lesion on non-contrast CT scan .Ductal dilatation was seen in 96%. In 70% of patients there was biductal dilatation associated with a mass. Computed tomography characterised the pancreatic mass lesion as adenocarcinoma in 28 out of 30 patients.

CONCLUSION- Dynamic computed tomography is highly sensitive in detecting and characterising pancreatic mass.

KEYWORDS dynamic computed tomography, pancreatic neoplasms, Serum bilirubin.

INTRODUCTION

During the past few decades there has been a marked increase in the incidence of pancreatic neoplasms worldwide. The overall prevalence of this pancreatic ductal adenocarcinoma is 10 per 1, 00,000. Pancreatic malignancy is twice as common in men as women.

Significant advances have been made during the last two decades in the radiologic diagnosis and characterization of pancreatic neoplasm and in the pre-operative staging of pancreatic adenocarcinoma. These advances have been made possible by the advent of new imaging modalities such as endoscopic ultrasound, computed tomography and magnetic resonance imaging and by refinements of previous techniques such as angiography, ultrasound, and endoscopic retrograde cholangio pancreatography.

USG is used as the screening modality to assess clinically suspected pancreatic lesions and mulitislice computed tomography has become the comprehensive modality of choice for the diagnosis, characterization and staging of pancreatic carcinoma. MRI as a diagnostic modality has sensitivity and specificity comparable to multislice CT. MRI is limited by lesser availability, higher cost of the study and patient compliance. Hence MRI can be a problem solving modality in undetectable/equivocal pancreatic lesions in CT scan. Endoscopic Ultrasound (EUS) is the modality of choice in detecting and characterising small tumours. EUS guided FNAC and MRCP are other adjuvant modalities. Easier availability, lesser cost of the study and better patient compliance, MDCT is currently the preferred modality of imaging in pancreatic mass lesions.

CLINICAL FINDINGS

The signs and symptoms of carcinoma of pancreas include

Pain
Weight loss.
Jaundice.
Nausea and vomiting.
Diabetes.

SITE

Sites involved are[1]:
Head - 70 %
Body - 10%
Tail - 5%
Body and tail - 10%
Diffuse Enlargement - 5%

LABORATORY FINDINGS

- Increased Serum alkaline phosphatase - 85%
- Increased SGOT - 67%
- Increased LDH - 69%
- Increased fasting blood sugar - 60%
- Increased serum bilirubin - 55%

ROLE OF COMPUTED TOMOGRAPHY

CT is currently the best pancreatic imaging technique in terms of overall accuracy, reliability, reproducibility and availability. The incidence of technically unsuccessful examination and false negative examination is 1% or less [2,3].

DIAGNOSIS AND CHARACTERISATION OF PANCREATIC TUMOURS BY COMPUTED TOMOGRAPHY

The most common (96%) CT finding in duct cell carcinoma is a mass deforming the size and contour of the gland. Normal measurements of pancreatic size are unreliable because of variations in normal size and configuration. A normal sized head is

consistent with a carcinoma when there is atrophy of the body and tail.

Dilatation of main pancreatic duct (>5mm in head and >2mm in the body) proximal to the obstructing tumour is detected in 88% of pancreatic head tumour [1], can also be seen in chronic pancreatitis where 50% of dilated duct will contain intraductal calcifications. Co-existing carcinoma is unusual except for familial hereditary pancreatitis. In pancreatic carcinoma the duct is dilated to greater than 50% of the anteroposterior diameter of the gland owing to atrophy [4].

In 86% of patients biliary dilatation (>9mm) is seen. In 77% there is combined biliary and pancreatic ductal dilatation, in 9%, biliary dilatation only and in 12% pancreatic ductal dilatation only [5].

COMPUTED TOMOGRAPHIC APPEARANCE

Smaller tumours (<2cm) are slightly hypodense on plain CT. Calcification and necrosis are CT features of larger islet cell tumours[6].

TUMOUR STAGING IN PANCREATIC ADENOCARCINOMA

Complete surgical resection of the tumour is the only procedure of choice in patients with pancreatic carcinoma. Unfortunately, 5-year survival rates following surgery are less than 5% regardless of the type of resection employed. Thus, surgical intervention must be prudent.

COMPUTED TOMOGRAPHIC STAGING OF PANCREATIC ADENOCARCINOMAS

The CT criteria of a resectable pancreatic tumour are an intrapancreatic neoplasm, usually less than 3cm in diameter surrounded by normal parenchyma, and with no evidence of extra capsular extension, vascular invasion, or nodal or hepatic metastases[7].

The CT criteria of an unresectable pancreatic carcinoma include a large tumour (greater than 3cm) that is contiguous with the surface of the gland, extra capsular extension, major vascular involvement, invasion of contiguous organs, ascites, lymphadenopathy or distant metastases[7].

Extra pancreatic local extension, manifest by extra pancreatic mass contiguous with and of similar density to the primary, is present in 40% to 70% of patients at initial evaluation [8]. Soft tissue density streaks and strands in the retroperitoneal fat in the region of the mass suggest extension [1,5 and 8]. Posterior extension is the most common followed by anterior extension and extension into the porta hepatis and splenic hilum.

Vascular encasement manifests itself on CT as narrowing or obliteration of a lumen that is surrounded by tumour and is best evaluated by dynamic techniques [8]. When CT shows the tumour partially surrounding or contiguous with a major vessel (loss of fat plane), it implies that the tumour is not resectable. Vascular involvement is the most common CT finding of tumour unresectability (84%).

Arterial encasement (SMA, splenic, celiac, hepatic) is seen somewhat more frequently than venous encasement. (SMV, splenic, portal). Obliteration of fat plane between the tumour and the IVC or aorta also suggests unresectability.

Invasion of contiguous structures occurs in advanced disease, most commonly involving the duodenum or stomach. The colon, spleen, left adrenal, kidney and even the spine may be affected.

Involvement of regional nodes is demonstrated by CT in approximately 15% to 30% patients [9]. Nodes may be confluent with the primary mass. It is often difficult to differentiate by CT peripancreatic adenopathy of non-pancreatic etiology from a duct cell carcinoma.

Ascites is rarely the only CT finding of unresectability [3, 10]. Unexplained ascites signifies peritoneal carcinomatosis. Soft tissue streaking and nodularity in the omentum are signs of peritoneal carcinomatosis.

The liver represents the first capillary bed that pancreatic venous drainage encounters and is thus by far the most common site of distant metastases. Hepatic metastases are present on CT at initial evaluation in 20% to 50% cases and are hypodense lesions. [10]

Objective

Objective of the study is to assess the role of CT in diagnosis and characterisation of pancreatic neoplasms

PATIENTS, MATERIALS AND METHODS

Our cross sectional study included 30 cases who were investigated during January 2016 to January 2017.

Patients referred to Radiology department of Sree Mookambika Institute of Medical Sciences with clinical suspicion of pancreatic mass were scanned sonographically. Those patients who on sonography demonstrated either a pancreatic neoplasm or an indeterminate pancreatic mass were included in the study.

Patients with pancreatic masses that were suggestive of inflammation and its complications were excluded from this study. Convenient sampling was used.

All 30 patients were further evaluated by computed tomography. The computed tomographic examinations were performed with SIEMENS SOMATOM Scope 16 slice CT scanner.

Technique:-

Oral water was used as negative bowel contrast. 100 to 150 mL of OMNIPAQUE was intravenously administered at a rate of 3-4 mL/ using pressure injector and imaging was done as per pancreatic protocol in arterial, venous and delayed phase [11,12].

Data was entered in Microsoft excel 2013 and analysed using SPSS 20.0 trail version.

RESULTS AND ANALYSIS

In our study, a total of 30 patients (18 males and 12 females) were examined. The age group ranged from 30-70 years in our study group with mean of 52.7 years (Table 2).

Majority of our patients presented with complaints of pain abdomen and jaundice (Table - 3) Serum bilirubin was elevated in 60% of the cases and serum alkaline phosphatase in 70% of the patients.

TABLE - 2 AGE

Age Group	No	Percentage
30-40	2	6.7
40-50	7	23.3
50-60	12	40.0
60-70	8	26.6
> 70 Yrs	1	3.3

TABLE - 3 SEX

Sex	No	Percentage
Male	18	60
Female	12	40

There is a slight male preponderance.

TABLE – 4 CLINICAL SYMPTOMS

Symptoms	No.	%
Pain abdomen	25	84.5%
Jaundice	21	70%
Loss of appetite/weight	16	53%
Mass	1	3%

Computed tomogram accurately diagnosed the mass or change in the contour of pancreas in 30 out of 30 patients (100%).

Twenty seven patients had a mass or altered contour in the region of the head and uncinate process of pancreas. One patient had a mass involving the head and neck region. In the remaining two patients, one had a mass in the body and the other had a mass in the tail of pancreas.

In our study the size of the mass lesions ranged from 2.8 to 6.5cm with a mean of 4.9cm. More than 80% of our patients had an isodense mass lesion on non-contrast CT scan and relatively hypodense mass on contrast administration.

Ductal dilatation (mass pancreatic duct and CBD) was seen in 96% of (29 out of 30 patients). In 70% (21/29) of patients there was bi ductal dilatation associated with a mass. MPD alone was dilated in 22% of cases (6/29). CBD alone was dilated in 7% of patients (2 out of 29).

In one case there was a mass in the tail region without any ductal dilatation.

Computed tomography characterised the pancreatic mass lesion as adenocarcinoma in 28 out of 30 patients. One case was diagnosed as mucinous cystadenoma and the remaining one as microcytic adenoma. These imaging findings were correlated with histopathological findings. Two cases which were diagnosed as adenocarcinoma in CT were found to be negative for malignant cells in histopathology. Thus in our study with computed tomography, a correct diagnosis and characterisation of pancreatic neoplasm was made in 93.3% cases. Two patients had false positive scan.

Peripancreatic infiltration indicating extra capsular extension of the tumour was seen in 77% of cases (Twenty out of thirty patients).

Contiguous organ invasion was seen in 36% of patients (11 out of 30 patients). In our study 10 patients had duodenal involvement and one patient had both duodenum and antrum of stomach involved.

Vascular involvement was seen in 60% of cases. (18 out of 30 cases). 14 patients had SMV involvement. Two patients had both SMV and SMA involvement. One patient had hepatic artery involvement. In one patient the fat plane between mass and IVC was lost.

Metastases to liver and lymph nodes were seen in computed tomography in 30% of cases. Liver metastasis was seen in five cases. Four patients had peripancreatic lymphadenopathy. Ascites was seen in 5 cases.

DISCUSSION

In our study group, the commonest complaint was pain abdomen which accounted for 84.5%. This was followed by jaundice in 70% of the cases.

There was a male preponderance in our study group. The mean age was 52.7 years. Majority of our patients were in the sixth decade. These parameters are similar to what has been reported by Friedman et al.

Laboratory investigations showed an increased alkaline phosphatase in 70% of our patients. Serum bilirubin was elevated in sixty percent of cases.

CT diagnosed a mass or focal change in the pancreatic contour in all the thirty patients. Thus CT had 100% sensitivity in detecting the lesions. Freeny et al had observed a mass in CT in 96% of cases. About eighty percent of our cases show central zone of decreased attenuation with bolus administration of contrast.

The size of the mass lesion ranged from 2.9cm to 6.5cm with a mean size of 4.9. Most of our cases were found to have CT criteria of unrepeatability at the time of initial presentation.

In a large series by Friedman et al, the commonest site of the lesion was found to be the head of the pancreas. The most common site of the tumour in our study was also the head of pancreas accounting for 90% of the cases.

Freeny et al had observed ductal (MPD/CBD) dilatation in 79% cases. In our study this parameter was seen in 96% of the cases. This is mainly because our patients had a large mass at the time of initial presentation. MPD dilatation was considered if the duct diameter was greater than 5mm in the head or greater than 3mm in the tail. CBD dilatation was considered if the diameter exceeds 9mm. CBD dilatation will be usually associated with intrahepatic biliary radicle dilatation. Isolated intra hepatic biliary radicles dilatation in the absence CBD dilatation may be due to nodes in the porta.

In our series contrast enhanced multislice computed tomography characterised the pancreatic lesion as adenocarcinoma in 28 cases. Out of these, two cases were found to be negative for malignant cells on histopathological examination.

Focal inflammatory masses mimicking carcinoma resulting in 2 false positive computed tomographic diagnosis were encountered in Freeny's studies. About 50% of dilated pancreatic ducts will contain intraductal calcification in chronic pancreatitis whereas intraductal calcification in carcinoma is unusual except in hereditary pancreatitis. In pancreatic carcinoma usually, but not always, the duct is dilated to greater than 50% of the anteroposterior diameter of the gland owing to atrophy. This figure is less than 50% in chronic pancreatitis.

The two cases which had false positive diagnosis had focal mass in the head of pancreas. One case had bi ductal dilatation. The other had only MPD dilatation. Both cases showed no calcification either in the mass or in the rest of the pancreas. Thus the accuracy of computed tomography in characterising pancreatic adenocarcinoma as correlated with histopathology was found to be 93.3%. Freeny et al [13] had made a correct diagnosis of pancreatic carcinoma in 97% of their cases.

Two cases of cystic pancreatic masses were encountered in this study. In one case there was rounded mass lesion with multiple tiny cystic lesions with a central speck of calcification see in the tail of pancreas. This mass showed inhomogeneous contrast enhancement. This was diagnosed as microcytic adenoma on computed tomography. The second patient had a well denned multicystic mass in the head of pancreas. Mass showed septal enhancement on contrast administration. This was diagnosed as mucinous cystadenoma. Histopathologic examination of both these tumours correlated with imaging findings.

Local tumour extension manifested by an extra pancreatic mass contiguous with and of similar density to the primary tumour was seen in 72% of cases in Freeny's series [14]. This parameter was noticed in 77% of our patients.

In a review by Traverse et al., contiguous organ invasion was seen in 43% of this cases. Duodenum and stomach were the two sites which were commonly involved followed by spleen and small bowel mesentry. The criteria used by Traverso et al for adjacent organ invasion was the loss of fat plane between tumour mass and the organ. Using this criteria in our series we observed adjacent organ invasion in 36%. The overall accuracy of computed tomography in detecting adjacent organ invasion was found to be 90% in comparison with surgery which is the gold standard.

Vascular encasement is identified when there is narrowing or obliteration of a lumen that is surrounded by a tumour. Tumour partially surrounding or contiguous with a major vessel producing loss of fat planes has negative implications for resectability. These criteria were followed by Freeny et al and they observed vessel involvement in 82% of cases. Venous involvement was more common than arterial involvement. Vascular involvement in our study was found to be 60%. Most of these cases showed focal loss

of fat plane. Superior mesenteric vein was the vessel commonly involved in our study.

The positive predictive value of tumour unresectability by CT was found to be 100% in our study. Freeny et al reported that dynamic CT correctly identified 100% of unresectable patients and 72% of resectable patients.

CONCLUSION

Contrast enhanced multislice CT is very effective as a primary modality in investigation, is highly sensitive in detecting and characterising pancreatic mass. It has a high diagnostic accuracy making it the imaging modality of choice in the preoperative assessment of resectability of the tumour. CT is also useful for planning guided biopsy procedures for preoperative histopathological examinations.

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