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Determination of Value of Contrast Enhanced Computed Tomography (CECT) in Early Diagnosis of Acute Pancreatitis: An Observational, Hospital - Based, Single - Center Study

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Abstract: ***Background: Management of patients with acute pancreatitis is based on the early assessment of severity of disease. This current prospective, observational, hospital - based, single - center study was aimed to determine the value of contrast enhanced computed tomography (CECT) in early diagnosis of acute pancreatitis. Methods: This study comprised of 60 cases on clinical suspicion of acute pancreatitis. A detailed clinical history of the patient was taken and relevant examination findings and investigations were recorded. All images were stored in memory and were reviewed on the console and on hard Copy. Multi planar reconstructions were performed wherever applicable. The data was entered; tabulated and statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS 22.0). Result: In our study, 73 patients had positive ultrasound finding, while CT was positive in all cases. According to, MCTSI 63 patients had moderate, 26 patients had mild and 11 patients had severe pancreatitis. Conclusion: Most patients are of mild score that possibly explains early use of CECT in diagnosis of AP and increased rate of detection of early pancreatitis.***

Keywords: Acute pancreatitis, Computed Tomography, Modified CT severity index

1. Introduction

Acute pancreatitis is a polymorphic disease with dynamic imaging characteristics and a multitude of possible complications established on cross - sectional imaging. [1] Acute pancreatitis remains a devastating disease, the hallmark of which is the presence of necrosis of the pancreatic parenchyma and/or the peri - pancreatic retroperitoneal tissues. Early treatment within the initial hours of onset of symptoms in an intensive care unit utilizing aggressive hemodynamic resuscitation, nutritional support and, possibly, prophylactic antibiotics have served to decrease markedly the mortality over the past three decades. [2]

An early and accurate diagnosis of severe acute (necrotizing) pancreatitis is important to allow timely institution of therapy to limit the extra - pancreatic sequelae of this necrotizing process and to minimize the incidence of super - infection of the necrosis (i. e., progression to infected necrosis). [3] Contrast - enhanced computed tomography (CECT) has become the cornerstone of diagnosis by confirming the clinical diagnosis of severe acute pancreatitis based on the various clinical scoring criteria. Moreover, CECT serves as an anatomic roadmap for guiding radiological and surgical interventions. However, still - controversial experimental studies in animals in the mid - 1990s suggested that the use of intravenous radiographic contrast media early in the course of the disease might exacerbate the necrotizing process by further impairing the already compromised pancreatic microcirculation. [4]

CECT is optimally performed technically by taking the CT cuts of the peri - pancreatic area at the peak of pancreatic arterial perfusion, using a sufficiently high volume of iodinated contrast medium given as a rapid bolus infusion. The reported sensitivity of CECT for the detection of necrosis in acute pancreatitis is 85%–92%, while the specificity of CECT has been shown to be 95%–100%. [5] Balthazar classified the severity of findings on CECT appearance into five categories—A to E. Patients with pancreatitis of grades A–C usually manifest a mild, uncomplicated, clinical course, whereas grades D and E have a more prolonged course, with a higher morbidity rate, a higher incidence of pancreatic infection, and a higher mortality rate. According to this classification, the presence of necrosis and an acute inflammatory reaction are the two most important prognostic factors in the assessment of severity of acute pancreatitis. [6]

In view of this, the current observational, hospital - based, single - center study was aimed to determine the value of Contrast enhanced CT (CECT) in early diagnosis of acute pancreatitis.

2. Materials and Methods

An observational, hospital – based study was conducted among 60 patients in Department of Radio - Diagnosis, Government Medical College, Aurangabad, Maharashtra, India during a period from June 2013 to June 2015. This study comprised of 60 cases on clinical suspicion of acute

pancreatitis. Ultrasonography suggestive of acute pancreatitis and known case of chronic pancreatitis with features of acute symptoms were taken up for computed tomography study and evaluated. All patient who were suspected of acute pancreatitis based on clinical findings, all the patients who were diagnosed of acute pancreatitis upon ultrasonography and those patients who presented as an acute cases on chronic pancreatitis were included in this study. Whereas, suspected acute pancreatitis patients with normal pancreas on CT scan, deranged renal function test and all patients with sensitivity to iodinated contrast media were excluded from this study.

The study protocol was performed in accordance with the principle of the declaration of Helsinki and after approval by the Institutional ethical review board. A written and informed consent was taken prior to the CT examination for contrast injection.

3. Technique

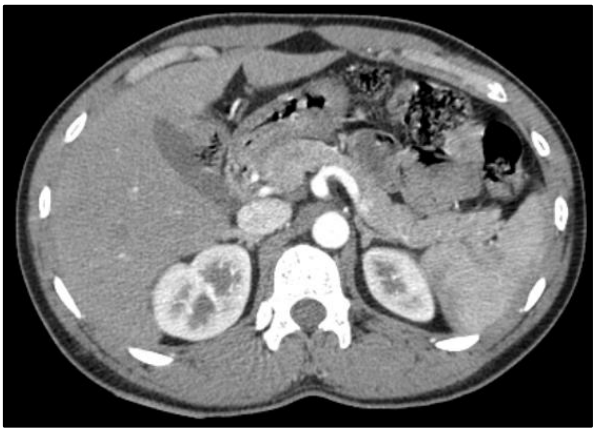
All patients were called with at least 6 hours of fasting before the scan. A written consent was obtained from each patient after explaining the possibility of contrast reaction.750 ml. of diluted iodinated contrast (containing sodium and megluminediatriazoate) was given orally 45 minutes prior to the scan to opacify and distend the bowel loops, about 500ml of oral contrast was given just prior to taking the patient for CT Scan, so as to distend the stomach in adults. In children, 500ml of diluted iodinated contrast was given orally 45 minutes prior to the scan followed by 200 ml of oral contrast given just prior to CT Scanning for stomach distension

Anantero - posterior topogram was taken initially followed by plain and contrast enhanced scan. A MedradVistron CT pressure injector was used for IV contrast injection at the rate of 2.5 ml/sec. The scan was finished in a single breath hold dynamic intravenous administration of 80 cc of 75% ionic contrast medium containing a combination of sodium diatriazoate and megluminediatriazoate (each ml containing 370 mg. of iodine) was used in patients who did not have any history of allergy. Nonionic contrast medium containing iohexol (each ml containing 300 mg iodine) was used wherever indicated. Plain scan, followed by arterial, pancreatic parenchymal and venous phases were taken. Retrospective reconstruction of overlapping slices, coronal, sagittal multiplanar reconstruction images and curved planar reformations were obtained using the raw data.

Table 1: Scanning parameters for present study

Position	Supine
Scanner setting	- kvp 120 (however may vary according to patient age and size) - mAs 16
Phase of respiration	Breath hold
Slice thickness	8 mm
Feed / Rotation	12.5 mm
Slice collimation	5 x 2.5 mm (Thinner slice sections when required)
Rotation time	0.5 sec
Kerne	B 30s
Increment	8 mm
Helical exposure time	Plain scan – 20 to 22 sec Arterial phase – 10 to 12 sec Venous phase – 20 to 22 sec Total exposure time – 50 to 60 sec
Reconstruction interval	2.5 sec
Superior extent	Dome of diaphragm
Inferior extent	Inferior border of Pubic symphysis
IV contrast	Ionic or nonionic contrast medium
Rate	2.5 ml/sec
Total Volume	80ml
Scan delay	20 sec for arterial phase and 60 sec for portal venous phase, pancreatic parenchymal phase with delay of 35 sec for evaluation of pancreatic masses
Scout film	Supine [AP]
Display FOV	Approximately 512 and varying according to patient

A detailed clinical history of the patient was taken and relevant examination findings and investigations were recorded. All images were stored in memory and were reviewed on the console and on hard copy. Multi planar reconstructions were performed where ever applicable.



Axial CECT section of pancreas

Statistical analysis

The data was entered; tabulated and statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS 22.0). Data had been summarized as mean for numerical variables and count and percentages for categorical variables.

4. Results

The study of "Determination of the value of contrast enhanced CT in early diagnosis of acute pancreatitis: A prospective, observational, hospital - based, single - center study in Indian settings'' was conducted in Department of Radio - Diagnosis, Government Medical College, Aurangabad, Maharashtra, India during a period of 24 months from June 2013 to June 2015, 60 patients were enrolled in our study. Maximum of the study participants were male (86.6%), whereas remaining 13.3% were females.

Table 2: Distribution of gender among the study patients

Gender	No. of cases	Percentage
Male	52	86.6
Female	08	13.3
Total	60	100

Gender - specific distribution of study population has been shown in **Table 2**. The male gender was found to be predominant in our study group. Around 86.6% and 13.3% of cases belonged to males and females respectively.

Table 3: Distribution of age among the study participants

Age (in years)	Number of patients (n=60)	Percentage
<25yrs	13	21.6
25 - 35yrs	20	33.3
36 - 45yrs	16	26.6
46 - 55yrs	08	13.3
>55yrs	03	8.3

Age - specific distribution of study participants have been shown in **Table 3**. A total of 60 cases ranged from <25 to >55 years. Among the 60 study patients, maximum of the study participants belonged to the age range of 51 - 60 years (26%), whereas, only 1 participant belonged to 71 - 80 age range.

Table 4: Distribution of patients according to symptoms

Symptoms	Number of patients
Epigastric pain	04
Epigastric pain radiating to back	17
Chest pain	21
Nausea	13
Vomiting	43
Diffuse pain abdomen	39
Fever	27

Distribution of patients according to symptoms was shown in **Table 4**. The number of symptoms fell into seven known categories. We recorded maximum cases of patients having vomiting, whereas the least recorded symptom was epigastric pain.

Table 5: Ultrasound findings in patients with acute pancreatitis (AP)

Ultrasound findings	Number of patients (n=60)	Percentage
No abnormality detected	08	13.3
Evidence of Pancreatitis	52	86.6

Ultrasound findings in patients with AP have been shown in **Table 5**. Out of 60 cases, diagnosis of AP was established in 52 cases (86.6%). Whereas, Ultrasound findings did not detect any abnormality in 08 (13.3%) cases.

Table 6: CT findings seen in cases of acute pancreatitis (AP)

	CT Findings	Number	Percentage
Gland	Normal size	13	21.6
	Diffuse enlargement	25	41.6
	Focal enlargement	22	36.6
Edematous		15	25
Necrosis	<30	16	33.3
	>30	04	6.6
Peri - pancreatic fat stranding		54	90
Peri/pancreatic fluid collection		47	78.3

CT findings seen in cases of AP were tabulated in **Table 6**. Diffuse enlargement and Focal enlargement of gland was noted in 41.6% and 36.6% of cases.

Table 7: CT findings in acute pancreatitis (AP)

CT findings	Number of patients		Percentage
	Present	Absent	
Peri - pancreatic fat stranding	54	06	90.0
Diffuse/focal pancreatic enlargement	47	13	78.3
Peri/pancreatic fluid collection	47	13	78.3

CT findings in AP were tabulated in above **Table 7**. The maximum cases of CT findings were recorded for peri - pancreatic fat stranding.

Table 8: Distribution of focal enlargement according to anatomical site

Site	Number of patient (n=60)	Percentage
Head & neck	18	30.0
Body	09	15.0
Tail	12	20.0
Non focal enlargement	21	35.0

Distribution of focal enlargement according to anatomical site was tabulated in **Table 8**. Focal enlargement was commonly seen observed in Head and Neck region (30%). The total number of patient does not correlate with the number of anatomical site, as more than one anatomical site was involved in a patient.

Table 9: Distribution of fluid collection according to anatomical site

Anatomical Site	Number of patient (n=60)	Percentage
Mesentery / Mesocolon	14	21.6
Lesser sac	23	38.3
Anterior pararenal space	16	26.6
Posterior pararenal space	03	5.0
Psoas muscle & Pelvis	04	6.6

Distribution of fluid collection according to anatomical site was tabulated in **Table 9**. The most commonsite of fluid collection was lesser sac (38.3%). The total number of patient does not correlate with the number of anatomical site, as more than one anatomical site was involved in a patient.

Table 10: Causes of Acute Pancreatitis (AP)

Causes	No. of patient (n=60)	Percentage
Alcohol	48	80.0
Gall Bladder/ CBD Calculus	03	5.0
Hyperlipidemia	06	13.3
Trauma	01	1.6
Idiopathic	01	1.6
Pancreatic mass causing pancreatitis	01	1.6

Distribution of the common causes of acute pancreatitis (AP) in our study was tabulated in **Table 10**. The most common cause of AP in our study was alcohol. Hence, or study proved that alcohol consumption was the commonest aetiology.

5. Discussion

In the present study, we prospectively studied 60 patients who were diagnosed acute pancreatitis on ultrasonography in a single Indian institution. These patients underwent CECT of the abdomen and pelvis and were graded according to the modified CT severity index.

The mean age of patients in the study was 35.63 ±12.58. The maximum patients were in the age group of 25 - 35 years (33.3%). The next group with maximum patients was in the 36 - 45 years group (26.6%). These results are in agreement with studies done by Jauregui - Arrieta Let al [7], Koenrad JM et al [8] and Bollen TL et al. [9]

In our study, most of the patients were male (86.6%) as compared to female (13.3%). No association of gender was noted with severity of pancreatitis in our study. These observations were similar to that of a study conducted by Lankisch Det al. [10] among 602 patients of acute pancreatitis which showed no correlation between gender and severity of acute pancreatitis.

Chronic alcohol abuse is the most common etiological factor in our study constituting 80% of cases. Similar results were observed from studies done by Dugernier TL et al [11] and Freeny PC et al [12].

In our study, as per the CT findings seen in cases of acute pancreatitis (AP), diffuse enlargement and focal enlargement of gland was noted in 41.6% and 36.6% of cases. Similar observations were recorded in a study done by Restrepo Ret al. [13] in 2016.

The maximum cases of CT findings were recorded for peri - pancreatic fat stranding in our study. Similar observations were recorded in a study done by French JM et al. [14] in 2020. Distribution of focal enlargement according to anatomical site revealed that focal enlargement was commonly seen observed in Head and Neck region (30%). Similar observations were recorded in a study done by Sun Y et al. [15] in 2021. In our study, distribution of fluid collection according to anatomical site revealed that the most commonsite of fluid collection was lesser sac (38.3%). Similar observations were recorded in the study of Marino KA at al. [16] in 2016.

6. Conclusion

Contrast Enhanced Computed Tomography (CECT) helps in differentiating between edematous and necrotizing pancreatitis. Serum lipase and amylase levels do not help to differentiate these types of acute pancreatitis. Ultrasound followed by CECT scanning helps in early and better anatomical delineation of the findings and early detection of complications such as fluid collection and vascular complications. Thus CECT evaluation of in patients of acute pancreatitis should be the investigation of choice.

7. Limitations

The limitations of the study were as follows: Non - randomized study. Biochemical investigations such as serum amylase/lipase were not available in our institute so levels were not included in this study. Not all patient of acute pancreatitis were able to do the test. Only 60 patients could perform this investigation.

8. Recommendations

The grading of acute pancreatitis can be classified according to MCTSI as mild (score 2 and score 4), moderate (score 6) and severe (score 8 and 10) contrary to other previous studies which classified it into mild (score 2), moderate (score 4 and score 6) and severe (score 8 and 10). Patients who have a severe score of AP should be transferred to a tertiary care centre.

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