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# Evaluation of Complications in Patients Suffering from Acute Pancreatitis Using Computed Tomography Severity Index (CTSI) - A Hospital-Based, Single-Center Study in Indian Settings

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**Abstract**

**Background:** Acute pancreatitis is a complex and frequent inflammatory disorder. Severe acute pancreatitis can develop into systemic inflammatory response. This prospective, observational, hospital-based, single-center study was aimed to evaluate the complications using computed tomography severity index

**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 where ever applicable. The data was entered; tabulated and statistical analysis was performed by using Statistical Package for the Social Sciences (SPSS 22.0).

**Result:** Ascites was the commonest extrapancreatic complication followed by pleural effusion. Around 29 (48.3%) patients who developed pseudocyst as a consequence of AP. Distribution of pseudocysts according the anatomical site confirmed that the most common site of pancreatic pseudocyst is lesser sac (23.3%). Distribution of patients according to MCTSI scores revealed that majority of the patients had score of 4 of 35 % and least in score 10 of 8.3%.

**Conclusion:** MCTSI helps in evaluating the percentage of pancreatic necrosis. Modified CT severity index can be used to predict the possibility of developing local and systemic complications and necessity of tertiary care (as this is done in a rural setting). Depending upon the MCTSI grading the treatment planning of patients can be done more effectively and accurately. Mild to moderate acute pancreatitis- MCTSI scores: up to 6 can be managed conservatively. MCTSI scores (8-10) acute pancreatitis may require surgical exploration.

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

## Introduction

Acute pancreatitis is potentially life-threatening inflammatory disorder, which varies in spectrum from a mild to a severe clinical presentation.[1] While the mild and moderate forms often have a self-limiting course, with negligible mortality, complications in the severe, fulminate form of this disease can occur, with development of the systemic inflammatory response syndrome (SIRS), pancreatic necrosis, infected necrosis, pancreatic abscess, hemorrhage, colonic necrosis, and pancreatic pseudo-cyst formation, many of which obligate a high mortality rate. Infected necrosis and systemic sepsis with multi organ failure may ensue, carrying a very high morbidity rate and a mortality rate of up to 40%.[2]

Once the diagnosis of pancreatitis is suspected, the use of one of three current clinical classification systems will help to identify those patients at highest risk, i.e., that subset of severe acute (necrotizing) pancreatitis.[3] Computed tomography (CT) is the most readily available and reliable imaging modality to assess suspected pancreatic disease.[4] Intravenous contrast enhanced computed tomography (CECT) is accepted as the current gold standard for the verification and determination of the degree of the disease in the assessment of severe acute pancreatitis and for detecting and estimating the extent of pancreatic parenchymal necrosis.[5]

Most surgeons and gastroenterologists seem to prefer the clinical staging systems (Ranson, Glasgow, APACHE II) for the initial assessment and reserve the CECT for patients with severe acute pancreatitis in an attempt to identify the presence of complications of the pancreatitis, such as infected necrosis, abscess or pseudocysts.[6] In mild forms of acute pancreatitis, an interstitial, edematous "pancreatitis" is present, characterized microscopically by marked edema of the interstitial space, with a minimal number of inflammatory cells present. Major necrosis of the pancreatic parenchyma is notably absent, although focal, microscopic acinar cell necrosis may arise. Severe acute pancreatitis is associated with organ failure and/or local complications such as necrosis, abscess or pseudocysts.[7]

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%.[8] 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.[9]

In view of this, the current prospective, observational, hospital-based, single-center study was aimed to evaluate the complications using computed tomography severity index.

**Materials and Methods:**

An observational, hospital based study was conducted during the period of June 2013 to June 2015 at Department of Radio-Diagnosis, Government Medical College, Aurangabad, Maharashtra, India and 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.

**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 meglumine diatriazoate) 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

An anteroposterior topogram was taken initially followed by plain and contrast enhanced scan. A Medrad Vistron CT pressure injector was used for IV contrast injection at the rate of 2.5 ml/sec.



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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 meglumine diatriazoate (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.

**Scanning Parameters** -

| **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<br>Arterial phase – 10 to 12 sec<br>Venous phase – 20 to 22 sec<br>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 | 80 ml |
| 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.



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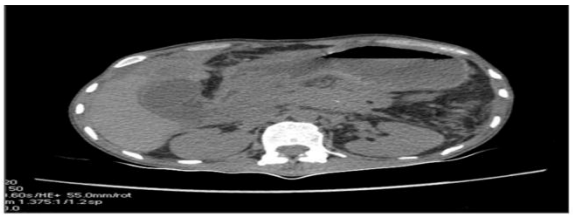

Fig 5 : Pre-contrast image showing evidence of acute necrotizing pancreatitis.

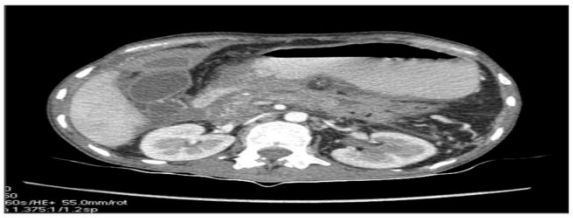

Fig 6 : Post-contrast image showing evidence of acute necrotizing pancreatitis.

**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.

**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 1: 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 1**. 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 2: Distribution of age among the study patients**

| Age (in years) | No. of patients (n=60) | Percentage |
|---|---|---|
| <25 yrs | 13 | 21.6 |
| 25-35 yrs | 20 | 33.3 |
| 36-45 yrs | 16 | 26.6 |
| 46-55 yrs | 08 | 13.3 |
| >55 yrs | 03 | 8.3 |



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Age-specific distribution of study patients have been shown in **Table 2**. 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 25-35 years (33.3%).

**Table 3: Distribution of patients according to symptoms**

| Symptoms | No. 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 3**. 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 4: 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 AP in our study was tabulated in the **Table 4**. The most common cause of AP in our study was alcohol. Hence, or study proved that alcohol consumption was the commonest aetiology.

**Table 5: Extra-pancreatic complications in AP**

| Extra-pancreatic complications | No. of patients (n=60) | Percentage |
|---|---|---|
| Ascites | 24 | 40.0 |
| Bilateral pleural effusion | 10 | 16.6 |
| Left pleural effusion | 07 | 11.6 |
| Right pleural effusion | 02 | 3.3 |
| Splenic vein thrombosis | 07 | 11.6 |



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| | | |
|---|---|---|
| Portal vein thrombosis | 03 | 5.0 |
| Pseudoaneurysm | 03 | 5.0 |
| Pancreato-pleura fistula | 01 | 1.6 |
| None | 28 | 46.6 |

An extra-pancreatic complication was recorded in **Table 5**. Ascites was the commonest extra-pancreatic complication followed by pleural effusion.

**Table 6: Patients developing pseudo-cyst as a consequence of AP**

| Pseudo-cyst | No. of patients (n=60) | Percentage |
|---|---|---|
| Present | 29 | 48.3 |
| Absent | 31 | 51.6 |

According to the **Table 6**, there were 29 (48.3%) patients who developed pseudo-cyst as a consequence of AP. whereas, there were 31 (51.6) patients who did not develop pseudo-cyst as a consequence of AP.

**Table 7: Distribution of pseudo-cysts according the anatomical site**

| Site | No. of patients (n=60) | Percentage |
|---|---|---|
| Head & uncinate process | 12 | 20.0 |
| Neck and body | 05 | 8.3 |
| Tail | 12 | 20.0 |
| Lesser sac | 14 | 23.3 |
| Anterior pararenal space | 09 | 15.0 |
| Posterior pararenal space | 03 | 5.0 |
| Psoas muscle and pelvis | 03 | 5.0 |
| Mediastinum | 01 | 1.6 |

Distribution of pseudo-cysts according the anatomical site is tabulated in **Table 7**. 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. Most common site of pancreatic pseudo-cyst is lesser sac (23.3%).

**Table 8: Distribution of patients according to MCTSI scores**

| MCTSI Total score | No. of patients (n=60) | Percentage |
|---|---|---|
| 2 | 08 | 13.3 |
| 4 | 21 | 35.0 |
| 6 | 18 | 30.0 |
| 8 | 08 | 13.3 |
| 10 | 05 | 8.3 |



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Distribution of patients according to MCTSI scores is tabulated in **Table 8**. Patients were distributed according to MCTSI scores which shows majority in score 4 of 35 % and least in score 10 of 8.3 %.

**Table 9: Distribution of patient according to MCTSI total scores with respect to age groups**

| Age group (in years) | No. of patients in MCTSI total scores | | | | |
|---|---|---|---|---|---|
| | **2** | **4** | **6** | **8** | **10** |
| <25 | 3 | 4 | 3 | 3 | 0 |
| 25-35 | 2 | 11 | 5 | 1 | 1 |
| 36-45 | 2 | 5 | 3 | 4 | 2 |
| 46-55 | 1 | 1 | 6 | 0 | 0 |
| >55 | 0 | 0 | 1 | 0 | 2 |

It was seen from **Table 9** that MCTSI scores are distributed according to their age group is as follows, with maximum number of patients in 25-35 yrs age group.

**Table 10: Distribution of CT score when AP is classified as mild, moderate and severe**

| MCTSI Scores | No. of patients (n =60) | Percentage |
|---|---|---|
| 2 & 4 (Mild) | 29 | 48.3 |
| 6 (Moderate) | 18 | 30.0 |
| 8 & 10 (Severe) | 13 | 21.6 |

As observed from **Table 10** that MCTSI scores of AP are grouped as mild (2 & 4) had 29(48.3%), moderate (6) had 18(30.0%) and severe (8) had only 13(21.6%).

**Table 11: Distribution of CT score of pancreatic necrosis according to mild, moderate and severe**

| MCTSI Scores | No. of patients (n =60) | Percentage |
|---|---|---|
| 2 & 4 (Mild) | 04 | 20.0 |
| 6 (Moderate) | 04 | 20.0 |
| 8 & 10 (Severe) | 12 | 60.0 |

It was seen from **Table 11** that MCTSI scores of pancreatic necrosis are grouped as mild (2 & 4) had 4(20%), moderate (6) had 4(20%) and severe (8) had 12(60%).

**Discussion:**

In this 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 a study done by Jauregui-Arrieta L et al[10]

In our study, most of the patients were male (86.6%) as compared to female (13.3%). No association of



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gender was noted with severity of pancreatitis in our study. These observations was similar to that of a study conducted by Lankisch D et al[11] 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 which constituting 80% of cases. Similar results were observed by Dugernier TL et al[12] and Freeny PC et al[13]

In this present study, Ascites was the commonest extra-pancreatic complication followed by pleural effusion. Similar results were observed a study done by Rafiq S et al[14] in 2020.

In our study 29(48.3%) patients who developed pseudo-cyst as a consequence of acute pancreatitis. Similar results were observed in a study done by Zheng L et al[15] in 2021. Distribution of pseudo-cysts according the anatomical site confirmed that the most common site of pancreatic pseudo-cyst is lesser sac (23.3%). Similar results were observed by Marino KA et al.[16]

In our study, distribution of patients according to MCTSI scores revealed that majority of the patients had score of 4 of 35 % and least in score 10 of 8.3%. Similar results were observed in the study done by Gupta P et al.[17] in 2020.

In the present study, MCTSI scores are distributed according to their age group is as follows, with maximum number of patients in 25-35 yrs age group. Similar results were observed in the study done by Kumar A et al.[18] in 2020. In our study, distribution of pancreatic necrosis according to mild, moderate and severe CT scores revealed that maximum patients (60%) had MCTSI Scores of 8 & 10 (severe). Similar results were observed by Xiao B et al.[19] in 2020.

**Conclusion:**

Our study demonstrated that MCTSI helps in evaluating the percentage of pancreatic necrosis. Modified CT severity index can be used to predict the possibility of developing local and systemic complications and necessity of tertiary care (as this is done in a rural setting). There should be early detection of fluid collection so that they can be managed accordingly. Depending upon the MCTSI grading the treatment planning of patients can be done more effectively and accurately. Mild to moderate acute pancreatitis- MCTSI scores: up to 6 can be managed conservatively. MCTSI scores (8-10) acute pancreatitis may require surgical exploration.

**Limitations:**

The limitations of the study are 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.

**Recommendations:**

We would propose that CECT can be used in early stages of AP and be supplemented by MCTSI to evaluate development of complications for further management of patients. As patients with moderate and severe score of AP have a higher possibility of local complications a follow up study with ultrasound / CT may be considered in these patients.

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