

Comparative and correlative study of Balthazar computed tomography severity index and modified computed tomography severity index in predicting the outcome of acute pancreatitis

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Abstract

In general acute pancreatitis is classified in to mild and severe pancreatitis. Mild pancreatitis is also known as oedematous or interstitial pancreatitis, which is the cause for mild organ failure and uneventful recovery. Severe pancreatitis also known as necrotizing pancreatitis is associated with organ failure and leads to other complications like necrosis, infection and pseudo cyst formation. Fifty cases of acute pancreatitis who presented to the emergency department as acute abdomen were included in the study. Informed and written consent was taken from all the participants. When the Modified CT Severity Index was applied, the average duration of hospital stay in patients categorized as mild pancreatitis was 1.5 days in moderate pancreatitis 6.9 days and in severe pancreatitis 14.2 days. None of the patients categorized as mild pancreatitis had an adverse or fatal outcome. The majority (90%) of patients requiring interventional procedure fell in the severe pancreatitis group.

Keywords: Balthazar computed tomography severity index, modified computed tomography, acute pancreatitis

Introduction

Acute pancreatitis is a complex disease with sudden diffuse inflammation of the pancreas that may be mild or life threatening. Presents with a variable clinical course. It is triggered by several factors like alcoholism and choledocholithiasis which are most common^[1]. Other causes of pancreatitis are metabolic causes and drugs. As Pancreatitis have variable presentation and there are several imaging modalities which play an important role in diagnosis and which help in management. Imaging is performed to know the presence of inflammatory extension of pancreatic fluid, pancreatic necrosis and associated complications^[2].

The different types of imaging are plain abdomen x-ray, Ultrasonography (USG), endoscopic ultrasound, Endoscopic Retrograde Cholangiopancreatography (ERCP), Contrast Enhanced Computed Tomography (CECT), Magnetic Resonance Imaging (MRI), Magnetic Resonance cholangiopancreatography (MRCP).

In general acute pancreatitis is classified in to mild and severe pancreatitis. Mild pancreatitis is also known as oedematous or interstitial pancreatitis, which is the cause for mild organ

failure and uneventful recovery. Severe pancreatitis also known as necrotizing pancreatitis is associated with organ failure and leads to other complications like necrosis, infection and pseudo cyst formation^[3].

To diagnose acute pancreatitis general physical examination and blood investigations like elevated serum amylase and serum lipase are useful.

However, severity of acute pancreatitis is more difficult to classify. For this purpose, several clinical and radiological scoring systems have been developed, Ranson's criteria, Imrie score the acute physiology and chronic health evaluation (APACHE II) scoring system, Simplified Acute Physiology score (SAP score)⁷ and the CT severity index^[4].

There are several radiologic prognostic scoring systems have been created and among all of them CT severity index (CTSI) designed by Balthazar in 1990, is the most widely accepted for clinical and research settings. The CTSI is a numeric scoring system that combines with the presence of pancreatic and extra pancreatic inflammation with the extent of pancreatic necrosis. It has good prognostic factors than the earlier scoring system but it also has many limitations. First, the score obtained with the index did not correlate with development of organ failure extra pancreatic parenchymal complications or peripancreatic vascular complications and their correlation with the final outcome. Secondly, as documented in some studies, inter-observer agreement for scoring the CT scans using the CT Severity Index was only moderate, with a reported agreement of approximately 75%. The main reason of this variability possibly due to the subjective and multiple categorization of the extent of pancreatic inflammation and necrosis. It has been observed that patients with >30% necrosis have similar morbidity and mortality, thus including an additional 50% in the score was not practically helpful^[5].

To overcome these limitations, in 2004, a modified CTSI (MCTSI) was designed by more *et al.* to account for several potential limitations of CTSI. MCTSI is very easy to calculate and correlates with the patient outcome like incidence of infection, occurrence of necrosis, organ failure and death than Balthazar CT Severity Index^[6].

Many other studies have evaluated the patient outcome of MCTSI in acute pancreatitis. The present study was made an attempt to correlate the Balthazar CTSI and Modified CTSI with outcome of acute pancreatitis patients to determine their strengths (advantages/ benefits) and limitations.

Methodology

This was a hospital based prospective correlative study done in the Department of Radiology, patients of all age groups referred to the department of Radio diagnosis, from the various inpatient and outpatient departments of the hospital (surgery, medical, casualty) with clinical/laboratory/ultrasonography findings suggestive of acute pancreatitis.

Fifty cases of acute pancreatitis who presented to the emergency department as acute abdomen were included in the study. Informed and written consent was taken from all the participants.

Diagnostic criteria

Presence of at least two of the following:

- 1) Acute abdominal pain and tenderness suggestive of pancreatitis.
- 2) Serum amylase/lipase ≥ 3 times the normal.
- 3) Imaging findings (USG and/or CT) suggestive of acute pancreatitis.

Inclusion criteria

- 1) Patients diagnosed as acute pancreatitis by clinical/laboratory/USG, who were willing to undergo Contrast enhanced computed tomography.
- 2) All age groups.
- 3) Both Male and Female were included in the study.

Exclusion criteria

- Patients not willing to undergo Contrast study.
- Patients with known history of allergy to iodinated contrast agents.
- Patients with deranged renal function test (serum creatinine > 1.5 mg/dl after rehydration).
- Pregnant women.
- Chronic pancreatitis with acute exacerbation identified on CT.

Procedure

The clinical details like, demographic data (name age sex address occupation) detailed clinical history with presenting symptoms like pain abdomen, nausea, vomiting and fever with duration, physical examination (local and systemic) including pulse rate, blood pressure, respiratory rate, temperature and icterus and any history suggestive of possible aetiology such as gallstone disease, alcohol abuse, trauma to abdomen, drug intake, metabolic disorder or any recent surgical intervention or procedure and surgery are recorded

All patients were explained about the purpose of study. A brief account of the procedure was explained to the patient with emphasis on reassuring the patient prior to the procedure. Informed and written consent was taken from the patient in writing both in English and Telugu. Imaging was done by TOSHIBA (ALEXION) 16 slice spiral CT scan. Patient placed in supine position. Initially, Plain CT was performed followed by contrast study. Cranio-caudal direction from the level of the domes of diaphragm to pubic symphysis 5mm axial sections were taken. Non-ionic iodinated contrast (Iohexol) of 70-100ml at a dose 1.5kg/bodyweight were administered intravenously by using pressure injector at the rate of 3.5ml per second followed by saline chase of 20 ml normal saline. Post contrast scanning was done late arterial 35-40sec and portal venous phase 70 seconds scanning parameters-

All images were viewed in a range of soft tissue window settings. Images were reformatted in sagittal, coronal and axial planes with reconstruction thickness of 1mm were analysed.

Scan parameters

- **Slice thickness:** 5mm with reconstruction into 1mm.
- **Pitch:** 0.938.
- **Collimation:** 20mm.
- **Rotation time:** 0.75seconds.
- **kV:** 120.
- **mA:** 280.

Results

Table 1: Grading of severity of acute pancreatitis by CTSI and MCTSI

Category	Grading of Severity of Acute Pancreatitis					
	CT Severity Index			Modified CT Severity Index		
	Mild	Moderate	Severe	Mild	Moderate	Severe
No of Patients (Total 50 in each category)	26	10	14	7	19	24

Majority of patients had mild pancreatitis according to CT Severity Index. However, according to Modified CT Severity Index, majority were categorized as severe pancreatitis. The Chi square test between CT Severity Index and Modified CT Severity Index was 16.36 with significance value of 0.0002.

Table 2: Comparison of mortality with Balthazar and MCTSI

Category	Mortality					
	CT severity index			Modified CT severity index		
	Mild	Moderate	Severe	Mild	Moderate	Severe
No of Patients(Total 50)	0	1	1	0	0	2

Mortality showed no significant correlation between the two CT scoring systems.

When the Balthazar CT Severity Index was applied, the average duration of hospital stay in patients categorized as mild pancreatitis was 4.8 days in moderate pancreatitis 7.2 days and in severe pancreatitis 14 days. One patient categorized as mild pancreatitis had an adverse or fatal outcome. The majority (50%) of patients requiring interventional procedure fell in the severe pancreatitis group. Likewise, 6 out of 10 patients who developed infection and 5 out of 7 patients who developed organ failure belonged to severe pancreatitis group. Mortality was seen in moderate and severe pancreatitis group.

Table 3: Patient incidence of outcome using Modified CT severity index

Patients outcomes using Modified CT severity index			
Outcome factor	Modified CT Severity Index		
	Mild(0-2 points)	Moderate(4-6 points)	Severe(8-10 patients)
No. of patients	7	19	24
Length of hospital stay (days)	1.5	6.9	14.2
Intervention or Surgery	0	1	9
Infection	0	1	9
Organ failure	0	1	6
Death	0	0	1

When the Modified CT Severity Index was applied, the average duration of hospital stay in patients categorized as mild pancreatitis was 1.5 days in moderate pancreatitis 6.9 days and in severe pancreatitis 14.2 days. None of the patients categorized as mild pancreatitis had an adverse or fatal outcome. The majority (90%) of patients requiring interventional procedure fell in the severe pancreatitis group. Likewise, 9 out of 10 patients who developed infection and 6 out of 7 patients who developed organ failure belonged to this group. Mortality was also only reported in this group i.e. 1 death was seen in severe pancreatitis group.

Discussion

In the present study according to Balthazar CTSI 26(52%) patients were graded into mild group and there average duration of hospital stay was 4.8 days, correlating with the study

conducted by Jain S *et al.* showing the fairly same average hospital stay. Among these 2(4%) patients required intervention, 1(2%) developed infection and one suffered organ failure and no mortality noted in this group.

In contrast to above mentioned CTSI only 7 patients fall under mild pancreatitis with MCTSI, with average duration of hospital stay was 1.5 days, with no evidence of associated infection, organ failure with good patient outcome

Study conducted by Irshad Ahmad Banday *et al.*^[7] showed the similar patient outcome according to Balthazar CTSI and MDCTSI.

According to Balthazar CT Severity Index 10(20%) patients graded under moderate pancreatitis, with average duration of hospital stay was 7.2 days, 3(30%) patients required intervention, 3(30%) developed infection and 1 (10%) patient developed organ failure and 1(10%) death noted in this group.

In comparison 19(38%) patients graded into moderate pancreatitis, with average length of hospital stay 7 days, 1(11%) patients required intervention, while 1(5.26%) patients developed infection and 1(5.26%) patient had organ failure. no mortality was noted in this group.

Study conducted by Koenraad J. Morteale, Walter Wiesner *et al.*^[8] showed the same patient outcome according to Balthazar CTSI and MCTSI.

In the 14 (28%) patients graded as severe pancreatitis with Balthazar CT Severity Index, the average duration of hospital stay was 14 days, 5 (35.7%) patients required intervention, 9(42.8%) developed infection, 5 (35.7%) had organ failure and 1 (7.14%) patients succumbed due to the disease process.

In contrast in the 24 (48%) patients graded as severe pancreatitis with the Modified CT Severity Index, the average duration of hospital stay was 15 days, 9 (37.5%) patients needed intervention, 9 (37.5%) patients had infection, and 7(25%) developed organ failure. 1(4.16%) patients died from this group.

Present study showed a strong correlation of grades of severity of pancreatitis based on both CT Severity Index and Modified CT Severity Index. However, Modified CT Severity Index was more closely associated with patient outcome than CTSI in present study.

Results of our study were also found similar to a study conducted by Shivanand Melkundi *et al.*^[9], which showed a significant correlation of grades of severity of acute pancreatitis based on MCTSI with patient outcome parameters than grades of severity of acute pancreatitis based on CTSI.

There are other studies reported with significant correlation between clinical severity and CT evaluation of acute pancreatitis.

This difference in statistical significance between CTSI and MCTSI in our study may be attributed to the inclusion of extra pancreatic complications (table complication in the MCTSI system which are not followed in CTSI).

In our study of 50 cases the extra pancreatic complications observed are 1) pleural effusion, ascites, portal and splenic vein thrombosis.

Among pleural effusions left sided effusion is more common than right which is correlating with the study Irshad Ahmad Banday *et al.*^[7].

We found that CT severity assessment using MCTSI showed increased accuracy in identifying moderate to severe cases when compared to CTSI and showed significant correlation with outcome parameters including mean duration of hospital stay, presence of persistent OF, evidence of infection, need for intervention.

The strong relationship between the Modified CT severity index and the patient outcome indices like duration of hospital stay, intervention or surgery, evidence of infection, organ failure, and mortality in patients with variable grades of severity of pancreatitis which were observed in our study well correlated with findings of Morteale^[8]. This also correlated with the study by Irshad Ahmad Banday *et al.*^[7], which concluded that Modified CT Severity Index is

a simpler scoring tool and more accurate than the Balthazar CT Severity Index.

In contrary to our study results, Bollen *et al.* [10] showed no statistically significant differences between the two CT scoring systems with regard to all the studied severity parameters.

Conclusion

When CTSI and MCTSI were compared for grading the severity of acute pancreatitis The Modified CT Severity Index is a simpler scoring tool and more accurate.

MCTSI differ from CTSI in adding points for extra pancreatic complications such as pleural effusion ascites and vascular complication and shows improved scoring over CTSI in prioritizing the patient for better management.

In our study MCTSI scoring by its grading of severity helped the patients showed more higher number clinical outcome parameters like length of hospital stay, organ failure and need for interventions. With significant correlation over CTSI.

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