Diagnostic Accuracy of Modified CT Severity Index in Assessing Severity of Acute Pancreatitis

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ABSTRACT

Objective: To determine the diagnostic accuracy of modified CT severity index in assessing the severe acute pancreatitis keeping APACHE II as gold standard.

Study Design: Cross-sectional (validation) study.

Place and Duration of Study: Department of Radiology, Allied Hospital, Faisalabad, from February to August 2014.

Methodology: A total of 120 patients of either gender aged 20-60 years with epigastric pain radiating to back and having sonographic findings (decreased or heterogeneous pancreatic echogenicity, pancreatic enlargement, peripancreatic fluid collection), supportive of acute pancreatitis were taken. CT with intravenous contrast was performed on 128-slice scanner within 24 hours of presentation. Slice thickness was 3 mm in region of pancreas. Modified CT severity index was calculated. Score above 5 was graded as severe pancreatitis. APACHE II score of >11 considered as gold standard was also calculated within 24 hours of admission.

Results: Mean age of the patients was 39.03 ±8.71 years. Most of the patients were females 73 (60.8%). Out of 120 patients, 43 (35.83%) patients had severe acute pancreatitis. Sensitivity, specificity, positive predictive value and negative predictive value of modified CT severity index in assessing the severe acute pancreatitis were 100%, 87%, 81.13% and 100%, respectively. The diagnostic accuracy was yielded as 91.67% considered APACHE II as gold standard.

Conclusion: Modified CT severity index had high diagnostic accuracy in assessment of severe acute pancreatitis and can be used reliably in early prediction of complications of severe acute pancreatitis.

Key Words: Acute pancreatitis. Modified CT severity index. APACHE II. Sensitivity. Specificity.

INTRODUCTION

Acute pancreatitis (AP) is a common disease in the developed world.¹ Nearly 60 - 80% of all cases of AP in developed countries are attributable to either gallstone disease or alcohol abuse.² Prevalence of acute pancreatitis is found to be 51.07%.³ Fortunately in 80 - 90% of the patients, acute pancreatitis is a mild self limiting disease due to edematous interstitial inflammation which resolves with conservative treatment.⁴ Acute pancreatitis has incidence of around 2.29%.⁵ About 10 and 20% of patients experience a severe attack of acute pancreatitis (SAP).⁶ Patients with severe acute pancreatitis are more likely to have a protracted hospital stay and to develop systemic or organ failure with renal, respiratory, and cardiovascular failure; disseminated intravascular coagulation; or gastrointestinal hemorrhage.⁸

As severe acute pancreatitis may progress very quickly and is normally associated with a complicated clinical course and higher mortality, it is vital to identify these patients as early as possible, especially within the first 24 hours after symptoms onset.⁷ Severity scoring systems have been used since 1970s, the first being the widely used Ranson's criteria. Others have subsequently been described, many of which are variants of the Ranson system, including the Imrie, acute physiology and chronic health evaluation APACHE-II score, Glasgow severity scoring system. APACHE II is considered superior to other systems because it takes into account all major risk factors that influence the patient's outcome.⁸ The sensitivity and specificity of APACHE II, according to studies, are found to be as high as 93.8% and 100%, respectively.⁹,¹⁰

Moreover, in the past two decades, several radiologic prognostic scoring systems have been developed. Among them, the CT severity index (CTSI), designed by Balthazar et al. in 1990, is the most widely adopted for clinical and research settings. In 2004, a modified computed tomographic severity index (MCTSI) was designed to account for several potential limitations of the CTSI. In contrast to the CTSI, the MCTSI incorporates extra pancreatic complications in the assessment and simplifies the evaluation of the extent of pancreatic parenchymal necrosis and peripancreatic.¹¹ Research has shown that a MCTSI score ≥ 5 correlated with prolonged hospitalization and higher rates of mortality and morbidity. Previous studies have shown that MCTSI was 71% sensitive and 93% specific, while positive predictive value was 69% and negative predictive value was 94%.⁹ Another observational study

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shows that CT severity scores, when obtained within first 48 hours, correlated better with complications and mortality.12

Prediction of complications to occur in acute pancreatitis is very challenging. Modified CT severity index is currently not in practice locally because no local data is available regarding this. Modified CT severity index is easier to apply. So, if found superior to APACHE II that is the gold standard, early prediction of complications with modified CT severity index scoring would help in better and early treatment of patients, reducing the morbidity.

The aim of this study was to determine the diagnostic accuracy of modified CT severity index in assessing the severe acute pancreatitis, keeping APACHE II as gold standard.

**METHODOLOGY**

It was a cross-sectional validation study, carried out in the Department of Radiology, Allied Hospital, Faisalabad, on 120 patients of acute pancreatitis from February to August 2014. Permission was taken from the Hospital Ethical Committee and informed consent was taken from all the patients.

Sample size was calculated using sensitivity and specificity calculator, using sensitivity and specificity of modified CT severity index for the diagnosis of severe acute pancreatitis as 71% and 93%, respectively,11 prevalence of acute pancreatitis was 51.07%,3 with 95% confidence level by taking precision for sensitivity 10% and for specificity it was 7%. One hundred and twenty patients were dealt by non-probability, consecutive sampling technique.

Patients of either gender aged 20-60 years, within 24 hours from the time of presentation, having two and more features of epigastric pain radiating through back, serum amylase or lipase three times upper normal limit (i.e., more than 210 U/L and >180 U/L, respectively) and sonographic findings of acute pancreatitis, i.e. decreased or heterogenous echogenicity, pancreatic enlargement, peripancreatic fluid collection, were included in the study. Pregnant females and patients allergic to urograffin were excluded.

CT scan was done in 24 hours of presentation taking axial slices from dome of diaphragm up to pelvis with IV contrast. Slice thickness was 3 mm in region of pancreas. Modified CT severity index includes various parameters of pancreatic inflammation, percentage of pancreatic parenchymal necroses and extra pancreatic complications, observed on CT, each parameter is given different points. Score above 5 is graded as severe pancreatitis.

APACHE II score was calculated after CT within 24 hours of admission. It takes into account 12 variables including temperature, mean arterial pressure, heart rate, respiratory rate, PaO₂, arterial Ph, serum Na, serum K, serum creatinine, Hematocrit, WBC and Glasgow Coma score. The recorded values of the variables are based on the most deranged values during past 24 hours. APACHE II score of >11 is taken as cut off for severe pancreatitis.

Data was analysed by using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics of age, gender, modified CT severity index, and APACHE II score were calculated. Diagnostic measures, i.e. sensitivity, specificity, positive predictive value and negative predictive value were calculated by standard formulas using APACHE II as gold standard.

**RESULTS**

Majority of the patients were between 31 - 40 years (42.5%) of age and least patients were 51 - 60 (15.8%) years old with mean age 39.03 ±8.71 years. The minimum age was 23 years and maximum age was 56 years. Out of 120 patients, 47 (39.2%) patients were males and 73 (60.8%) patients were females. Mean MCTSI was 5.35 ±2.95 with minimum MCTSI was 2 and maximum was 10. Mean APACHE II score was 8.58 ±3.8 with minimum APACHE II score was 2 and maximum was 16.

Among all patients of acute pancreatitis, 43 (35.83%) patients showing APACHE II score > 11 had severe acute pancreatitis and 77 (64.17%) patients showing APACHE II score < 11 had mild acute pancreatitis. The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of modified CT severity index was 100%, 87%, 81.13%, 100% and 91.67%, respectively.

![Figure 1: Axial contrast enhanced CT scan showing edematous swollen pancreas with irregular and fuzzy margins, peripancreatic and left sided gerota's fascia fat stranding. Case of acute mild pancreatitis having MCTSI as 2 and APACHE II score as 4.](image-url)
Acute pancreatitis (AP) is an inflammatory process with a highly variable clinical course. Most patients with AP have a mild disease that resolves spontaneously without sequelae; however, 10 - 20% of patients experience a severe attack with high mortality up to 30%. This high risk group of patients may benefit from aggressive fluid resuscitation, close monitoring for development of organ failure, proper administration of antibiotics and specific therapeutic procedures, such as endoscopic sphincterotomy and radiologic intervention. Therefore, early assessment of the severity and identification of patients at risk is important for early intensive therapy and timely intervention, and has been shown to improve prognosis and survival.

Multi-factorial scoring systems, including Ranson et al. and acute physiology and chronic health evaluation APACHE II scores have been used since 1970s for assessment of the severity of acute pancreatitis. APACHE-II, the most commonly used prediction scoring system, was initially designed to predict prolonged ICU treatment and includes a large number of parameters, some of which may not be relevant to prognosis of patients with acute pancreatitis. Balthazar computed tomography severity index (CTSI) was developed in 1990. These predictive methods have been established as an important tool for assessment of the severity of AP. The sensitivity and specificity of APACHE II values are found to be as high as 93.8% and 100%, respectively. The introduction of the CT severity index was a significant advance in the assessment of patients with acute pancreatitis. The CTSI comprises two components: First the Balthazar grade, which also takes into account the presence of peripancreatic collections; second, the pancreatic necrosis score. However, despite the fact that the CT severity index has been successfully used to predict overall morbidity and mortality in patients with acute pancreatitis, recent literature has revealed the limitations of this currently accepted CT severity index.

First, the presence of organ failure, extrapancreatic parenchymal complications, and peripancreatic vascular complications do not significantly correlate with the score obtained with this index. Second, as reported in two independent studies, the interobserver agreement for scoring CT scans using the current CT severity index is only moderate, with a reported percentage of agreement approximating 75%. Finally, as acknowledged by Balthazar et al. and confirmed by others, no significant difference in morbidity and mortality is seen, when using the CT severity index, between patients who have 30 - 50% necrosis and patients who have more than 50% necrosis. Therefore, it is questionable whether these specific categorisations of the degree of pancreatic necrosis are necessary?

In the light of these limitations, it was hypothesised that a simplified CT severity index that incorporated features reflecting organ failure and extrapancreatic complications would be useful for predicting outcomes more accurately. The modified CT severity index differentiates only between presence or absence of acute fluid collections and, therefore, does not require a count of the collections. Furthermore, on the modified index, the presence of pancreatic necrosis is only scored as no minimal or substantial necrosis, thereby eliminating the unnecessary categorisation between patients who have 30 - 50% necrosis and patients that have more than 50% necrosis. In addition, with moderate weighting (2 points or 20%), the presence of extrapancreatic findings, such as pleural fluid, ascites, extrapancreatic parenchymal abnormalities, vascular complications, or involvement of the gastrointestinal tract, can be incorporated into the analysis.

Bollen et al. worked on modified CT severity index for the assessment of severity of acute pancreatitis. Their study results showed that modified CT severity index was 71% sensitive and 93% specific, while positive predictive value was 69% and negative predictive value was 94%. They concluded that modified CT severity index accurately diagnose clinically severe disease and better correlate with pancreatic infection.

Another study conducted by Bollen et al. showed the sensitivity and specificity of modified CT severity index as 78% and 81%, respectively. Jauregui-Arrieta et al. conducted a study on the effectiveness of modified CT severity index for assessment of severity of acute pancreatitis. Their study results showed 61% sensitivity, 66% specificity and 81% positive predictive value of modified CT severity index. They concluded that modified CT severity index is more useful for the screening in patients with severe acute pancreatitis.
Sharma et al. conducted a study on evaluation of different radiologic scoring system for assessing severity of acute pancreatitis. They found that the sensitivity of modified CT severity index was 98.6%, specificity 26.5%, positive predictive value 73.7%, and negative predictive value 90%. They confirmed that the currently accepted modified CT severity index is indeed a powerful tool with which they predicted severe acute pancreatitis and correlated well with APACHE II, which is considered most reliable among clinical scoring system available to predict complications of pancreatitis.21

CONCLUSION
Modified CT severity index is a powerful tool in assessing the severe acute pancreatitis, with high sensitivity and specificity comparable to APACHE II, i.e. considered most sensitive among the available clinical scoring systems. It is helpful in early prediction of complications associated with severe acute pancreatitis, thus making timely treatment possible, helping to reduce morbidity and mortality associated with the condition.

REFERENCES