Original Article

Evaluate the Role of Various Early Predictors and Computed Tomography in Assessing the Severity of Acute Pancreatitis

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Abstract

Background: Acute pancreatitis is a common and the most unpredictable of abdominal emergencies.

Materials and Methods: The present study "to evaluate the role of various early predictors and computed tomography in assessing the severity of acute pancreatitis" was conducted in the Postgraduate Department of General Surgery, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu. 40 patients were included in the study irrespective of age and sex of the patients. A full consent for the study was obtained from each patient separately after explaining completely about the study.

Conclusion: The early assessment of severity of acute pancreatitis is important and crucial to identify the patients who are at risk of developing life-threatening complications and to decrease the mortality in acute pancreatitis by providing intensive treatment to those who are likely to have severe disease.

Key words: Acute, APACHE, Pancreatitis, Ranson's

INTRODUCTION

Acute pancreatitis is a common and the most unpredictable of abdominal emergencies. Acute pancreatitis presents as an inflammatory disease that is characterized clinically by sudden onset of symptoms in a previously healthy individual and disappearance of those symptoms as the attack resolves. The clinical course of acute pancreatitis can vary from mild, self-limiting attack to severe systemic illness, and at times with fatal outcomes. In 1901, Opie described the association of gallstones to acute pancreatitis. Alcohol was firmly established as an important prognostic factor in 1917. Approximately 300,000 cases of acute pancreatitis occur in the USA per year, 10-20% of which are severe leading to over 3000 deaths.[1-8]

Acute pancreatitis presents with multiple etiologies. Most common 70-80% cases are due to biliary stone disease and alcohol abuse. 10-15% cases are idiopathic and remaining are associated with one of many possible miscellaneous causes such as hyperlipidemia, hypercalcemia, post-operative endoscopic retrograde cholangiopancreatography (ERCP), and trauma.

The diagnosis of acute pancreatitis is mainly clinical and supported by laboratory tests. Early clinical findings such as upper abdominal pain, fever, vomiting, tachycardia, restlessness, dehydration, and hypoactive bowl sounds are all unreliable in predicting the diagnosis and prognosis of acute pancreatitis and this account for increasing use of various types of prognostic indicators with promising sensitivity and specificity ranging between 65-100% and 70-100%, respectively.[8-15]

Laboratory test most commonly used for the assessment of acute pancreatitis are serum amylase and serum lipase determination but a judicious combination of both serum amylase and lipase determination may give better

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performance than lipase alone in assessment of acute pancreatitis, although determination of serum lipase is considered to be more specific and sensitive as compared to serum amylase alone.

Serum amylase is the group that degrades complex carbohydrates into glucose supplements. Serum contains two amylase isoenzymes, pancreatic or p-type and salivary or s-type in a ratio of 40:60, respectively. Serum amylase determination is most likely used laboratory test for diagnosis of acute pancreatitis.

Serum lipase is mainly derived from pancreatic acinar cells, where it is synthesized and stored in granules. The specificity (50-99%) and sensitivity (86-100%) of lipase measurement is better than those of amylase, particularly in detecting alcoholic pancreatitis.

Abdominal ultrasonography (USG) is the initial imaging modalities. USG is often utilized for diagnosis of patients with acute abdominal pain. In acute pancreatitis patients, USG is important in evaluation of gallbladder and biliary tract to detect possible gallstones and biliary obstruction.

The first numeric system for predicting the severity of acute pancreatitis was proposed by Ranson *et al.* in 1974 is still the most widely used system.

Acute Physiology and Chronic Health Evaluation-II (APACHE-II) is a severity of disease classification system (Knaus *et al.* 1985). This score uses 12 routinely available physiological and laboratory measurements with an additional weighting of age and pre-admission health status. It is applied within 24 h of admission.

Contrast-enhanced computed tomography (CECT) has become the standard imaging method in diagnosing and staging acute pancreatitis and its complications (Balthazar *et al.* 1990). It allows complete visualization of the pancreas and retroperitoneum, to stage the severity of disease, to detect pancreatic necrosis, and to depict local complications such as fluid collections, pseudocysts, and abscesses. The diagnostic accuracy of contrast-enhanced CECT findings has proved high, reaching a specificity approaching 100% (Clavien *et al.* 1989 and Balthazar *et al.* 1994). The use of CECT for the primary diagnosis is impossible due to the limited availability and high costs. Furthermore, CECT may be normal in 8-28% of patients with AP, especially in mild form of disease.[16-20]

Keeping in mind, that is, the importance of early prediction of the severity of acute pancreatitis, a study was conducted in Postgraduate Department of General Surgery, at Acharya Shri Chander College of Medical Sciences and Hospital, JAMMU, from October 2014 to October 2015 to assess the severity of acute pancreatitis using various early predictors and CECT.

MATERIALS AND METHODS

The present study "to evaluate the role of various early predictors and computed tomography in assessing the severity of acute pancreatitis" was conducted in the Postgraduate Department of General Surgery, Acharya Shri Chander College of Medical Sciences and Hospital, Jammu.

A total of 40 patients were included in the study irrespective of age and sex of the patients.

The diagnosis of acute pancreatitis was based on following criteria:
- History of pain in abdomen with tenderness and guarding on palpation.
- An elevated serum amylase and serum lipase levels.
- Documentation of acute pancreatitis on ultrasound abdomen.
- A complete history of general physical examination and systemic examination was done.

CECT scan abdomen: It was done in all patients within 48 h of admission and computed tomography severity index (CTSI) was calculated as follow.

RESULTS

The following observations were made.

Sex and Age
Out of 40 patients, 17 patients were male and 23 patients were female.

Age Distribution
The mean age of the patients was 47 years. The youngest patient was 14-year-old and the oldest patient was 75-year-old. Majority of the patients (42.5%) were between 30 and 50 years of age.

Symptomatology
The most common presenting symptom of the patients was pain abdomen present in all patients (100%).

Pain epigastrium and vomiting were present in 13 patients (32.5%), followed by pain right hypochondrium and vomiting were present in 11 patients (27.5%). Pain epigastrium with yellowish discoloration of eyes was present in 1 patient (2.5%).

On examination, tenderness in epigastrium was found in 18 patients (45%), tenderness in epigastrium with right hypochondrium was found 12 patients (30%). In 1 patient, tenderness was found in whole abdomen (2.5%).

Comorbidities
Out of 40 patients, associated diseases were present in 15 patients. These included hypertension in 9 patients (22.5%), diabetes mellitus in 2 patients (5%), and both hypertension and diabetes mellitus in 4 patients (8.3%). The most common associated comorbid medical condition was hypertension.

Etiology
Out of 40 patients, gallstones were present in 26 patients (65%). In 14 patients (35%), alcoholism, post-cholecystectomy, and idiopathic etiology were found.

Diagnosis
Diagnosis of acute pancreatitis was based on clinical features, serum amylase estimation, serum lipase estimation, and USG abdomen.

Serum Amylase Levels
Serum amylase levels were elevated at presentation in 34 patients (85%) and normal in 6 patients (15%) (normal range of serum amylase 25-150 U/L).

Serum Lipase Levels
Serum lipase was elevated at presentation in 27.5% of patients (normal range of serum lipase 0-160.

Serum lipase was more specific in diagnosing acute pancreatitis than serum amylase.

The sensitivity and specificity of serum amylase was 71% and 15%, respectively, whereas sensitivity and specificity of serum lipase was 64% and 96%, respectively. The mean range of serum amylase and lipase in patients with gallstone pancreatitis was 1051.61 ± 748.65 and 315.15 ± 179.56 and with non-gallstone pancreatitis was 979.36 ± 551.57 and 609.71 ± 343.53, respectively.

Ultrasonography
USG was done in all patients. It was suggestive of acute pancreatitis in all 40 cases (100%). Acute pancreatitis with cholelithiasis was found in 27 (67.5%) patients. Out of those 2 (5%), patients had focal necrosis on USG.

Investigations
Out of 40 patients, 28 patients had leukocytosis (thin-layer chromatography [TLC] >11000/mm³) at the time of presentation, whereas leukocyte count was normal in 12 patients (TLC <11000/mm³).

Deranged renal function tests were present in 15 patients (37.5%).

Early Predictors in Assessing the Severity of Acute Pancreatitis
Assessment of severity was done using Ranson's scoring, APACHE-II scoring, and CTSI score using CECT abdomen within 72 h of admission.

Ranson's Scoring
Ranson's scoring predicted that the attack of pancreatitis will be severe in 17 patients (Ranson's score >3). However, out of these 17 patients, 13 patients actually had disease, whereas 4 patients had mild disease.

Ranson's score predicted that the attack of acute pancreatitis will be mild in 23 patients (Ranson's score <3). However, out of these 23 patients, 7 had severe disease and 16 patients had mild disease.

Thus, the sensitivity and specificity of Ranson's scoring in predicting the severity of attack in acute pancreatitis in our study is 65% and 80%, respectively.
- Sensitivity of Ranson's scoring:- a/a+b × 100 = 13/13+7 × 100 = 65%
- Specificity of Ranson's scoring:- d/d+c × 100 = 16/16+4 × 100 = 80%

CECT Abdomen
Contrast-enhanced CT scan abdomen was done in all patients within 72 h of admission. CTSI was calculated using Balthazar scoring system.

16 patients were predicted to have severe attack (CTSI >7) out of 40 patients.

CECT abdomen predicted that the attack of acute pancreatitis will be mild in 24 patients. However, out of 24 patients, 19 patients had mild attack of pancreatitis and 5 had severe attack.

Thus, the sensitivity and specificity of CECT scan abdomen in assessing the severity of acute pancreatitis was 75% and 95%, respectively.

Hospital Stay
The average duration of hospital stay for patients with acute pancreatitis was 8.6 days. Shortest duration of hospitalization was 4 days and longest was 23 days.

Mortality
Out of 48 patients, only one patient died. The death was because of multiple organ dysfunctions syndrome. The patient developed respiratory and cardiac failure. Thus, the mortality of the disease in our study was 2.5%.

DISCUSSION

Acute pancreatitis is a common aliment encountered by surgeons in any part of the world and it forms a good proportion of emergency admissions in surgical emergency units. Although approximately 80% of patients have mild disease that resolves spontaneously with little morbidity, the remaining 20% suffer from severe attack with mortality rates as high as 30%. A number of studies have been conducted to find out the best measures to assess early the severity of acute pancreatitis. Comparisons of Ranson, BISAP, APACHE-II, CRP, CTSI scores, comparisons of Ranson, Glasgow, MOSS, SIRS, BISAP, APACHE-II, CTSI scores, IL-6, CRP, and procalcitonin comparative study of BISAP, Ranson, and CTSI scores, risk stratification in acute pancreatitis, assessing the severity using biochemical markers; serum amylase, lipase, IL-6, IL-8, CRP, procalcitonin, PMN elastase, TAP, etc.[21-26]

In the present study, out of 40 patients, 17 patients (42.5%) were male and 23 patients (57.5%) were female, which is similar to the observation made by Blamey *et al.* (1984) who studied 408 patients with males representing 43% and females 57% of the total. The sex distribution of the disease reported in other studies is as follows Jacobs *et al.* (1977) males 54.9% and females 36.3%, Askel *et al.* (1986) males 68.6% and females 31.4%, respectively. In the study conducted by Khanna *et al.*, 72 patients were screened there were 51.4% of males and 48.6% of females. Yadav *et al.* (2015) reported 70.6% males and 29.4% females from their study. In our study, there is slightly higher preponderance of females.[27-32]

The mean age of the patients in our study was 47 years. The mean age was found to be 44 years by Askel *et al.* (1986) and 53.8 years by Jacobs *et al.* (1977). Khanna *et al.* reported mean age as 40.5 years and Yadav *et al.* (2015) reported mean age as 38.9 years. The mean age of patients in the present study is comparable with the finding of Mir *et al.* (2013).

The most common presenting symptom in our patients was pain abdomen. Pain in epigastrium was most common site with vomiting presented in 32.5% of patients. In our study, vomiting was present in 27 patients (72%) which are almost similar to Jacob *et al.* (1977).

Jacobs *et al.* (1977) in their study found that associated diseases were present in 33% of patients; diabetes mellitus was present in 9.8% of patients. Fan *et al.* (1989) found that out of 203 patients of acute pancreatitis in their study, diabetes was present in 10% patients.

In the present study, 67.5% of the patients had biliary tract stone disease, 10% had alcoholism, 7.5% patients had idiopathic pancreatitis, and 2.5% had pancreatitis post-cholecystectomy. Fan *et al.* (1989) found in their study that 55.7% of the attacks occurred due to the gallstones, 16.7% due to alcoholism. Pierre-Alain *et al.* (1988) reported the etiology of acute pancreatitis in their study as gallstones 55%, alcoholism 39.2%, and idiopathic 11%. Wilson *et al.* observed the etiology as gallstones in 43%, alcoholism 64%, idiopathic 30%, and post-ERCP in 3.4%. Khanna *et al.* reported the etiology as biliary 64%, alcoholic 13%, idiopathic 9%, post-ERCP 2%, trauma 2%, and hypertriglyceridemia (2%). Yadav *et al.* (2015) reported alcohol as most common cause accounting for 40.3% followed by gallstones. Cho *et al.* found etiology as gallstones in 54% of cases, alcohol in 22%, idiopathic in 21%, and others in 3% of cases.

In the present study, on 40 patients, 34 patients (85%) had elevated levels of serum amylase at time of presentation. According to the "Manigots Abdominal Surgery 10th edition - 1904" 95% of the patients have hyperamylasemia at presentation. Jacobs *et al.* (1977) reported that 90% of patients had raised serum amylase at time of presentation.

According to Matull *et al.* (2006), Vissers *et al.* (1999), and Keim *et al.*, the sensitivity and specificity of serum amylase in acute pancreatitis was 55-84% and 95%, respectively.19-32% of patients may have normal serum amylase level at time of admission according to Matull *et al.* (2006) and Clavien *et al.* In the present study, sensitivity and specificity of serum amylase is 15% and 71%, respectively.

In the present study, serum lipase was found to be elevated in 11 patients (27.5%) and normal in 29 patients (72.5%). The sensitivity and specificity of serum lipase in the present study is 64% and 96.2%, respectively. Chang and Chung and Lott *et al.* reported from their study that the sensitivity and specificity of serum lipase was 80% and 60%, respectively. At a cutoff level of 600 IU/l, the sensitivity and specificity of serum lipase was 55-100% and 95% respectively in study by Matull *et al*, (2006)and Back *et al* (2002) which is similar to the present study. The mean level of serum lipase in gallstone pancreatitis. The mean level of serum lipase in gallstone pancreatitis in the present study is 315.15 ± 139.56 and non-gallstone pancreatitis is 609.71 ± 343.53.

In the present study, Ranson's score predicted that the attack will be mild in 23 patients (57.5%) and severe in 17 patients (42.5%) giving the sensitivity and specificity of 65% and 80% in predicting the severity in acute pancreatitis which is similar to study conducted by Fan *et al.* (1989). Area under the curve (AUC) of Ranson's score in our study is 0.795 (0.66-0.93). AUC in the study by Yadav *et al.* (2015) was 0.94.

Wilson *et al.* reported the sensitivity and specificity of Ranson's score as 87% and 71%, respectively. Balthazar *et al.* reported a sensitivity of 70% for Ranson's score in predicting the severity in acute pancreatitis. According to Larvin *et al.* (1989), Ranson's score correctly predicted the outcome in 69% of the patients. Khanna *et al.* reported sensitivity and specificity of 83.9% and 78%, whereas Papachristou *et al.* reported sensitivity and specificity of 84.2% and 89.8%, respectively, in their study.

APACHE-II score had a sensitivity and specificity of 70% and 85% at 48 h of admission in predicting the severity of disease in acute pancreatitis in our study. Wilson *et al.* reported that APACHE-II score has a sensitivity of 68% and specificity of 67% in predicting the severity in acute pancreatitis. Larvin *et al.* (1989) observed that APACHE-II score at admission predicts outcome in 77% of the patients similar to the present study. After 48 h it correctly predicts outcome in 88% of the patients compared with 69% for Ranson's score and 84% for Imrie score. Balthazar *et al.* reported a sensitivity of 70% for APACHE-II score in predicting the severity in acute pancreatitis. Khanna *et al.* reported sensitivity and specificity of 82.9% and 88.0%, Papachristou *et al.* reported sensitivity and specificity of 71.9% and 78%, respectively. Yadav *et al.* (2015) and Cho *et al.* reported AUC for APACHE-II 0.78, whereas in the present study, AUC is 0.913 (0.83-0.99). In our present study, APACHE-II shows specificity similar to Khanna *et al.*

According to Balthazar, APACHE-II score has a sensitivity and specificity of 56% and 72%, respectively, in differentiating interstitial and necrotizing pancreatitis. Fan *et al.* reported the sensitivity and specificity for APACHE-II score as 78% and 52%, respectively.

CECT was done in all patients in the present study and acute pancreatitis was graded according to Balthazar CT grading score and CTSI was calculated for each patient. In the present study, the sensitivity and specificity of CECT was 75% and 95% with AUC 0.920 (0.84-1.01). The maximum patients with CECT scan felled in grade E (32.5%) of acute pancreatitis and grade A of pancreatic necrosis (47.5%). Cho *et al.* reported sensitivity and specificity of 66.7% and 67.1% while Yadav *et al.* (2015) reported AUC 0.958 in predicting pancreatic necrosis using CECT scan which is similar to our study.

Berger *et al.* (1997) found that contrast CT has an accuracy of 87% with a sensitivity of 100% for detection of extended pancreatic necrosis and sensitivity of 50% if only minor necrotic areas are present at surgery. The specificity of CT was shown to be 98%. Balthazar *et al.* reported that CT has an overall detection rate of 90% for pancreatic gland necrosis in acute pancreatitis, the sensitivity increases to 100% after 4 days.

We observed a mortality of 2.5% (1 patient) in our study for acute pancreatitis. The mortality in acute pancreatitis reported in different studies as follow Jacobs *et al.* (1977) 12.9%, Fan *et al.* (1989) 10%, and Wilson *et al.* 7.6%.[33-40]

CONCLUSION

The following observation and conclusion are drawn from the present study. The mean age at presentation is in 40's with male-female ratio of 1:1.35.

The most common presenting symptom is pain epigastrium associated with vomiting. Associated disease is present in 15 patients which included hypertension in 9 patients, diabetes mellitus in 2 patients, and both hypertension and diabetes mellitus in 4 patients. Acute pancreatitis is associated with biliary tract stone disease in majority of cases followed by alcoholism. Serum amylase levels are more sensitive but less specific for detection of acute pancreatitis, whereas serum lipase levels are more specific for detection of acute pancreatitis. Total leukocyte counts were raised in 70% of patients and deranged liver function test and renal function test present in 55% and 37.5% of patients, respectively. Ranson's score is less sensitive but more specific for predicting the severity of acute pancreatitis with sensitivity and specificity of 65% and 80%.

APACHE-II score is less sensitive and more specific (70% and 85%) for predicting the severity of acute pancreatitis. CECT showed a sensitivity and specificity of 75% and 95% in predicting the severity of acute pancreatitis. Combined use of all the three parameters, that is, Ranson's score, APACHE-II score, and CTSI leads to increase in the sensitivity (88.25%) and specificity (95.7%) of predicting the severity of the disease.

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