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ORGINAL PAPER

Comparison of Self Developed Scoring System for Managing Acute Pancreatitis with APACHE-II and Ranson's Scoring System

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ABSTRACT

Acute pancreatitis includes a wide spectrum of disease, from one end with mild self limiting symptoms, to fulminating processes with multi-organ failure and high mortality. Early prediction of severity avoids the risk of subsequent morbidity and death. Approximately half the deaths of patients with severe acute pancreatitis occur within 2 weeks of onset. Early death is related to the development of severe and irreversible multi-organ dysfunction, whereas late death occurs in the second phase of illness that is dominated by sepsis and the consequences of multi-organ failure. Several biochemical markers, radiological imaging procedures and multiple clinical and biochemical scores have been used to assess severity and outcome of acute pancreatitis. The Acute Physiologic and Chronic Health Evaluation II (APACHE II) score is another physiologic scoring system that attempts to estimate the disease severity based on quantifying the degree of abnormality of multiple physiologic variable. The present study comprising of 100 patients suffering from acute pancreatitis was conducted to compare RANSON, APACHE II and the locally developed Scores and their correlation with outcome. The study also evaluated the diagnosis, aetiology, hospital stay, complications and death.

***Keywords**: Pancreatitis, severity scoring, APACHE-II*

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INTRODUCTION

Although conservative management is followed by early recovery in many cases, a reported 20 to 30% develop extensive pancreatic inflammation and necrosis, a systemic inflammatory response syndrome and multi-organ failure. Early assessment of severity has an important implication for management and timely intervention. However, an objective, reproducible and universally accepted measure to score the disease severity is still lacking.

Important recent advances have improved our understanding of the natural history of acute pancreatitis. Disease activity can be more accurately assessed using various clinical, biochemical, and immunologic markers, along with the several scoring systems for early assessment of severity.

In 1974, Ranson identified a series of prognostic signs for early identification of patients with severe pancreatitis. Out of these 11 objective parameters, five are measured at the time of admission and remaining six are measured within 48 hours of admission. If the number of positive RANSON signs is less than two, the mortality is generally zero, with three to five signs, mortality is increased from 10 to 20%. The mortality rate increases to e"50% when there are more than seven positive RANSON signs. Ranson criteria have sensitivity from 40% to 90.[1]

Glasgow score, another addition to the scores, which seems to be more precise than that of Ranson was proposed in 1978,[2] with a sensibility for the assessment of severe acute pancreatitis of 56%-85%.[3]

APACHE II scoring system was created to evaluate any

severe acute illness and has also been used to predict severe acute pancreatitis successfully. Though not specific for pancreatitis and somewhat cumbersome to use, the APACHE II system is as accurate at 24 hours as other systems at 48 hours, and is now therefore regarded as perhaps the optimal scoring system to assess the disease severity in acute pancreatitis. Twelve physiologic variables are measured- temperature, mean arterial pressure, heart rate, respiratory rate, arterial oxygen tension (PaO_2), arterial pH, serum sodium, serum potassium, serum creatinine, hematocrit, white blood cell count and Glasgow coma scale. APACHE II score more than 8 predicts 11 to 18% mortality. Several comparative studies have been carried out between the different severity scoring systems. Most studies, but not all studies report that APACHE II score may be more accurate. In our setup, we have been using a locally developed scoring system in our patients with acute pancreatitis to categorise them. Here, we will also use the locally developed criteria in our study population and compare it with Ranson and APACHE II in predicting the severity of disease at admission.

1n 1985, it was demonstrated that contrast enhanced computed tomography is able to assess the severity of acute pancreatitis.[4] They divided the severity of acute pancreatitis into 5 categories. In 83 patients with acute pancreatitis, they found that the mortality was nil in stages A, B and C, and reached 17% in those of grade E. The findings of left-sided or bilateral effusions on chest radiograph within 24 hours of admission were associated with a severe outcome.

SAPS II[5] similar to APACHE-II scoring with lesser specificity and sensitivity is also used in predicting acute sever pancreatitis. Study found that SAPS II was 66.7% sensitive and 79.1% specific.

A Clinically Based Classification System for Acute Pancreatitis which was known as Atlanta Classification was formulated in 1992 and is followed world over.

There have been few clinical studies of systemic inflammatory response syndrome (SIRS) in patients with acute pancreatitis. Presence of e" 2 of the following criteria is considered as severe pancreatitis:

1. Pulse >90 beats / min,
2. Respirations >20 per min, or $PaCO_2$ < 32 mm Hg,
3. Temperature >100.4 ° F or < 96.8 ° F ,
4. White blood cell count >12,000 or < 4,000 cells per mm 3 or >10% immature neutrophils.

Various studies[6] concluded that persistent SIRS is associated with MODS and death in patients with acute pancreatitis and is an early indicator of the likely severity.

Bedside index for severity in acute pancreatitis (BISAP) score was evaluated among 397 consecutive cases of acute pancreatitis admitted to hospitals of Pennsylvania between June 2005 and December 2007.[7, 8] BISAP scores were calculated on all cases using data within 24 hours of presentation.

BISAP score is comprised of 5 variables:

1. blood urea nitrogen >25 mg / dl,
2. impaired mental status,
3. systemic inflammatory response syndrome,
4. age >60 years,
5. Pleural effusion detected on imaging.

HAP score, is another scoring system to grade the severity of Acute pancreatitis. New Japanese Severity Score (JSS) or SPS (simple scoring system) is another scoring system that includes 9 components and a score of 3 or more indicates SAP. [9, 10]

The Panc 3 score (hematocrit-44; BMI-30 kg/m2; and pleural effusion on x-ray) is another recently developed severity assessment tool, in which presence of all 3 components was found to predict severity with a post-test likelihood of 99%. [11] Pancreatitis Outcome Prediction (POP) Score was developed by retrospectively analysing data. [12]

Some of the recently described individual markers of severity in AP include urinary trypsinogen activation peptide (TAP) [13], procalcitonin (cut-off more than 3.8 ng/mL)[14], coagulation parameters (anti-thrombin III) [15] interleukin-6,[16] intra-abdominal hypertension (15 mm Hg),[13] and immunoparalysis (reduced HLA-DR expression).[13] TAP and procalcitonin are about to be available in a commercial kit form.

The utility of artificial neural networks (ANNs)[17] to predict severity of AP has been frequently studied in recent years. ANN is a nonlinear pattern recognition technique that contains a set of processing units that simulate human neurons so that it can learn from the data presented, thereby improvising their predictive capability. In a recent systematic review of 11 studies, ANN was found to predict prolonged hospital stay with 75% sensitivity and was comparable to APACHE II and Ranson score.[18]

LOCAL SCORING: As detailed in the next chapter, presence of three or more observations at the time of admission is defined as severe disease.

MATERIALS AND METHODS

The prospective study was carried out from 1st August 2011 to 31st July 2012 at the GMCH among the patients admitted with acute pancreatitis. These patients were evaluated in the light of Ranson's, APACHE-II as well as the Local scoring to understand their severity and treat them accordingly. The experience gained, is presented in this present work

APACHE-II was scored according to the following chart (**Table 1**):

Table 1

Physiologic Variable	High Abnormal Range						Low Abnormal Range		
	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature - rectal (°C)	≥41°	39 to 40.9°		38.5 to 38.9°	36 to 38.4°	34 to 35.9°	32 to 33.9°	30 to 31.9°	≤29.9°
Mean Arterial Pressure - mm Hg	≥160	130 to 159	110 to 129		70 to 109		50 to 69		≤49
Heart Rate (ventricular response)	≥180	140 to 179	110 to 139		70 to 109		55 to 69	40 to 54	≤39
Respiratory Rate (non-ventilated or ventilated)	≥50	35 to 49		25 to 34	12 to 24	10 to 11	6 to 9		≤5
Oxygenation: A-aDO2 **or** PaO2 (mm Hg) a. FIO2 ≥0.5 record A-aDO2 b. FIO2 <0.5 record PaO2	≥500	350 to 499	200 to 349		<200 PO2>70	 PO2 61 to 70		 PO2 55 to 60	 PO2<55
Arterial pH (preferred) Serum HCO3 (venous mEq/l) (not preferred, but may use if no ABGs)	≥7.7 ≥52	7.6 to 7.69 41 to 51.9		7.5 to 7.59 32 to 40.9	7.33 to 7.49 22 to 31.9		7.25 to 7.32 18 to 21.9	7.15 to 7.24 15 to 17.9	<7.15 <15
Serum Sodium (mEq/l)	≥180	160 to 179	155 to 159	150 to 154	130 to 149		120 to 129	111 to 119	≤110
Serum Potassium (mEq/l)	≥7	6 to 6.9		5.5 to 5.9	3.5 to 5.4	3 to 3.4	2.5 to 2.9		<2.5
Serum Creatinine (mg/dl) Double point score for acute renal failure	≥3.5	2 to 3.4	1.5 to 1.9		0.6 to 1.4		<0.6		
Hematocrit (%)	≥60		50 to 59.9	46 to 49.9	30 to 45.9		20 to 29.9		<20
White Blood Count (total/mm3) (in 1000s)	≥40		20 to 39.9	15 to 19.9	3 to 14.9		1 to 2.9		<1
Glasgow Coma Score (GCS) Score = 15 minus actual GCS									
A. Total Acute Physiology Score (sum of 12 above points)									
B. Age points (years) ≤44=0; 45 to 54=2; 55 to 64=3; 65 to 74=5; ≥75=6									
C. Chronic Health Points (see below)									
Total APACHE II Score (add together the points from A+B+C)									

LOCAL SCORING: The following observations are taken into consideration. Presence of three or more observations at the time of admission is defined as severe disease.

1. Age <12 yrs ->50 yrs
2. Male- sex
3. Biliary- less severe (-1)
4. Alcohol intake>180 ml>day
5. Presence of dehydration
6. WBC>12000/cumm
7. Signs of sepsis<48hrs
8. Multiple organ dysfunction
9. Co-existing diseases (Co-morbid)
10. Amylase >4fold rise
11. Lipase >1000
12. CRP>4 fold rise
13. Calcium < 7mg/dl
14. Sodium>150mEq/L
15. Potassium < 3mEq/L

< 3- Mild disease

≥ 3- Severe disease

RESULTS

Age distribution: Age of the patients ranges from 15 years to 67 years. The mean age of incidence is 36.6 years as shown in **Table 1**.

Table 1 Age wise distribution of cases

Age Group	No (s) of patients	Percentage
<20yrs	9	9%
21-30yrs	30	30%
31-40yrs	30	30%
41-50yrs	19	16%
51-60yrs	12	12%
61yrs>	3	3%

Sex incidence: The male and female ratio was 70:30.

DIAGNOSIS

Patients were diagnosed as cases of acute pancreatitis on the basis of clinical features and ultrasonographical and biochemical evidence.

Etiology

Biliary pancreatitis: 35 patients had gall stone disease. Out of these 35 patients, 21 patients were female and 14 male patients. 3 patients of which 1 was male and 2 female had choledocholithiasis in addition to gall stone. 1 female patient had only CBD stone and no gall stone. 2 patients used alcohol on a regular basis.

Alcohol intake: 43 patients took alcohol on a regular basis out of which 42 were male and 1 female patient. 2 alcoholic patients also had gallbladder stones.

Other etiologies: In 16 patients no cause of acute pancreatitis could be determined and were labelled as idiopathic AP

Co-Morbidities: 14 patients had additional co-morbidities among which Diabetes Mellitus (35.7%) was the most common. Co-morbidities are considered significant in APACHE II, but not in RANSON'S criteria.

Ranson's Criteria: Patients with RANSON score more than or equal to 3 were considered severe. 58 patients were considered mild of which 14 patients were female and 44 patients were male.

The average hospital stay of the patients with mild pancreatitis was approximately 6.8 days. There was no death in the mild category. No patient of the mild category required ICU care. 42 patients were considered severe out of which 16 were female patients and 26 were male patients.

The average RANSON score of the severe patients was 4. The average hospital stay of the severe patients was 13.7 days. 12(27.2%) patients required ICU care. 3(6.8%) patients died. Among the 42 severe patients 18 patients had gall stones and 14 patients were alcoholic.

APACHE II SCORE: The average APACHE II score of the patients was 4.17. 79 patients had mild disease and 21 had severe disease when APACHE II score was used. Out of the 79 mild patients 26 were female and 53 were male.

The average APACHE II SCORE of the mild patients was 2.2 for which the average hospital stay was 7.9 days. No death occurred among the patients from mild category. Out of the 21 severe cases, 4 were female and 17 were male.

The average APACHE II score of the severe patients was 11.2. Average hospital stay of the patients was 17 days. 11(52%) patients from the severe group required ICU care. 3(14.2%) patients died. 16(76%) of the patients developed either local or systemic complication.

LOCAL SCORE: As per the local score, 40 patients had mild disease and 60 had severe disease. Out of 40 mild patients, 28 were male and 12 were female. 12 patients had gallstones, 17 patients were alcoholic and 11 patients had other causes of disease (**Table 2**).

Table 2 Distribution of cases as per the local score

Etiology	Numbers	Percentage
Gall Stones	12	30.0%
Alcohol	17	42.5%
Others	11	27.5%

The average hospital stay of the patients with mild disease was 6 days. No patient with mild disease required ICU care. 3 patients developed pseudocyst of pancreas. There was no death in the mild category.

Out of the 60 severe patients 42 patients were male and 18 patients were female. 23 patients had gall stones, 26 patients were alcoholic and 11 cases had other causes of disease.

The average hospital stay of the patients with severe disease was 12.5 days. 12 (20%) patients needed ICU care. 3(5%) patients died. 19(31.6%) had developed complications. The scoring wise mortality predictor is as follows.

RANSON SCORE 0-3- no mortality

≥ 3 –6.8% mortality

APACHE II SCORE <8- no mortality

≥8- 14.3% mortality

LOCAL SCORE Mild- no mortality

Severe- 5%

COMPARISON BETWEEN RANSON, APACHE II AND LOCAL SCORE IN PREDICTING SEVERITY

The sensitivity of RANSON'S scoring system was 81.8% and 66.7% specificity in predicting severe acute pancreatitis. The positive predictive value (PPV) of RANSON'S score was 40% , while negative predictive value (NPV) was 89%.

The APACHE II scoring system had a sensitivity of 72.7% and specificity of 93.4%. The PPV was 76.2% and NPV was 89.8%.

The LOCAL scoring system had sensitivity of 86.3% while specificity of only 47%. The PPV of the scoring system was 31.7% and NPV was 92.5%.

The LOCAL score with 86.3% had the highest sensitivity in the study. APACHE II scoring system with 93.4% had the highest specificity. It also had the highest PPV (76.2%). While RANSON'S and APACHE II scored similar in NPV the LOCAL score had the highest with 92.5%.The high negative predictive value (NPV) allows this score to exclude severe AP outcome.

There was significant correlation between disease severity and RANSON'S score ≥ 3 with ODDs ratio of 9.0, confidence interval of 95% between 2.7619 to 29.3273 and p value .0003.

Significant correlation between disease severity and APACHE II score was found with ODDs ratio 28.4, 95% CI 8.2016 to 98.3424 and p value 0.0001.

The LOCAL score had significant correlation with disease severity with ODDs ratio of 5.71, 95% CI 1.5635 to 20.8930 and p value 0.008 (**Table 3**).

Table 3 Comparison between Scoring Systems and their Correlation with Severity, Mortality, Complications and Hospital Stay

Score	Severity	Mortality	Complication	Hospital Stay
RANSON	Odds ratio 9.0 (2.7619 to 29.3273) p- 0.0003	p-0.09	p- <0.02	6v/s 13days p- <0.0001
APACHE II	Odds ratio 28.4(8.2016 to 98.3424) p- 0.0001	p-0.014	p~0.1	7 v/s 17 days p- <0.0001
LOCAL SCORE	Odds ratio 5.71 (1.5635 to 20.8930) p-0.008	p-0.22	p-<0.01	5v/s 11days p- <0.0001

DISCUSSION

On the basis of data on patients in United States, Asia and Western Europe and from various studies[9, 20] it was seen that gallstones are the most common cause of acute

pancreatitis, accounting for approximately 45% of cases. Alcohol accounts for 35% of the cases being the second most common cause. Some investigators from United Kingdom[21, 22] and Asia[23] have reported gallstones in approximately two thirds of their patients, whereas some centres in United States have reported alcoholism as the predominant cause in two thirds to three quarters of patients.

The cause of AP cannot be established in 2% to 40% patients[24, 25, 26] and termed as idiopathic pancreatitis. In most patients with acute pancreatitis, the cause can be established on the basis of initial history, physical examination, laboratory studies, and abdominal sonography. Patients with unexplained pancreatitis at that point are often considered to have idiopathic disease. However, a cause and, often, effective treatment to prevent recurrent pancreatitis are possible in many of these patients if an aggressive diagnostic approach is taken to discover undiagnosed hyperlipidemia, occult gallstones, abnormalities of the bile and pancreatic ducts, sphincter of Oddi dysfunction, pancreatic cancer and other tumors, and cystic fibrosis (in children and young adults)[27] The factors influencing morbidity and mortality in acute pancreatitis in 279 cases were studied.[28, 29] Study revealed-Mortality in gall stone related pancreatitis was 3% compared with 15% ($p = 0.03$) in pancreatitis of unknown aetiology and 27% ($p = 0.01$) in post-endoscopic retrograde cholangiopancreatography pancreatitis. Mortality was related to age (mortality > 55 years old 11% v 2%; $p = 0.003$.

CONCLUSION

It was concluded that mortality in acute pancreatitis is influenced by age, aetiology of the disease and presence of organ failure.

In our study APACHE II score was found to be better predictor of survivability with good sensitivity and high specificity in predicting disease severity. Even correlation was seen between mortality and APACHE II score. APACHE II score more than 8 was associated with severe disease, longer hospital stay and mortality. However, no association was seen between APACHE II score and complications. But association between Ranson's score and Local score was appreciable. Both had more sensitivity, but were less specific in predicting severe disease and no association were seen with mortality. The high negative predictive value of local score allows the score to exclude severe acute pancreatitis. The patients from the mild group of local scoring are less likely to have severe disease than the patients from the mild group of other two scoring systems (Ranson and APACHE II).

Conflict of interest: None

Ethical clearance: Taken

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Academic Excellence of Member of International Advisory Board of IJHRMLP

Prof. Dalbir Singh MBBS MD, Chandigarh has received life time achievement award in ICFMT conference held at Gurgaon, SGT Medical College, November, 2015.