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Original Research Article

Comparative assessment of severity and prognosis of acute pancreatitis through APACHE II and HAPS predictor models

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ABSTRACT

Background: Acute pancreatitis is one of the leading causes of hospitalization amongst all gastrointestinal disorders with high burden of morbidity and mortality. Predicting the progression of AP in terms of course and outcome to determine suitable management strategy and level of care is challenging. A number of predictor models are developed to predict the severity of acute pancreatitis but they vary in their definitions of severity. HAPS have been proposed as a simple scoring tool for assessment of severity and prognosis of acute pancreatitis. Thus, the aim of present study was to investigate the usefulness of HAPS predictor model against APACHE II model.
Methods: Current investigation was a hospital based prospective study conducted on 80 proven cases of acute pancreatitis at K. K. hospital, Uttar Pradesh. The serum amylase and lipase levels of all enrolled patients, were tested and measured at admission, and at 48 and 72 hours post admission. The pancreatitis-specific clinical investigations like; HAPS, APACHE II were calculated and assessed statistically in terms of sensitivity, specificity, positive and negative predictive values and accuracy.
Results: The findings of present investigation revealed that amongst the two scoring systems, APACHE II was superior predictor model in terms of sensitivity and specificity for various outcomes like severe acute pancreatitis, hospital stay >7 days and in-hospital mortality. However, HAPS exhibited high specificity for all the outcomes.
Conclusions: HAPS can be recommended as a useful tool for early evaluation of acute pancreatitis in patients specifically in primary care settings of developing countries like India.

Keywords: Acute pancreatitis, Prognosis, APACHE II, HAPS, Primary care centres

INTRODUCTION

An acute necro-inflammatory modification in pancreas, characterized histologically by acinar cell destruction is termed as acute pancreatitis (AP).[1] AP is an acute inflammatory disorder which is an acute response to injury of the pancreas that affects multiple body organs in its severe form.[1,2] Amongst all gastrointestinal disorders AP is one of the leading causes of hospitalization and its severity varies widely ranging from mild disease manageable with conservative treatment to complicated and severe disease with high morbidity and mortality rate.[3,4] According to the published literature reports, annual incidence of AP ranges from 15.9 to 36.4 per 100000 persons, and the overall mortality rate of AP ranges from 1.5% in mild cases to 17% in severe AP cases.1-4 Burden of AP on healthcare system is further expected to increase in future. According to the Atlanta system of classification, severe AP (SAP) is associated with multiple organ failure and may additionally include local complications such as necrosis, abscess or pseudocyst formation.[5] Etiology of AP mainly includes idiopathic factors, gallstone/biliary related factors and alcohol related factors. As per prior published reports patients with AP due to alcohol related factors were more

likely to be males whereas females are more likely to have biliary related pancreatitis. The increase in incidence of AP is mostly observed in woman of age <35 years and men between the age group of 35 and 54 years.[3-6]

The diagnosis of AP is comparatively easier, while the major challenge is predicting progression of AP in terms of course and outcome to determine the management strategy and level of care.[7] An precise and accurate predictor strategy to determine the severity of AP, allows early identification of treatment in an intensive care unit (ICU), and/or specific interventions if required.[8] A number of models are developed to predict the severity of acute pancreatitis (AP) based upon clinical, laboratory, and radiologic risk factors, various severity grading systems and serum markers but these predictors systems drastically vary in their definitions of severity thus limiting their applications.[7-9] Also only a few of these predictor models are applicable and can assist immediately upon admission of patients, while others can assist only after 48 to 72 hours or even later after the patients admission.[9] One major hurdle in determination of severity classification for AP is that in wake of so many scoring systems it is difficult for a physician to decide which model would be best suitable, accurate and precise in their clinical settings.

The most widely accepted predictor model for determining the severity in AP is Atlanta classification which divides AP into two groups: mild and severe. In these predictor systems severe AP is defined by the presence of organ failure (OF), local pancreatic complications on imaging (acute fluid collection, pancreatic necrosis (PNec) and pseudocyst and pancreatic abscess).[9,10] However the limitations of Atlanta classification model are its retrospective nature, unspecified duration of organ failure and low mortality due to local complications.[10] Ranson criteria is an another clinical scoring system for pancreatitis that takes into account age along with other physiological parameters to determine the severity of pancreatitis.[11] The acute physiology and chronic health evaluation II (APACHE II) is also one of the most commonly used scoring system based on severity of illness.[11,12] Balthazar score is yet another predictor model to determine severity of AP. It stratifies the patients of acute pancreatitis into different severity categories based on necrosis extent and pancreatic morphologic changes assessed on computed tomography.[13] Limitations of APACHE II and Balthazar scoring systems are their dependence on varied physiological parameters and computed tomography techniques which are feasible only at a highly equipped centre.[10-13] Recently, a simple scoring system requiring only three parameters, *viz.* rebound tenderness and/or guarding, hematocrit and serum creatinine levels was developed as harmless acute pancreatitis score (HAPS).[14,15] HAPS provide a rapid assessment of severity of acute pancreatitis. One of the many advantages of HAPS is that even a non-specialist physician can evaluate the severity of AP with a basic laboratory set up.[14-17]

Keeping in view the promising role of HAPS in limited resource settings in developing countries like India, the present study was proposed to compare and evaluate HAPS usefulness against acute physiology and chronic health evaluation (APACHE II) for prediction of severity of acute pancreatitis in North Indian patients.

Aim and objectives

Aim of current study was to compare the assessment of the severity and prognosis of acute pancreatitis between APACHE II and HAPS. The specific objectives of current investigations were; to assess the severity of acute pancreatitis using HAPS and APACHE II, to compare HAPS and APACHE II scoring systems for assessment of prognosis of acute pancreatitis on admission and to assess the feasibility of HAPS scoring system over complicated APACHE II scoring system.

METHODS

Study design, population, location and duration

Current study was a hospital based prospective study conducted on all proven cases of first episode of acute pancreatitis presenting within 48 hours of symptoms indication; admitted in emergency department of general surgery at K. K. hospital, Lucknow, Uttar Pradesh during the time span of one year from January 2019 to December 2019.

Sample size

Sample size for the current investigation was calculated using the formula as mentioned below on the basis of 80% power of study and incidence of the disease in India;

$$n=Z^2\ pq/E^2$$

Where, n=size of sample, Z=1.96 (statistic, for the level of confidence of 95%), p=expected prevalence or proportion, q=1-p and E=error rate (in proportion of one). As per the calculated sample size total 80 patients were included in the study.

Inclusion criteria

Inclusion criterion for current study was all patients admitted to the study setting with acute pancreatitis between the age group of 18 to 69 years who gave their consent to participate in this study.

Exclusion criteria

Exclusion criteria for current study were; age <18 years or >70 years, serum amylase levels less than thrice the

upper limit of normal, patients with CKD, patients with asthma and patients with HTN.

Procedure for data collection methods and measurement of outcome

In current investigation, severe acute pancreatitis was diagnosed according to revised Atlanta criteria. Diagnosis of AP was made if the patient fulfills at least the two of listed Atlanta criteria of; typical pain in the abdomen, serum amylase or lipase more than thrice the normal upper limit and radiological evidence. The serum amylase and lipase levels of all enrolled patients, were tested and measured at admission, and again at 48 and 72 hours post admission. The pancreatitis-specific clinical investigations like; HAPS, APACHE II, Glassgow coma score, temperature, mean arterial pressure, heart rate, respiratory rate, presence of abdominal rebound tenderness, PaO_2, arterial pH, HCO_3, sodium, potassium, hematocrit (HCT), serum creatinine, WBC, and BUN were investigated. Age, gender, body mass index, etiology, and length of hospital stay were also documented. Outcomes such as total hospital stay, complications including necrosis, development of organ failure, development of hospital acquired infections like urinary tract infection, pneumonia, primary infections necrosis (IN), sepsis and in-hospital mortality were studied. The patients were followed up till discharge. All patient received i.v. fluids after diagnosis, initial assessment (including HAPS) and blood samples were withdrawn in emergency room. APACHE II calculation was done based on parameters shown in (Figure 1). HAPS calculation was done on following basis; patients with peritonitis (rebound tenderness/guarding), creatinine ≥2 mg/dl (177 µmol/l) and hematocrit ≥43% for male or 39.6% (female) are given a score of 1 each and patients with absence of above-mentioned indications ia given a score of 0. A total score of 0 reflects a non-severe course of acute pancreatitis and was termed as marmless (HAPS-0), score ≥1 indicates a possibility of severe course with possible admission to ICU and was termed as no harmless (HAPS+).

	+4	+3	+2	+1	0	+1	+2	+3	+4
Rectal temperature (°C)	≥41	39–40.9		38–38.9	36–38.4	34–35.9	32–33.9	30–31.9	≤29.9
MAP (mmHg)	≥160	130–159	110–129		70–109		50–69		≤49
Heart rate (/min)	≥180	140–179	110–139		70–109		55–69	40–54	≤40
Respiratory rate (/min)	≥50	35–49		25–34	12–24	10–11	6–9		≤5
If FiO_2 ≥50%, check A-a gradient; if FiO_2 <50%, PaO_2									
A-a gradient	≥500	350–499	200–349		<200				
PaO_2 (mmHg)					>70	61–70		55–60	<55
Arterial pH	≥7.7	7.6–7.69		7.5–7.59	7.3–7.49		7.25–7.3	7.15–7.2	<7.15
Na (mM)	≥180	160–179	155–159	150–154	130–149		120–129	111–19	≤110
K (mM)	≥7	6–6.9		5–5.9	3.5–4.9	3–3.4	2.5–2.9		<2.5
Creatinine(mg/L)	≥35	20–34	15–19		6.0–14		<6.0		
Hematocrit (%)	≥60		50–59.9	46–49.9	30–45.9		20–29.9		<20
WBC count(10^9/L)	≥40		20–39.9	15–19.9	3–14.9		1–2.9		<1

Glasgow coma score (GCS): 0–12 points = 15–GCS

Age (y)	Points
<44	0
45–54	2
55–64	3
65–74	5
>75	6

Chronic health (history of chronic conditions)[a]	Points
None	0
If patient is admitted after elective surgery	2
If patient is admitted after emergency surgery or for reason other than after elective surgery	5

Figure 1: Parameters for APACHE II calculation.[12]

At the time of discharge/death, patients were divided into two groups adapted from the Atlanta 2012 classification; mild acute pancreatitis: patients having no local complications or organ failure and moderately severe/severe acute pancreatitis: patients having transient organ failure or local complications or both (moderately severe) and/or patients with persistent organ failure (severe acute pancreatitis). Organ failure was defined based on the modified Marshall scoring system. A score of ≥2 for more than 48 hours was considered as persistent organ failure, whereas a score of ≥2 for less than 48 hours was considered as transient organ failure. Local complications included pancreatic necrosis, acute fluid collections, pseudocyst, acute necrotic collections and walled-off necrosis.

Statistical analysis

Data was analyzed using statistical package for social sciences, version 21.0. Chi-square test, independent

samples 't' test and receiver-operator characteristic curve analysis were performed. The efficacy of two scoring systems was assessed in terms of sensitivity, specificity, positive predictive value, negative predictive value and accuracy.

RESULTS

Demographic and general of 80 patients with diagnosis of acute pancreatitis enrolled in current investigation undertaken to assess the severity and prognosis of acute pancreatitis by comparing APACHE II and HAPS are depicted in (Table 2). Age of patients ranged from 19 to 69 years with a mean of 42.11±15.54 years. Half the patients were aged ≤40 years. Majority of patients were males (63.8%) with nale to female ratio of 1.76. Majority of patients were hindus (76.3%) and remaining were muslims (23.7%). Majority of patients belonged to upper middle socioeconomic group (55%) followed by lower middle (41.3%) and lower-class groups (3.8%) (Table 1). Gall stones (N=52; 65%) was the most common etiology followed by alcohol (N=22; 27.5%) and 3 cases (3.8%) each with hyperlipidemia and idiopathic etiologies. There were no complications in 65 (81.3%) cases (Table 1). However, remaining 15 (18.8%) had complications. There were 4 (5%) cases each with developing pancreatic necrosis, pseudopancreatic cyst and SIRS respectively while remaining 3 (3.8%) had organ failure (Table 1). As per Atlanta classifications, a total of 65 (81.3%) patients were diagnosed with mild acute pancreatitis while remaining 15 (18.8%) were diagnosed with severe acute pancreatitis. APACHE II scores ranged from 2 to 18 with a mean of 7.31±4.16. Majority of patients (76.3%) had APACHE II scores ≤10 (Table 1). A total of 19 (23.8%) had APACHE II scores >10. A total of 65 (81.3%) exhibited HAPS-0 while 15 (18.8%) were HAPS+ (Table 1). Duration of hospital stay ranged from 3 to 18 days. Majority (N=44; 55.0%) had ≤4 days' hospital stays, followed by >7 days (26.3%) and 5-7 days (18.8%), mean duration of hospital stay was 5.51±3.26 days A total of 72 (92.5%) patients were discharged after recovery and there were 6 (7.5%) deaths (Table 1).

No significant association was observed between age, gender, religion, etiology and severity of acute pancreatitis ($p>0.05$). However, lower and lower-middle socioeconomic class had significantly higher proportion of cases with severe acute pancreatitis as compared to mild pancreatitis when compared with upper middle class ($p<0.001$). APACHE II score >10 and HAPS+ also showed a significant association with severe acute pancreatitis ($p<0.001$). Mortality rate was significantly higher in SAP cases (40%) as compared to mild acute pancreatitis (0%) ($p<0.001$). Patients with severe acute pancreatitis had significantly higher proportion of hospital stay >7 days (60%) as compared to mild acute pancreatitis (18.5%) ($p=0.001$) (Table 2).

Table 1: Demographic and general profile of patients and distribution according to etiology, complications, severity (Atlanta classification), prognostic scores and clinical course with outcome.

Characteristic	N	%
Age (years)		
≤20	2	2.5
21-30	24	30.0
31-40	14	18.8
41-50	12	15.0
51-60	12	15.0
61-70	15	18.8
Mean age ±SD (range) in years	42.11±15.54 (19-69)	
Sex		
Male	51	63.8
Female	29	36.3
Religion		
Hindu	61	76.3
Muslim	19	23.7
Socioeconomic status		
Lower	3	3.8
Lower middle	33	41.3
Upper middle	44	55.0
Etiology		
Alcohol	22	27.5
Gall stone	52	65.0
Hyperlipidemia	3	3.8
Idiopathic	3	3.8
Complications		
No complications	65	81.3
Organ failure	3	3.8
Pancreatic necrosis	4	5.0
Pseudo-pancreatic cyst	4	5.0
SIRS	4	5.0
Severity		
Mild	65	81.3
Severe	15	18.8
APACHE II		
≤10	61	76.3
>10	19	23.8
Mean score ±SD (range)	7.31±4.16 (2-18)	
HAPS		
HAPS-0	65	81.3
HAPS+	15	18.8
Hospital stay (days)		
≤4	44	55.0
5-7	15	18.8
>7	21	26.3
Mean duration ±SD (range) days	5.51±3.26 (3-18)	
Outcome		
Discharge after recovery	72	92.5
Death	6	7.5

Table 2: Association of different clinicodemographic parameters and outcome with severity of acute pancreatitis.

Variables	Severe acute pancreatitis (N=15)		Mild acute pancreatitis (N=65)		Statistical significance	
Mean age ±SD (years)	39.27±16.95		42.77±15.26		t=0.785; p=0.435	
	Frequency	**%**	**Frequency**	**%**	**χ^2**	**P value**
Sex						
Male	8	15.7	43	84.3	0.867	0.352
Female	7	24.1	22	75.9		
Religion						
Hindu	10	16.4	51	83.6	0.936	0.333
Muslim	5	26.3	14	73.7		
Socioeconomic status						
Lower	3	100	0	0	21.72	<0.001
Lower middle	10	30.3	23	69.7		
Upper middle	2	4.5	42	95.5		
Etiology						
Alcohol	3	13.6	19	86.4	2.401	0.493
Gall stone	12	23.1	40	76.9		
Hyperlipidemia	0	0	3	100		
Idiopathic	0	0	3	100		
APACHE II						
≤10	3	4.9	58	95.1	32.26	<0.001
>10	12	63.2	7	36.8		
HAPS						
Harmless (HAPS-0)	5	7.7	60	92.3	27.82	<0.001
No harmless (HAPS+)	10	66.7	5	33.3		
Mortality	6/15	40.0	0	0	28.11	<0.001
Hospital stay >7 days	9/15	60.0	12/65	18.5	10.9	0.001

Table 3: Association of different clinicodemographic parameters with duration of hospital stay.

Variable	Hospital stay >7 days (N=21)		Hospital stay ≤7 days (N=59)		Statistical significance	
Mean age ±SD (years)	40.33±16.40		42.75±15.32		t=0.609; p=0.545	
	Frequency	**%**	**Frequency**	**%**	**χ^2**	**P value**
Sex						
Male	13	25.5	38	74.5	0.042	0.838
Female	8	27.5	21	72.4		
Religion						
Hindu	19	31.1	42	68.9	3.182	0.074
Muslim	2	10.5	17	89.5		
Socioeconomic status						
Lower	3	100	0	0	12.54	0.002
Lower middle	4	12.1	29	87.9		
Upper middle	14	31.8	30	68.2		
Etiology						
Alcohol	8	36.4	14	63.6	3.340	0.342
Gall stone	13	25.0	39	75.0		
Hyperlipidemia	0	0	3	100		
Idiopathic	0	0	3	100		
APACHE II						
≤10	9	14.8	52	85.2	17.53	<0.001
>10	12	63.2	7	36.8		
HAPS						
HAPS-0	12	18.5	53	81.5	10.86	<0.001
HAPS+	9	60.0	6	40.0		
Mortality	5/21	23.8	1/59	1.7	10.92	0.001

Table 4: Association of different clinicodemographic parameters with mortality.

Variable	Deaths (N=6)		Survival (N=74)		Statistical significance	
Mean age ±SD (years)	45.00±16.69		41.88±15.54		t=0.471; p=0.639	
	Frequency	**%**	**Frequency**	**%**	**χ^2**	**P value**
Sex						
Male	2	3.9	49	96.1	2.597	0.107
Female	4	13.8	25	86.2		
Religion						
Hindu	6	9.8	55	90.2	2.020	0.155
Muslim	0	0	19	100		
Socioeconomic status						
Lower	3	100	0	0	40.69	<0.001
Lower middle	3	9.1	30	90.9		
Upper middle	0	0	44	100		
Etiology						
Alcohol	0	0	22	100	3.493	0.322
Gall stone	6	11.5	46	88.5		
Hyperlipidemia	0	0	3	100		
Idiopathic	0	0	3	100		
APACHE II						
≤10	0	0	61	100	20.83	<0.001
>10	6	31.6	13	68.4		
HAPS						
HAPS-0	2	3.1	63	96.9	9.77	0.002
HAPS+	4	26.7	11	73.3		

Table 5: Receiver-operator characteristic curve analysis for comparison of prognostic efficacy of APACHE II and HAPS for the outcome's severe acute pancreatitis, hospital stay >7 days and mortality.

Severe acute pancreatitis								
Parameters	**Area under the curve ±SE**	**P value**	**Projected cut-off**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
APACHE II	0.955± 0.023	<0.001	≥10	86.7	87.7	61.9	96.6	87.5
HAPS	0.795± 0.076	<0.001	≥1	66.7	92.3	71.4	91.8	88.0
Hospital stay >7 days and								
APACHE II	0.780± 0.063	<0.001	≥10	66.7	88.1	66.7	88.1	82.5
HAPS	0.663± 0.075	0.027	≥1	42.9	89.8	60.0	81.5	77.5
Mortality								
APACHE II	0.999± 0.002	<0.001	≥15	100	86.5	37.5	100	87.5
HAPS	0.759± 0.116	0.036	≥1	66.7	85.1	26.7	96.9	83.8

No significant association of age, sex, religion and etiology was observed with duration of hospital stay. However, hospital stay >7 days was significantly associated with lower and upper-middle socioeconomic strata as compared to lower middle calls socioeconomic status (p=0.002). Higher APACHE II and HAPS+ were significantly associated with longer duration of hospital stay. No significant association of GCS was observed with hospital stay >7 days. Mortality rate was significantly higher among patients having hospital stay >14 days (23.8%) as compared to those having hospital stay ≤7 days (1.7%) (p=0.001) (Table 3).

No significant association of age, sex, religion and etiology was observed with mortality. However, mortality rate was significantly higher in lower socioeconomic status as compared to lower-middle and upper middle socioeconomic strata (p<0.001). Higher APACHE II scores and HAPS+ were also significantly associated with mortality (p<0.05) (Table 4).

The area under curve values of APACHE II and HAPS were 0.955 and 0.795 respectively (Figure 2). APACHE II at a cut-off ≥10 was 86.7% sensitive and 87.7% specific (Table 5). It had positive and negative predictive

values of 61.9% and 96.6% respectively. The accuracy of APACHE II was 87.5%. HAPS+ (HAPS ≥1) was 66.7% sensitive and 92.3% specific in prognosis of severe acute pancreatitis. It exhibited positive and negative predictive values of 71.4% and 91.8% respectively (Table 5). The accuracy of HAPS was 88%.

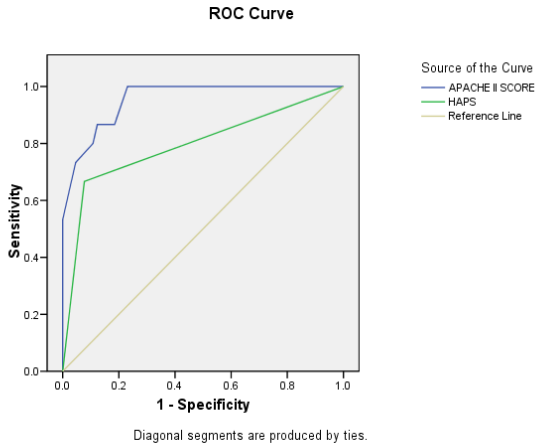

Figure 2: Receiver-operator characteristic curve analysis for comparison of prognostic efficacy of APACHE II and HAPS for the outcome severe acute pancreatitis.

The area under curve values of APACHE II and HAPS were 0.780 and 0.663 respectively (Figure 3). APACHE II at a cut-off ≥10 was 66.7% sensitive and 88.1% specific. It had positive and negative predictive values of 66.7% and 88.1% respectively. The accuracy of APACHE II was 82.5% (Table 5). HAPS+ (HAPS≥1) was 42.9% sensitive and 89.8% specific in prognosis of hospital stay>7 days. It has positive and negative predictive values of 60.0% and 81.5% respectively. The accuracy of HAPS was 77.5% (Table 5).

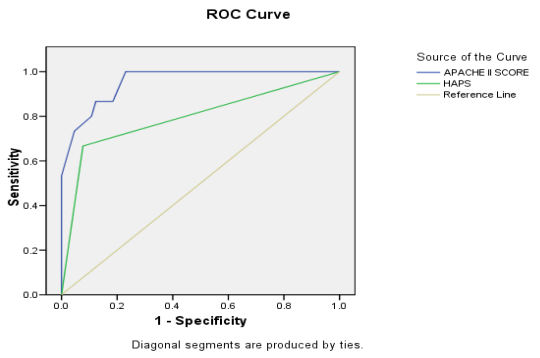

Figure 3: Receiver-operator characteristic curve analysis for comparison of prognostic efficacy of APACHE II and HAPS for the outcome hospital stay >7 days.

The area under curve values of APACHE II and HAPS were 0.999 and 0.759 respectively (Figure 4). APACHE II at a cut-off ≥15 was 100% sensitive and 86.5% specific. It had positive and negative predictive values of 37.5% and 100% respectively (Table 5). The accuracy of APACHE II was 87.5%. HAPS+ (HAPS≥1) was 66.7% sensitive and 85.1% specific in prognosis of mortality. It has positive and negative predictive values of 26.7% and 96.9% respectively. The accuracy of HAPS was 83.8% (Table 5).

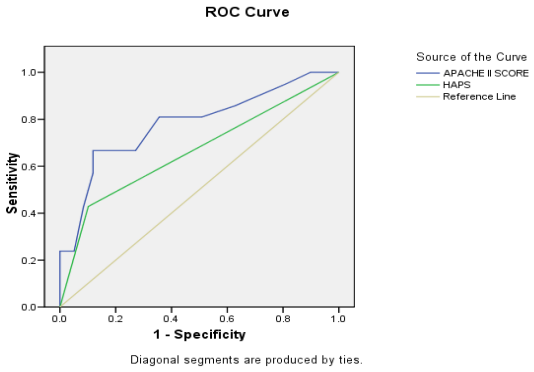

Figure 4: Receiver-operator characteristic curve analysis for comparison of prognostic efficacy of APACHE II and HAPS for the outcome mortality.

DISCUSSION

Epidemiological studies report the risk of acute pancreatitis to be highest in the young age typically between ages 35 and 44 years, with males being affected slightly higher as compared to females. However, age and gender profile in different clinical studies exhibit a considerable variability. Baig et al in their series reported the mean age of patients to be 30 years which is lower than the mean age in present study; however, they reported the proportion of males as 73.3% which is higher than that in present study.[18] Pattanaik et al reported the mean age of patients as 41.1 years which is close to the mean age of patients in present study, however, in their study the proportion of males was much higher (91%) as compared to present study.[19] Most of the published studies report the mean age of patients to be in early forties range with a dominance of males as observed in present study. In present study, there was a dominance of patients from lower middle (41.3%) and upper middle (55%) socioeconomic strata. Acute pancreatitis was observed to be linked with socioeconomic deprivation and a probable link with prevalence of alcoholism in this segment of society. In present study, gall stone (65%) and alcohol (27.5%) were the dominant etiologies. The proportion of those with alcoholic etiology was relatively lower in current study. This may be because gallstone disease has a high prevalence in northern part of India especially around Lucknow. Compared to present study, Jalal et al in their study reported alcoholic etiology to be the more common (56.3%) as compared to gall stone (21.3%).[20] However, Kumar et al in their study, similar to current study reported a dominance of gall stone disease (74%) over alcoholic etiology.[21] As such gall stone disease was

observed to be the most common etiology reported in different published reports similar to present study.

In present study, incidence of severe acute pancreatitis was 18.8%. Complications of severe acute pancreatitis were pancreatic necrosis, pseudo-pancreatic cyst and SIRS and organ failure (n=3; two renal failure, one liver failure) respectively. Compared to present study, Jalal et al in their study reported the complicated course in 31% of patients in their study and severe AP in 32.5% cases.[20] In their study they found pancreatic pseudocyst as the most common complication affecting (13.8% patients) followed by pancreatic necrosis (10%), hemorrhagic pancreatitis (5%) and SIRS (2.5%) patients respectively. Buxbaum et al reported the combined prevalence of moderately severe/severe pancreatitis in 17% of patients and local complications like necrosis, pseudocyst and walled-off pancreatic necrosis in only 11% of cases, however, they reported a high prevalence of SIRS on admission (24%) which enhanced to 50% during the hospital stay.[22] As such, the rate of severe acute pancreatitis and other complications varies substantially in different literature reports depending upon the status of patient at admission and other etiological and management factors. In current study, all the patients were primarily managed conservatively. However, Jalal in their study carried out surgical intervention in 10 (12.5%) patients who developed complications.[20] In present study too, alternate course was adopted in cases developing complications, whenever there was need. A total of four patients developed pancreatic necrosis, out of them two were treated conservatively with i.v. antibiotics and closed monitoring were done with CT abdomen and serial USG. They showed full recovery and were discharged in stable condition. Wide bore Malecot tube inserted in remaining two patients for drainage and conservative management continued subsequently. Patients responded to the treatment well. Out of four patients' developing pseudo-pancreatic cyst, only one patient developed complication and was managed surgically. Kumar et al also reported a dominance of conservative management, and reported surgical intervention for pancreatic necrosis in only 4% of cases.[21] Surgical options in acute pancreatitis are often limited as there is no single operative treatment for acute pancreatitis. The most common indication for intervention in acute pancreatitis is for the treatment of complications and most notably the treatment of infected walled off necrosis. Here, the step-up approach has become established, with prior drainage (either endoscopic or percutaneous) followed by delay for maturing of the wall and then debridement by endoscopic or minimally invasive surgical methods. In present study, a conservative approach was preferred over radical surgical interventions.

Mortality rate in different studies have shown a considerable variability. In present study, severe acute pancreatitis was seen in 18.8% cases and mortality rate was 7.5%. Leung et al however diagnosed severe acute pancreatitis in 21% cases but reported only 3.3% mortality rate.[23] Baig et al on the other hand reported the severe acute pancreatitis in 24.4% patients but did not report any mortality.[18] Compared to published studies, the mortality rate in present study was higher.[20-23] The reason for this could be high proportion of patients with systemic complications, especially acute renal failure which is considered to be a significant predictor of mortality in acute pancreatitis patients. Moreover, the high proportion of patients from lower-socioeconomic class in present study could also be a possible reason for high mortality due to poor nutritional status which might have contributed towards a higher mortality. Moreover, the time taken for financial decision making could also be a reason. As far as hospital stay is concerned, Jalal et al reported mean duration of hospital stay as 6.2 and 10.8 days respectively for mild and severe acute pancreatitis cases.[20] In the study by Kumar et al mean duration of hospital stay was 6.98 days which is slightly higher than that in present study.[21] Lower duration of hospital stay in present study could be owing to the tertiary care status of our facility where most of the patients were referred from primary or secondary care facilities and duration of hospital stay mentioned in the study is only reflective of stay at reported facility.

In current study, no significant association of severe acute pancreatitis was observed with age, gender, religion and etiology. Significantly lower proportion of those with upper middle socioeconomic status as compared to lower and lower-middle socioeconomic status had severe acute pancreatitis. APACHE II scores >10 and HAPS+ status was significantly associated with higher risk of SAP. Patients with severe acute pancreatitis had significantly higher rate of mortality and prolonged hospital stay (>14 days) as compared to those with mild acute pancreatitis. Pezzilli et al in their study observed a significant association of severity of acute pancreatitis with male gender and age >55 years.[24] In present study, only a few (18.8%) patients were above 60 years of age, and as such the lower proportion of patients with higher age could be one of the reasons for absence of this relationship. As far as association of lower socioeconomic strata with severe acute pancreatitis is concerned, it is seen to have a socioeconomic correlation at least in India, with a possible linkage of alcoholic etiology and poor nutritional reserves of the body. With respect to association of APACHE II and HAPS with severe acute pancreatitis, prolonged duration of hospital stays and mortality, the findings of present study were similar to published reports.[22-30] In present study for all the outcome, APACHE II had higher AUC values as compared to HAPS. For outcomes mortality and prolonged hospital stay too, it has been shown to have high area under curve (AUC) values. In contrast, similar to findings of present study, HAPS has been shown to have low area under curve values for prediction of severe acute pancreatitis, mortality and longer duration of hospital stay with values as low as 0.54 (for severe acute pancreatitis).[31] It was observed that for all the outcomes, the sensitivity of

HAPS was lower as compared to APACHE II, however, for outcomes like severe acute pancreatitis and hospital stay >7 days, HAPS had higher specificity as compared to APACHE II. For the outcome mortality, both the sensitivity and specificity of HAPS were lower as compared to that of APACHE II. As such, HAPS only showed to have a useful role in prediction of SAP and that too in terms of high specificity only. A high sensitivity and specificity of APACHE II for adverse outcomes has been reported in literature.[25-30] For SAP, Maheshwar et al found APACHE II to be 83.3% sensitive and 86.1% specific which is close to present study.[30] All these findings establish APACHE II to be a highly useful prognostic score in acute pancreatitis. As far as poor performance of HAPS is concerned, its performance has been questioned in many published studies. It has been stated to be more specific while its sensitivity has always been questioned.

Although, like previous study reports it was observed in current investigation that HAPS hold limited value for prediction of severe course of disease. The high specificity of HAPS in prediction of severe acute pancreatitis indicates its high true negative rate, i.e., its high ability to rule out non-severe course of disease (i.e. harmless acute pancreatitis) which has also been endorsed by Al-Qahtani et al who were of the view that HAPS is effective in rapid identification of patient who will run non-severe course of AP.[32] In present study, we found that HAPS performed dismally in prediction of prolonged hospital stay where its sensitivity and specificity was only 42.9% and 89.8% respectively. Thus, HAPS despite its simplicity and early calculability lack to determine the severe course of disease, however, a high specificity for all the adverse outcomes showed that HAPS could be used more specifically for harmless course of acute pancreatitis, the very purpose for which the score was proposed.

Although in the present study HAPS score above 0 was taken as indicator of adverse outcome, in order to enhance the sensitivity of the HAPS for adverse outcomes, however, we found that even doing so did not result in an increased sensitivity. In fact, HAPS-0 is an indicator of an almost complication free status of patients at the time of admission and hence could be used as a predictor of harmless course of disease, however, the number of variables is not sufficient enough to detect the severe course of disease. The usefulness of HAPS lies only for primary care settings with low infrastructure which can use HAPS for referral purposes. The HAPS score more than 0 thus reflect only a probability of severe course of disease while HAPS-0 scores being specific for a harmless course of disease indicates that the patient can be managed successfully even in primary care settings. In view of rapid physiological changes taking place in case of acute pancreatitis, reliance should be paid on scoring systems that take into account larger number of physiological changes, from this point of view APACHE II is a better predictor than HAPS.

Limitations

The results of distribution of patients in respect to their socioeconomic status and other factors related to their socioeconomic status may be biased as high prevalence of patients from middle socioeconomic strata was observed in the current medical facility owing to the fact that the facility is run by a charitable society and mainly caters to the lower and deprived segments of the society. Larger sample size and prediction of usefulness oh HAPS at variable time intervals for variable etiologies could have lead to more significant and concrete conclusion.

CONCLUSION

The findings of current investigation revealed that although APACHE II and HAPS were useful in assessment of severity of acute pancreatitis and its prognosis, of the two scoring systems, APACHE II was superior for almost all the outcomes with respect to both sensitivity and specificity. However, for almost all the outcomes, HAPS had a high specificity, thus showing that it was more useful in prediction of a harmless clinical course of acute pancreatitis. Given its ease of calculation, it could be recommended as a useful tool for early evaluation of acute pancreatitis patients specifically for decision making for referral in primary care settings.

Recommendations

From the findings of current investigation authors recommend that; assessment of severity of acute pancreatitis should be done in all the cases, for primary settings, HAPS must be used as a decision making tool for referral to secondary or tertiary care centers, in higher centers, APACHE II should be used as a prognostic tool for assessment of severity and outcome, further studies evaluating usefulness of HAPS at variable time intervals, *i.e.* at admission, 24 hour and 48 hour should be done and studies on larger sample size should be done to evaluate the usefulness of HAPS for variable etiologies separately.

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