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Accuracy of bedside index for severity in acute pancreatitis 'BISAP' score in predicting outcome of acute pancreatitis

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Abstract

Introduction: Early identification of severe acute pancreatitis is of paramount importance in the management and for improving outcomes. Bedside index for severity in acute pancreatitis (BISAP) is a simple and accurate score for stratification in acute pancreatitis. This study was conducted to find out the accuracy of BISAP score in predicting outcomes of acute pancreatitis in local population.

Method: We prospectively analyzed 96 patients with acute pancreatitis from February 2019 to December 2019. Revised Atlanta classification was used to stratify mild, moderately severe and severe pancreatitis. BISAP score was calculated within 24 hours of admission. Accuracy was measured by area under receiver operating curve (AUC).

Result: Out of 96 patients, alcohol related acute pancreatitis accounted for 74.7%. There were 63.2% of mild AP, 37.3% of moderately severe AP, 9.4% of severe AP and 15.8 % of pancreatic necrosis. The AUC for moderately severe AP, severe AP and pancreatic necrosis were 0.77 (CI 0.68-0.87), 0.95 (CI 0.90-0.99) and 0.87 (CI 0.79-0.96) respectively. The statistically significant BISAP cut off for diagnosing sever AP was≥3, and ≥2 for moderately sever AP and pancreatic necrosis. There was positive correlation between revised Atlanta severity of acute pancreatitis and length of hospital stay (r=0.41). Mortality was 3.3 % which was seen in BISAP score 3 or above.

Conclusion: BISAP is a simple predictive model in identifying patient at a risk of developing different severity of pancreatitis and its outcome in our population.

Keywords: bedside index for severity in acute pancreatitis (BISAP), moderately severe pancreatitis, outcome, severe acute pancreatitis

Introduction

Most cases of acute pancreatitis have mild and self-limiting course (80-90%) whereas 10-20% follow a more severe course with pancreatic necrosis and organ failure with mortality rate up to 40%.[1] It is necessary to predict severity of disease early in order to improve outcome by assisting in early triage for intensive care and selection for specific interventions.

There are multiple predictive models available, the most commonly used being Ranson's, Glasgow, and APACHE II.[2] However, these models are complex and have limitations.[3,4] Bedside index of severity in acute pancreatitis (BISAP) score is a simple, validated model in Nepalaese population, for quick assessment in predicting severe acute pancreatitis with a predictive value comparable to Ranson's score.[5,6]

The purpose of this study was to predict the severity of acute pancreatitis and its outcome (pancreatic necrosis, length of hospital stay and mortality) by BISAP score in our population.

Method

A prospective observational study was performed in department of Gastroenterology in Bir hospital, National Academy of Medical Sciences (NAMS) from February 2019 to December 2019. Patients with age ≥18 years with diagnosis of acute pancreatitis who gave informed consent were enrolled in the study. The diagnosis of acute pancreatitis was based on the presence of two of the following features: (i) abdominal pain consistent with acute pancreatitis (ii) serum lipase or amylase activity ≥3 times of upper limit of normal and (iii) characteristic findings of acute pancreatitis on contrast enhanced computed tomography (CECT) or trans-abdominal ultrasonography (USG). The patients were assessed by adequate history, thorough examination and necessary investigations. BISAP scores were calculated on all patients based on data obtained within 24 hours of presentation, Table 1.

The sample size is calculated from below mention formula:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}{}^2 p(1-p)}{d^2}$$

Z1-a/2 = Is standard normal variate
p = Expected proportion in population based on previous studies or pilot studies.
d = Absolute error or precision

So, by taking account of normal variate error 5% type 1 error (P<0.05) it is 1.96, precision/absolute error of 5% and expected population of severe pancreatitis of 7 % as from previous study done in Nepal, the sample size will be around 100.

The severity of acute pancreatitis was stratified as mild, moderately severe, and severe according to Atlanta 2012 guidelines.[7] In mild acute pancreatitis there was no organ failure or local or systemic complications. In moderately severe acute pancreatitis, there was organ failure that resolves within 48 hours (transient organ failure) and/or local or systemic complications. In severe acute pancreatitis there was persistent organ failure (>48 h) of single or multiple organ failure. Systemic complications were defined as exacerbation of pre-existing co-morbidity, such as coronary artery disease or chronic lung disease, precipitated by the acute pancreatitis.[6] Organ failure was defined as a score ≥2 in one or more of three organs (respiratory, renal and cardiovascular) in Modified Marshall scoring system,[7] Table 2. Evidence of local complication (Per/pancreatic fluid collection and necrosis) was assessed by CECT in indicated patient.

All patients enrolled in study were managed according to standard management protocols as guided by treating physician. All relevant data were collected at time of discharge. The study was approved by Institutional Review Board (IRB) of NAMS.

Continuous variables were presented in mean and standard deviation or mode depending on the distribution. Categorical data were presented as proportion. The linear association of severity, necrosis, organ failure and mortality by BISAP score were assessed by chi square test. The association of BISAP score with Atlanta severity of pancreatitis and duration of hospital stay were done by correlation. The receiver operating characteristic (ROC) Curve was examined for optimal BISAP scores for predicting severity, necrosis, organ failure and mortality. A p-value of <0.05 was considered statistically significant. All statistical calculations were performed with SPSS version 20.

Result

All of 96 patients enrolled in the study presented with pain; mild, moderately severe, and severe acute pancreatitis accounted for 63.2%, 37.3% and 9.4% respectively. Three patients, all with severe acute pancreatitis, died during the course of treatment (mortality 3.1%). Trend for increasing severity, pancreatic necrosis, organ failure and mortality with increasing BISAP score were statistically significant (P<0.05). There was significant association between increasing BISAP score and Atlanta severity of acute pancreatitis (r=0.73, P<0.001). There was a positive correlation between increasing BISAP score and increasing length of hospital stay (r=0.41, P<0.001), Table 3. Alcohol related acute pancreatitis was the most common etiology, followed by gall stone and idiopathic.

ROC curves for BISAP score predicting moderately severe acute pancreatitis (MSAP), severe acute pancreatitis (SAP) and pancreatic necrosis (Pnec), were AUC of 0.77 (95% CI 0.68–0.87), 0.95 (95% CI, 0.90-0.99) and 0.87 (95% CI, 0.79-0.96) respectively. The BISAP score cut off values, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were ≥2, 69%, 78%, 76%, 71% (for MSAP) ; ≥3, 88%, 94%, 93%, 89% (for SAP) and ≥2, 86%, 75%, 77% , 84% (for Pnec) respectively, Table 5.

Table 1. Components of the BISAP scoring system[5]

BUN > 25 mg/dl
Impaired mental status (Glasgow Coma Scale Score < 15)
SIRS SIRS is defined as two or more of the following: (1) Temperature of < 36 or > 38 ° C (2) Respiratory rate > 20 breaths/min (3) Pulse > 90 beats/min (4) WBC < 4,000 or >12,000 cells/mm 3 or >10% immature bands
Age > 60 years
Pleural effusion detected on imaging
BISAP, bedside index for severity in acute pancreatitis; SIRS, systemic inflammatory response syndrome. One point is assigned for each variable within 24 h of presentation and added for a composite score of 0 – 5.

Table 2. . Criteria for organ failure based on Modified Marshall scoring system for Severe Acute Pancreatitis[7]

Organ system	Score				
	0	1	2	3	4
Respiratory (PaO_2 /FiO_2)	>400	301-400	201-300	101-200	<101
Renal (serum (cr, mg/dl)	≥ 1.5	>1.5-1.8	1.9 -3.5	3.6 - 4.9	>4.9
Cardiovascular (syst BP)	>90	<90, fluid responsive	<90, fluid unresponsive	<90, pH <7.3	<90, pH<7.2

Table 3 Demographic, clinical characteristics and outcome of patients with acute pancreatitis (N=95)

Variables	Items	N (%)
Demography	Age (year)	39±15
	Male/Female	71/24
Etiology	Alcohol	71 (74.7)
	Gallstones	10 (10.3)
	Idiopathic	12 (12.6)
	Post –ERCP	2 (2.1)
	Hypertriglyceridemia	1 (1.05)
Pain Abdomen	Pain Abdomen	96 (100)
Vomiting	Vomiting	60 (63.2)
SIRS	SIRS	54(56.8)
Severity	MAP	61(63.5)
	MSAP	26(27.3)
	SAP	9 (9.4)
Outcomes	Local complication	
	Fluid Collection	32 (33.7)
	Necrosis	15 (15.8)
	Both	13 (13.3)
	Any Organ Failure	
	Transient (< 48 h)	6 (6.1)
	Persistent (> 48 h)	9 (9.2)
	Hospital Stay (days)	
	MAP	4 (3-10)
	MSAP	5 (5-60)
	SAP	10 (4-15)
	ICU admissions	
	MAP	0
	MSAP	1(1.05)
	SAP	7(7.36)
	Death	
	MAP	0
	MSAP	0
	SAP	3 (3.1)

ERCP, endoscopic retrograde cholangiopancreatography; SIRS, Systemic inflammatory response syndrome; MAP, mild acute pancreatitis; MSAP, moderately severe acute pancreatitis; SAP, severe acute pancreatitis

Table 4. Observed MSAP, SAP, PNec, transient OF, persistent OF and mortality stratified by BISAP score.

BISAP score	Number of Patients	MSAP	SAP	PNec	Transient OF	Persistent OF	Mortality
0	35	1 (3)	0	0	0	0	0
1	28	7 (25)	0	2 (7.1)	2 (7.1)	0	0
2	20	13 (65)	1 (5)	4 (20)	1 (5)	1 (5)	0
3	10	3 (30)	7 (70)	9 (90)	3 (30)	7 (70)	2 (20)
4	2	2 (100)	0	0	0	0	0
5	1	0	1 (100)	0	0	1 (100)	1 (100)

BISAP, Bedside index for severity; MAP, mild acute pancreatitis; MSAP, moderate severe acute pancreatitis; SAP, severe acute pancreatitis; PNec, pancreatic necrosis; OF, organ failure.
linear association (p value) for different grades of acute pancreatitis, PNec, Transient OF, Persistent OF and mortality were < 0.001, <0.001, 0.01, < 0.001 and <0.001 respectively.

Table 5. AUC, BISAP cut off, sensitivity, specificity, PPV, NPV of different outcomes of acute pancreatitis

	AUC (95% CI)	BISAP Cut off	Sensitivity	Specificity	PPV	NPV
Moderately Severe AP	.77 (.68-.87)	2 or >	69%	78%	76%	71%
Severe AP	.95(.90- .99)	3 or >	88%	94%	93%	89%
Pancreatic necrosis	.87(.79 - .96)	2 or >	86 %	75 %	77 %	84 %

AUC, area under the receiver operating curve; PPV, positive predictive value; NPV, negative predictive value

Discussion

In our study majority of the patients were male (N=71; 74.7%), and alcohol induced acute pancreatitis accounted for 74.7% (N=71), which were similar to findings from other studies.[8,9] Biliary pancreatitis was the major cause in other Nepalese study. Discrepancy might be due to enrolment of patient in gastroenterology department. Biliary cases might be selectively admitted in surgical department.[6,10] Nine patients (9.4%) were classified as severe acute pancreatitis (Atlanta classification) which was similar to other studies done by Lakhey et al. (7 %) and Cho et al. (7.4%).[10,11]

We found significant correlation between BISAP score and Atlanta grades for severity of acute pancreatitis (r=0.73). There was statistically significant linear trend of increasing BISAP score with occurrence of pancreatic necrosis, organ failure and mortality ($p<0.05$). Similar trend was mentioned in other studies.[12,13] The AUC of BISAP score in predicting severe pancreatitis was 0.95 (95% CI 0.90-0.99) in our study which was better than other studies (0.68 and 0.79).[8,14] By taking cut off of BISAP score ≥3 the sensitivity and specificity were 88 % and 94 % respectively. In comparison to other studies the specificity was higher.[8,13] Similarly the AUC for predicting pancreatic necrosis was 0.87 (95% CI, 0.79-0.96) which was comparable to other studies (0.82 and 0.83).[8,13] With BISAP cut off ≥2 the sensitivity and specificity were 86% and 75% respectively. The differences may be related to different factors like geographical differences, lifestyle, and genetic basis of study participants. However, we did not compare BISAP score with other standard predictive models. The performance of BISAP score in predicting different outcomes of acute pancreatitis was similar to APACHE II, Ranson's and CT severity index.[14,15,16]

Moderately severe pancreatitis comprised 27.3% in our study. The proportion was similar to validation study done by Lakhey et al. (33%) in this subgroup.[10] The AUC of BISAP score for this subgroup was 0.77 (95% CI 0.68–0.87). With BISAP cut off at ≥2, the sensitivity and specificity were 69% and 78% respectively. So far, studies predicting accuracy of BISAP score in this subgroup is lacking.

There were three deaths in our study (3.1%), all in severe pancreatitis. Among them two had BISAP score 3 and one had score of 5. Similar mortality rates have been reported in studies done by Carnovale et al. (4.8%) and Singh et al. (3.5%).[17,18] Though there was trend of increased mortality with BISAP score ≥3, further analysis could not be done because of few numbers of cases in this category.

There are few limitations of this study. Majority of acute pancreatitis in this study population were due to alcohol and so comparison with other etiology could not be made. There were significant proportion of mild pancreatitis, and relatively small number of severe pancreatitis for performing a proper subgroup analysis. We did not compare our results with other predictive models like Ranson`s and APCHAE II which might limit the effectiveness of accuracy of BISAP score in our population.

Conclusion

BISAP score is an effective tool to predict severity of acute pancreatitis and its outcome viz. pancreatic necrosis and length hospital stay. Because of its simplicity and risk stratification within 24 hours of admission, this score is helpful in guiding management of acute pancreatitis.

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Conflict of Interest

None.

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Author Contribution

All authors made substantial intellectual contribution to the study.

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