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Original Research Article

BISAP plus serum lactate dehydrogenase: a new scoring system for assessment of severity of acute pancreatitis

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ABSTRACT

Background: Acute Pancreatitis is a process of acute inflammation of pancreas along with peripancreatic tissue and multi organ involvement. To reduce morbidity and mortality by predicting the course of the disease and do an early intervention several scoring systems have been proposed such as RANSON'S score, BISAP score, APACHE II etc.
Methods: Patients are chosen with clinical diagnosis of acute pancreatitis over a period of 6 months, based on inclusion criteria, with consent. They underwent investigations base d on the scoring systems and institutional protocol. The different scoring systems were used and calculated. The effectiveness of all the scoring systems were calculated using Microsoft Excel indicating its sensitivity, specificity, accuracy, positive and negative predictive value.
Results: BISAP with LDH (BISAP PLUS) shows the highest sensitivity (85.71%), Positive predictive value (70.59%), Negative predictive value (84.62%) and Accuracy (76.67%) among different scoring systems. The highest specificity was seen in APACHE II (75%)
Conclusions: Use of BISAP plus serum LDH (BISAP plus) can help in daily assessment and quicker management of acute pancreatitis and should be studied further, as it is showing promise in helping in management of acute pancreatitis.

Keywords: BISAP, BISAP plus, LDH, APACHE II, Ranson's Score, Acute pancreatitis

INTRODUCTION

Acute Pancreatitis is a process of acute inflammation of pancreas along with peripancreatic tissue and multi organ involvement. Approximately 80% of patients either have gallstones or history of sustained alcohol abuse.[1] Malnutrition, independent of alcohol abuse, is a factor for pancreatitis. Males are affected more than females in third world countries.[2] It represents a spectrum of disease with mortality rates up to 24%.[3] Most patients present with a mild disease, however approximately 20% run a severe course associated with high risk of mortality and require appropriate management in an intensive care unit.[4] To reduce morbidity and mortality by predicting the course of the disease and do an early intervention several scoring systems have been proposed such as RANSON'S score, BISAP score, APACHE II etc. RANSON'S score is developed based on 11 clinical and biochemical parameters taken at two stages. The 11-point scoring system was measured in 2 stages: 5 initial data points on admission (Age, WBC count, Blood glucose level, Serum LDH level and serum AST) and a further 6 data points (Haematocrit, fluid sequestration, Serum calcium, PaO2, Blood urea nitrogen level and Base deficit) within the subsequent 48 hours. Mortality 0 to 2 points: 0% to 3%, 3 to 4 points: 15%, 5 to 6 points: 40%, 7 to 11: nearly 100%.[5] APACHE II is a scoring system used in Acute Pancreatitis using 12 parameters, Temperature, MAP (mmHg), Heart rate, Respiratory rate, PaO2, pH, Na, K, S. Creatinine, HCV, TLC, GCS. Mortality greater with score of 8 or

higher.[6] BISAP score was calculated using data from 24 hours following admission. BISAP score uses five parameters which include Age >60 years, BUN >25 mg/dl, Impaired mental status, SIRS, Pleural effusion. BISAP score greater or equal to 3 has a significantly higher mortality, with high specificity and low sensitivity 56%.[7-9] Serum LDH is currently used as a stand-alone parameter to predict persistent organ failure in acute pancreatitis.[10] There is no ideal single method in assessing the severity of the disease. Individual preference and available institutional facilities influence the method chosen for prognostic assessment of acute pancreatitis.[11]

Objectives

The objective of the study is to study effectiveness of different scoring systems currently present for assessment of severity of acute pancreatitis, and to assess the effectiveness of BISAP plus Serum LDH, in assessment of severity of acute pancreatitis.

METHODS

A prospective study done in the department of general surgery in Rajarajeswari medical college and hospital over a period of 6 months from April 2021 to September 2021.

Inclusion criteria

Patients with provisional diagnosis of Acute Pancreatitis, that included at least first 2 of the 3 criteria i.e., Acute pain abdomen, Serum Amylase and Serum lipase elevated three times their normal value, Imaging showing evidence of Acute pancreatitis were included.

Exclusion criteria

Patients of less than eighteen years of age, patients with pancreatitis following trauma, Patients not giving willing consent were excluded.

Patients satisfying the above-mentioned criteria are admitted for the study. They undergo routine investigations along with Arterial blood gas, Serum Amylase (S. Amylase), Serum Lipase (S. Lipase), Serum Calcium (S. Calcium), Serum Lactate Dehydrogenase (S.LDH). The patients also undergo Ultrasonogram of abdomen, Chest X-Ray, and CECT-Abdomen. Using the above data, BISAP, S.LDH, APACHE II and RANSON's criteria Scoring-Systems are calculated. The cut-off values for the above scoring systems are based on criteria for Severe Acute Pancreatitis that is based on Revised Atlanta Criteria i.e., BISAP (greater or equal to 3), S.LDH (greater or equal to 1), APACHE II (greater or equal to 8), and RANSON's score (greater or equal to 3, RANSON's score is done over 48 hrs). Following comparison of the different scoring systems, the combination of BISAP with S. LDH was devised to improve the effectiveness of BISAP on identifying and quickly intervening in cases of severe acute pancreatitis for early recovery and for preventing complications of severe acute pancreatitis. Findings were tabulated in Microsoft Excel and assessed with the help of SPSS by using Chi-Square and t test.

BISAP

Criteria has the following criteria, Blood urea nitrogen (>25 mg/dl), Altered mental status (defined as any disorientation, lethargy, somnolence, coma or stupor), pleural effusion(assessed in CT or Chest X-Ray), age > 60 years, and the systemic inflammatory response syndrome (SIRS) defines by presence of more than 2 of the following(each criteria is given 1 point and the total BISAP score was calculated): pulse >90 bpm, Rate of respiration >20 cpm or $PaCO_2$ <32 mmHg, temperature >38ºC or <36ºC, WBC count >12000 or <4000 cells/mm^3 or >10% immature neutrophils. BISAP score ≥3, is indicative of severe acute pancreatitis (SAP).

RANSON's score

Criteria is split into two parts. First part involve parameters during the time of admission and the second part is assessed after 48 hours (Each criterion is given 1 point). Components of Criteria at the time of admission: Age >55yrs, WBC count >16000/mm^3, blood glucose >200 mg/dl, AST >250 IU/l, LDH >350IU/l. Components of Criteria studied after 48 hours, blood urea nitrogen rise >5 mg%, arterial oxygen saturation (PaO2) 4 mEq/l, fluid needs >6l, haematocrit fall >10%. Ranson's Score ≥3, is the cut-off for severe acute pancreatitis.

APACHE II

APACHE II (Acute physiology and chronic health evaluation) has 12 criteria's with the cut-off ≥8 for severe acute pancreatitis. The following are the criteria for APACHE II: Body temperature, heart rate, rate of respiration, mean arterial blood pressure, oxygenation, arterial pH, serum potassium, serum sodium, serum creatinine, haematocrit, WBC and Glasgow coma scale.

Serum LDH

It is a new parameter used in assessing the severity of Acute pancreatitis as suggested by Chui et al with a cut-off of ≥647 U/l Serum LDH was studied as an independent prognostic factor for assessment of severity of acute pancreatitis.

BISAP plus serum LDH

The idea of combining the different scoring system to boost the accuracy of a scoring system. The strategy of improving on the scoring system is more beneficial if we combine simple pre-existing scoring systems that can be done on regular intervals to assess the progression of a disease on treatment. The Serum LDH is divided into 3 scores, where <350mg/dl is 0, 350 to 650mg/dl is 1 and >650mg/dl is 2. It is combined with the pre-existing score

of BISAP with a cut-off for severe acute pancreatitis is ≥4 (Table 1).

Table 1: BISAP plus serum LDH.

Parameters	Score
Blood urea nitrogen >25 mg/dl	1
GCS <15	1
SIRS	1
Age >60 years	1
Pleural effusion	1
Serum LDH (mg/dl)	
<350	0
350 to 650	1
>650	2

Each parameter is allotted 1 point. The cut-off for severe acute pancreatitis is ≥4.

Table 2: Demographic profile of the study.

Parameters	N (%)
Gender	
Male	54 (90)
Female	6 (10)
Mean age (yrs)	47.5
Clinical features	60 (100)
Pain abdomen	48 (80)
Vomiting	26 (43)
Abdominal Distention	26 (43)
Fever	18 (30)
Constipation	30 (50)
Etiology	
Jaundice	14 (23)
Alcohol	34/60 (57)
Biliary	12/60 (20)
Biliary and alcohol	2/60 (3)
Idiopathic	12/60 (20)
Type of acute pancreatitis	
Mild to moderate	32/60 (53)
Severe	28/60 (47)
Complications following sever acute pancreatitis	
Pseudocyst	15/28 (54)
Acute Kidney Injury (AKI)	6/28 (21)
Acute Respiratory Distress	3/28 (11)
Syndrome (ARDS) Necrosis	2/28 (7)
Death	2/28 (7)

Statistical analysis

The data was analysed using the SPSS program IBM v.22. The results of the study were presented in terms of the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of all the involved scoring systems and the associated ROC curve and AUC is calculated. The data representation was in the form of table and graphs.

RESULTS

The results of the different scoring systems were tabulated in (Tables 3-7). All the patients in our study were categorised as Severe Acute pancreatitis with a Ranson's score of ≥3, and others (i.e., mild to moderate acute pancreatitis) with RANSON'S score of <3. Table 3 shows us that about 30 of 60 patients were identified as having Severe Acute Pancreatitis and the remaining 30 has having mild to moderate pancreatitis. All the patients in our study were categorised as Severe Acute pancreatitis with a APACHE II score of ≥8, and others (i.e. mild to moderate acute pancreatitis) with APACHE II score of <8, (Table 4) shows us that about 22 of 60 patients were identified as having Severe Acute Pancreatitis and the remaining 38 has having mild to moderate pancreatitis.

Table 3: Diagnostic value of RANSON's SCORE in predicting disease severity (n=60).

RANSON's Score	Atlanta classification (n=60)		
	SAP (Positive)	Others (negative)	Total N (%)
Positive (≥3)	20	10	30 (50)
Negative (<3)	8	22	30 (50)
Total	28	32	60 (100)

SAP-severe acute pancreatitis.

Table 4: Diagnostic value of APACHE II in predicting disease severity (n=60).

APACHE II	Atlanta classification (n=60)		
	SAP (Positive)	Others (negative)	Total N (%)
Positive (≥8)	14	8	22 (37)
Negative (<8)	14	24	38 (63)
Total	28	32	60 (100)

Table 5: Diagnostic value of BISAP score in predicting disease severity (n=60).

BISAP score	Atlanta classification (n=60)		
	SAP (Positive)	Others (negative)	Total N (%)
Positive (≥3)	24	17	41 (68)
Negative (<3)	04	15	19 (32)
Total	28	32	60 (100)

Total 11 the patients in our study were categorised as Severe Acute pancreatitis with a BISAP score of ≥3, and others (i.e., mild to moderate acute pancreatitis) with BISAP score of <3. About 41 of 60 patients were identified as having Severe Acute Pancreatitis and the remaining 19 has having mild to moderate pancreatitis (Table 5). All the

patients in our study were given individual score from 0, 1 and 2 based on there Serum LDH level i.e., <350U/l, 350 to 650U/l and >650U/l respectively.

Table 6: Diagnostic value of serum LDH in predicting disease severity (n=60).

Serum LDH	Atlanta classification (n=60)			
	Score	SAP (Positive)	Others (negative)	Total N (%)
<350 U/l	0	10	15	25 (42)
350 to 650 U/l	1	16	17	33 (55)
>650 U/l	2	02	0	02 (3)
Total	-	28	32	60 (100)

Table 7: Diagnostic value of BISAP plus serum LDH score in predicting disease severity (n=60).

BISAP plus serum LDH	Atlanta classification (n=60)		
	SAP (Positive)	Others (negative)	Total N (%)
Positive (≥4)	24	10	34 (57)
Negative (<4)	04	22	26 (43)
Total	28	32	60 (100)

Compared against severity of acute pancreatitis based on revised atlanta classification. All the patients in our study were categorised as Severe Acute pancreatitis with a BISAP plus Serum LDH score of ≥4, and others (i.e., mild to moderate acute pancreatitis) with BISAP plus Serum LDH score of <4, (Table 7) shows us that about 34 of 60 patients were identified as having Severe Acute Pancreatitis and the remaining 26 has having mild to moderate pancreatitis.

All the patients in our study were evaluated and scored of severity of acute pancreatitis using different scoring systems and their respective sensitivity, specificity, Positive predictive value, negative predictive value and accuracy were calculated to assess their effectiveness in categorising the severity of acute pancreatitis. The table helps in understanding the significance (p value <0.05) of the result of our study based on the p value, other than Serum LDH (p value 0.381) study group rest of the scoring system had significant results. It also tells us about the effectiveness of the individual scoring system by providing the AUC. The highest AUC seen in 0.93 for BISAP plus Serum LDH. The figure provides us the graphical representation of our study data to assess the effectiveness of the different scoring systems.

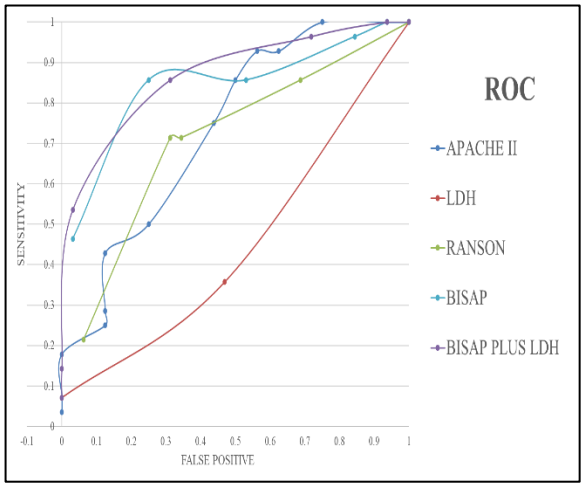

Figure 1: ROC of different scoring systems.

DISCUSSION

Accuracy and swift response to detect severe acute pancreatitis is important to reduce mortality. An ideal scoring system should be simple, safe, cheap and less time consuming. BISAP with S.LDH is one of the new scoring systems to predict the severity of acute pancreatitis. The test contains 6 variables and can be done bedside within 24 hrs.

Table 8: Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of different scoring systems.

Statistics (%)	BISAP	BISAP plus Serum LDH	RANSON's	APACHE II	Serum LDH Score (≥1)
Sensitivity	85.71	85.71	71.43	50.00	35.71
Specificity	46.88	68.75	68.75	75.00	53.12
PPV	58.54	70.59	66.67	63.64	40.00
NPV	78.95	84.62	73.33	63.16	48.57
Accuracy	65.00	76.67	70.00	63.33	45.00

Table 9: P value and area under curve (AUC) of different scoring systems.

Statistic	BISAP	BISAP plus serum LDH	RANSON's	APACHE II	Serum LDH (≥1)
P value	0.006783	0.000022	0.001901	0.044987	0.381673
AUC	0.9	0.93	0.82	0.78	0.7

Table 10: Comparison of our results with other studies in assessment for severe acute pancreatitis.

	Reference	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
Ranson's	Khanna et al	83.9	78	74.3	86.5	80.6
	Gao et al	66	78	-	-	-
	Our Study	71.4	68.75	66.67	73.33	70.00
BISAP	Khanna et al	74.2	68.3	63.4	77.8	70.8
	Georgios et al	37.5	92.4			
	Our Study	85.71	46.88	58.54	78.95	65.00
APACHE II	Khanna et al	80.6	82.9	78.2	85.0	81.9
	Jianhua et al	87	65	-	-	-
	Our Study	50.00	75.00	63.64	63.16	63.33
Serum LDH	Jing Chui et al	76.2	98.8	-	-	-
	Our Study	35.71	53.12	40.00	48.57	45.00
BISAP plus serum LDH	Our Study	85.71	68.75	70.59	84.62	76.67

Our study revealed that among 60 patients diagnosed with acute pancreatitis, 54 were male and 6 were female, with a mean age of 47.5 yrs. The study had a total of 60 patients over a period of 6 months clinically diagnosed with acute pancreatitis. With 54 (90%) patients being male and 6 (10%) patients being female. With the mean age of patients with acute pancreatitis of 47.5 years, with maximum range of patients between the age of 30 to 39 years of age. The clinical features seen in patients with clinical diagnosis of acute pancreatitis are pain abdomen (100%), Vomiting (80%), abdominal distention (43%), fever (30%), constipation (50%) and jaundice (23%). 36 (60%) patients were with history of alcohol intake and 14 (23%) having biliary etiology and 12 (20%) being idiopathic and 2 (3%) with both alcohol and biliary etiology. With mortality of 3% with among 2 from 60 patients belonging to severe acute pancreatitis. The complications noted in our study are: pseudocyst (15/60 i.e., 25%), Acute kidney injury (6/60=10%), Acute respiratory distress (3/60=5%), pancreatic necrosis (2/60=3.3%), Death (2/60=3.3%). As shown in the (Table 10). Comparison of outcome with different studies that are Khanna et al, Gao et al, Georgios et al, Wan et al and Cui et al showed comparable results.[6-10,13] We had compared the Area under the curve (AUC) for a more statistically significant review of the scoring systems, where the greater AUC showed more accurate scoring system, Our study showed AUC of 0.93 for BISAP plus Serum LDH versus 0.876 for only Serum LDH by Cui et al, 0.81 for BISAP by Geogios et al, 0.78 for APACHE II by Geogios et al, 0.94 for RANSON'S Score by GEOGIOS et al. Our study showed the highest sensitivity for BISAP and BISAP plus Serum LDH at 85.71%, highest specificity for APACHE II at 75%, highest accuracy of 76.67% for BISAP plus Serum LDH, Highest Positive predictive value of 70.59% for BISAP plus Serum LDH, and highest negative predictive value of 84.62% for BISAP plus Serum LDH. The highest area under the curve was at 0.93 for BISAP plus Serum LDH, indicating it to be one of the better diagnostic scoring systems in our study group.

CONCLUSION

The study reveals that pre-existing scoring systems for initial assessment of severity of Acute pancreatitis, like Ranson's criteria need to be done over 48hrs, it will delay the initiation of treatment protocol, APACHE II is one of the most complex scoring systems and has one of the least accuracies based on our study. Use of BISAP with serum LDH (BISAP plus) can help in daily assessment and quicker management of acute pancreatitis and should be considered. I would also like to suggest the need for further study of this new scoring system for a more accurate assessment of this new study.

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