A comparison of the BISAP score and Amylase and BMI (CAB) score versus for predicting severe acute pancreatitis

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Abstract

Background and aims **: Early prediction of severe acute pancreatitis (SAP)would be helpful for triaging patients to the appropriate level of care and intervention. The aim of this study is to compare the performance of the Change in Amylase And Body mass index (CAB) score and BISAP score for predicting SAP.**

Patients and methods **: A total of 406 with AP were enrolled. The age, gender, body mass index(BMI), blood urea nitrogen determined at the time of admission and serum amylase determined on day 1 and day 2 after hospitalization were collected and analyzed statistically.**

Results **: Multivariable analysis confirmed that blood urea nitrogen (OR 1.06; 95%CI 1.03-1.09) and percentage change in amylase day 2 (OR 0.75; 95%CI 0.65-0.87) were independently associated with development of SAP. No statistically significant association was observed between BMI (OR 1.04; 95%CI 0.95-1.13) and severity of acute pancreatitis. The area under the receiver operating characteristic curve for Body mass index (BMI), percentage change in amylase day 2, BISAP score and CAB score were 0.57±0.05, 0.68±0.04, 0.84±0.03 and0.53±0.05, respectively.**

Conclusions **: BISAP is more accurate for predicting the severity of acute pancreatitis than the CAB score.** (Acta gastroenterol. belg., **2019**, 82, **397-400**).

Keywords : BMI, CAB score, Severe acute pancreatitis, Predictor, Risk factor, BISAP score

Introduction

Acute pancreatitis (AP) is a common gastrointestinal disease. Most patients with AP develop a mild course while about 20% of the patients develop a complicated clinical course with significant morbidity and mortality. Early prediction of severe acute pancreatitis may play an important role in the emergency room management of these patients. Various prognostic scoring systems have been developed, such as Ranson's score, the APACHE-II score, the bedside index of severity of AP (BISAP) (1), and the harmless acute pancreatitis score (HAPS) (2). However, Mounzer et al reported (2**)** that these clinical scoring systems have only moderate diagnostic accuracy in the prediction of severe acute pancreatitis (SAP).

Recently, Kumaravel et al (3), from the Cleveland Clinic Foundation, reported a simple score based only on the Change in Amylase and BMI (namely CAB score) which could accurately predict the severity of acute pancreatitis. However, this score has not been validated in patients with AP in different countries and race. In addition, BISAP score is a convenient, prognostic scoring system for severity of AP. As little study has compared BISAP with the CAB score, the aim of the present study was to compare the performance of the CAB score and BISAP score for prediction of SAP.

Materials and methods

Consecutive patients with AP admitted at the First Affiliated Hospital of Wenzhou Medical University between 2012 and 2015 were enrolled. Exclusion criteria included: time from pain onset to admission>3 days, recurrent acute pancreatitis, and organ failure before data collection, chronic pancreatitis, pancreatic tumor, pregnancy, intoxication and unavailability of complete data. In addition, patients with increased amylase on day 2 were also ruled out because only the slope of the decrease in serum amylase levels was measured in the study by Kumaravelet al**(3)**.

Age, gender, body mass index (BMI) andBUNwere recorded at admission. All patients underwent an abdominal CT scan within 6 hours of admission and the presence of pleural effusion was recorded. BISAP was calculated at admission according to the laboratory and physiological data (1).Serum amylase was measured ont day1 and day 2 after admission. As described by Kumaravel et al (3),at first, we calculated the z-score with the following formula:z-score = -5.9 + (0.14×BMI (kg/m2) + (0.01×Percent change in amylase day 2). Of which, the percentage change in serum amylase day 2 was defined as: [(amylase day 1 - amylase day 2)/amylase day 1 × 100]. Then, we calculated the Change in Amylase and BMI (CAB) score with the following formula : CAB score=100×exp(z-score)/(1+exp(z-score)).

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The diagnosis of acute pancreatitis was based on two of the three following factors: (i) abdominal pain(ii) serum amylase and/or lipase > 3 times the upper limit of normal(iii) characteristic findings of AP on ultrasongraphy or computed tomography (4).According to the revised Atlanta criteria (4), the severity of acute pancreatitis was classified into mild, moderate, and severe. Severe acute pancreatitis was considered if they had persistent organ failure (cardiovascular, pulmonary or renal failure that persisted for >48 hours), with organ failure being defined as a modified Marshall score >2 (4).

This study protocol was approved by the Ethic Committee of the First Affiliated Hospital of Wenzhou Medical University. This study was performed according to the principles expressed in the Declaration of Helsinki and informed consent was obtained from the subjects.

Statistical analysis

Categorical values were described by count and proportions and compared by the $\chi 2$ test. Continuous values were then expressed by the median and interquartile range and compared by Wilcoxon signed-rank test. Multiple logistic regression analysis was used to identify the independent predictors of SAP. Multicolinearity was considered to be significant if the largest variance inflation factor exceeded 10 (5). Odds ratios (OR) were calculated with 95% confidence intervals (CI). The performance of potential predictors was also evaluated by receiver operating characteristic (ROC) curve analysis. The area under the ROC curve (AUC) was used to evaluate the performance of predictions. A predictor with an AUC above 0.7 was considered useful, while an AUC between 0.8 and 0.9 indicated excellent diagnostic accuracy (5) .

P values below 0.05 were considered significant. All statistical procedures were performed with Stata 10.0 software.

Results

Patient Characteristics

A total of 406 patients were enrolled. The median age was 49 years (IQR39-65) and 60.69% patients were males. The median BMI of the patients was 23.5 (IQR 21.2-26.0). The most common etiology was biliary (182/406, 44.8%), followed by idiopathic (130/406, 32.0%, alcohol (60/406, 14.8%), hypertriglyceridemia (21/406, 5.2%) and others (13/406, 3.2%). Of all patients, there were 310 (76.4%), 54 (13.3%), 42 (10.3%) patients who developed mild, moderate and severe acute pancreatitis, respectively. The mean time interval between onset and admission was 1.80±0.78 days.

Independent predictors of SAP : univariable and multi-variable analysis

As shown in Table 1, univariable analysis indicated that etiology, BUN at admission, amylase at admission and amylase on day 2 and BISAP score were significantly associated with the severity of AP. Patients with SAP had a higher proportion of idiopathic etiology, greater serum amylase and higher BISAP score compared to patients without SAP. No significant statistical differences were observed between patients with and without SAP with respect to age, gender, etiology, BMI or CAB score.

According to the results of collinearity diagnostics, serum amylase on day 1 and day 2 was not included into multivariable logistic regression because of collinearity with percent change in amylase. Multivariable analysis confirmed that BUN (OR 1.06 ; 95% CI 1.03-1.09 ; P<0.0001) and percentage change in amylase day 2(OR 0.75 ; 95% CI0.65-0.87 ; P<0.0001) were independently associated with development of SAP after adjusting by age, gender and etiology. No statistically significant

Table 1. — **Univariate analysis of predictive factors of SAP in 406 patients**

Variable	No SAP(n=364)	SAP(n=42)	**P values**
Age(yr) (IQR)	48(38, 65)	54.5(41, 66)	0.190
Male sex(%)	225(61.8)	21(50)	0.138
Etiology (%)			0.035
Biliary, N (%)	168(46.2)	14(33.3)	
Alcohol, N (%)	56(15.4)	4(9.5)	
Hypertriglyceridemia,N (%)	17(4.7)	4(9.5)	
Idiopathic, N (%)	114(31.3)	16(38.1)	
Other, N (%)	9(2.5)	4(9.5)	
BMI(kg/m2) (IQR)	23.5(21.2, 26.0)	24.2(22.1, 26.6)	0.145
BMI>23.99(Overweight), N (%)	161(44.23)	25(59.52)	0.060
BUN (mmol/l)(IQR)	4.7(3.7, 6.1)	8.5(5.7, 13.5)	<0.001
Amylase at day 1(IQR)	761(325, 1843)	1231(748, 2122)	0.022
Amylase at day 2(IQR)	233(103.5, 515)	261(330, 1245)	<0.001
BISAP score(IQR)	1(0, 1)	2(1, 3)	<0.001
CAB score(IQR)	-2.02(-2.31, -1.67)	-2.08(-2.31, -1.74)	0.432

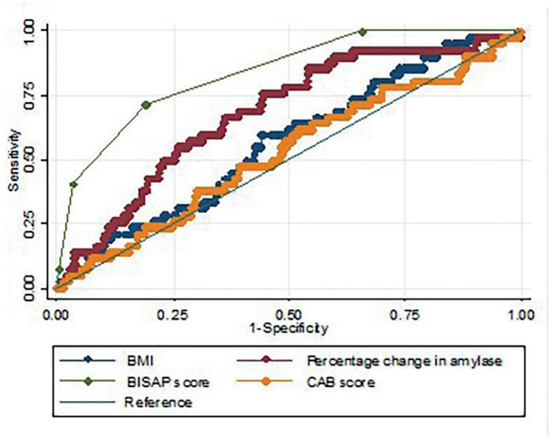

Figure1. — ROC curves for various predictors for SAP. The AUCs for Body mass index(BMI),percentage change in amylase day 2, BISAP score and CAB score were 0.57±0.05,0.68±0.04, 0.84±0.03 and0.53±0.05, respectively.

association was observed between BMI (OR 1.04 ; 95%CI0.95-1.13 ; P=0.393) and severity of acute pancreatitis.

Performance of potential predictors of SAP: ROC analysis

As shown in Figure1, the AUCs for Body mass index (BMI), percentage change in amylase day 2, BISAP score and CAB score were 0.57±0.05, 0.68±0.04, 0.84±0.03 and0.53±0.05, respectively. The BISAP score was a useful predictor of SAP, with AUC of more than 0.7.On the other hand, BMI, the percent change in the amylase and CAB score were not useful predictors of SAP, with AUC of less than 0.7.

Discussion

The results of the present study demonstrate firstly that percentage change in amylase day 2 (OR 0.75 ; 95% CI0.65-0.87) was independently associated with the development of SAP after adjusting by age, gender, etiology. No statistically significant association was observed between BMI (OR 1.04 ; 95% CI0.95-1.13) and severity of acute pancreatitis. Secondly, based on ROC analysis, BMI, percentage change in amylase day 2 and CAB score were not useful predictors of SAP, with AUC of less than 0.7. BISAP score was a good predictor of SAP, with AUC of more than 0.8.

Obesity is thought to be associated with a low-grade inflammatory status in normal circumstances (6). Several studies have shown that obesity is associated with development of SAP. De Waele et al(7)reported that Patients with class II and III obesity (BMI 35-49.9) had more organ failure and local complications than did their normal-weight counterparts. Sempere et al. (8) reported that obese patients and patients with central fat distribution had significantly more comorbidity, a higher proportion of severe AP and more intense systemic inflammatory response syndrome. These may be because obesity amplifies the inflammatory response to pancreatic injury by upregulating the proinflammatory mediators leptin, TNF-a, IL-6 which play important roles in the pathogenesis of multisystem organ failure (6).

The association between high BMI and severity of AP has been controversial. Numerous meta-analyses have consistently confirmed that general obesity worsens the course of AP (9).BMI, as a measure of body fat based on height and weight, has been proposed as a valuable prognostic index of severe acute pancreatitis (3,10). However, Abu Hilalet al. (11) proposed that android fat comprises intra-abdominal and visceral fat, an important feature of the metabolic syndrome, and plays a more significant role in acute pancreatitis than obesity itself. Mery et al. (6) reported that android fat distribution by waist-to-hip ratio and waist circumference were significantly associated with severity. A recent population-based prospective cohort study by Sadr-Azodi et al. (12) showed that waist circumference (as a proxy for abdominal adiposity), but not BMI (as a proxy for total adiposity), is an independent risk factor for the development of acute pancreatitis. It was suggested that visceral adipose tissue releases greater amounts of inflammatory mediators such as vascular endothelial growth factor, IL-6, and plasminogen activator inhibitor 1 compared with subcutaneous fat in obese humans (11). An alternative explanation for these differences may be due to the variations among studies regarding etiology and race. Evidence from the literature showed that the relationship between BMI and body fat percent differs among different ethnic groups (13). Possible explanations for these differences might be differences in activity level (14), in relative leg lengths (15) and/or in frame size (13).Our multivariable analysis suggested that no statistically significant association was observed between BMI and severity of acute pancreatitis after adjusting by age, gender and etiology (OR 1.04 ; 95% CI0.95-1.13). Furthermore ROC analysis showed that BMI was not an ideal predictor with an AUC of 0.57 (Figure 1).

Many serum enzymes such as amylase, lipase, trypsinogen, are available to diagnose AP, but elevated amylase levels continue to be the “gold standard” among the serum markers (16). Total serum amylase was also the most convenient laboratory test for the diagnosis of acute pancreatitis because of the simplicity and rapidity of its’ determination. Repeating serum amylase tests is thought to have no value in assessing the clinical progress of the patients or ultimate prognosis, once the diagnosis of AP has been made (16). However, recently, Kumaravel et al (3) suggested that percentage change in amylase day 2 was a useful predictor of SAP (AUC=0.726). Our study showed that percentage change in amylase day 2 (OR 0.75 ; 95% CI0.65-0.87) was independently associated with development of SAP after adjusting by age, gender and etiology. However, based on ROC analysis, it

achieves an AUC of 0.68 (Figure 1) in predicting SAP, which means it was not a useful predictor.

Both percentage change in amylase day 2 and BMI are major components of the CAB score (3).Therefore, CAB score may be not a useful predictor since both the percentage change in serum amylase and BMI perform poorly in predicting SAP in our study. As expected, our univariable analysis showed there was no difference in CAB score between patients with and without SAP (Table 1).Based on ROC analysis, CAB score achieved an AUC of 0.53 (Figure 1), which means it was not an ideal predictor of SAP. As to BISAP score, Kumaravel et al reported that BISAP score was not a useful predictor of SAP with an AUC of 0.67 (3). In the study by Kumaravel et al, the BISAP score was analyzed as a dichotomous variable (score : ≤2 versus >2) when calculating AUC. Dichotomization of a continuous predictor has many disadvantages such as notably a considerable loss of power (17).In our study, as well as most studies in the literature (1,18), BISAP score was analyzed as a continuous variable when calculating AUC. Our study indicated that BISAP score was a good predictor of SAP, with AUC of more than 0.8. This was consistent with a previous report from Korea (18).

In conclusion, percentage change in amylase day 2 was independently associated with development of SAP. No statistically significant association was observed between BMI and severity of acute pancreatitis. BMI, percentage change in amylase day 2 and CAB score were not good predictors of SAP.BISAP is more accurate for predicting the severity of acute pancreatitis than the CAB score.

Author Contributions

*These authors contributed equally to this work.

WH joined in the design of the study and carried out the studies, LZ, WH and JP participated in data collection. LZ, WG, WH and SS conducted data analysis and drafted the manuscript. SS and JP helped to finalize the manuscript. All of the authors read and approve the manuscript.

Competing financial interests

The authors declare that they have no competing financial interests.

Ethics approval and consent to participate

This study protocol was approved by the Ethic Committee of the First Affiliated Hospital of Wenzhou Medical University. This study was performed according to the principles expressed in the Declaration of Helsinki and informed consent was obtained from the subjects.

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