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ARAŞTIRMA / RESEARCH

Evaluation of scoring systems in terms of early prediction of severe acute pancreatitis and mortality in patients over 65 years of age.

65 yaş üstü hastalarda puanlama sistemlerinin şiddetli akut pankreatiti ve mortaliteyi erken öngörme açısından değerlendirilmesi

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Abstract

Purpose: The aim of this study is to investigate the power of disease severity scores to predict the development of Severe Acute Pancreatitis (SAP) and mortality in the early period over 65 years old diagnosed with acute pancreatitis in the emergency department.
Materials and Methods: We calculated RANSON (on admission) and Computed Tomography Severity Index (CTSI) in addition to Bedside Index for Severity in Acute Pancreatitis (BISAP) score on admission to the emergency department.
Results: One hundred and sixty patients (46.9% over 80 years of age) were included in the study. We observed statistically higher length of hospitalization, longer duration of stay in the intensive care unit, SAP and higher mortality in patients over 80 years of age. When we examined the ROC curve, we determined that the AUC values of the BISAP score were highest in both SAP and mortality estimation (AUC: 0.911, 95% CI 0.861-0.962; AUC: 0.918, 95% CI 0.864-0.9722, respectively). Binary logistic analysis indicated a 4.7-fold increased risk for SAP and a 12.3-fold increased mortality for each unit increase in BISAP score value.
Conclusion: BISAP may be a good predictor for SAP and mortality estimation on admission to the emergency department in patients over 65 years of age with acute pancreatitis.

Keywords:. BISAP, CTSI, mortality, RANSON, severe acute pancreatitis

Öz

Amaç: Bu çalışmanın amacı, acil serviste akut pankreatit tanısı alan 65 yaş üstü hastalarda hastalık şiddeti skorlarının erken dönemde Şiddetli Akut Pankreatit (SAP) gelişimini ve mortaliteyi öngörme gücünü araştırmayı amaçladık.
Gereç ve Yöntem: Acil servise başvuru sırasında Yatak Başı Akut Pankreatit Şiddet İndeksi (BISAP) skoruna ek olarak RANSON (ilk başvuru) ve Bilgisayarlı Tomografi Şiddet İndeksi (CTSI) hesaplandı.
Bulgular: Çalışmaya yüz altmış hasta (%46,9'u 80 yaş üstü) dahil edildi. 80 yaş üstü hastalarda istatistiksel olarak daha yüksek hastanede yatış süresi, yoğun bakımda kalış süresi, SAP ve daha yüksek mortalite gözlemledik. ROC eğrisini incelediğimizde, BISAP puanının AUC değerlerinin hem SAP hem de mortalite tahmininde en yüksek olduğunu belirledik (AUC: 0.911, %95 CI 0.861-0.962; AUC: 0.918, %95 CI 0.864- 0.9722, sırasıyla). İkili lojistik analiz, BİSAP puan değerindeki her birim artış için SAP için 4,7 kat artan risk ve 12,3 kat artan ölüm oranı gösterdi.
Sonuç: BISAP, 65 yaş üstü akut pankreatitli hastalarda acil servise başvuruda SAP ve mortalite tahmini için iyi bir öngörücü olabilir.

Anahtar kelimeler: BİSAP, CTSI, mortalite, RANSON, şiddetli akut pankreatit

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INTRODUCTION

There has been an increase in age-related acute and chronic diseases with the increase in the older adults population and the resulting prolonged life expectancy[1]. Geriatric patients constitute 20% of the patients applying to the emergency department with abdominal pain[2,3]. Biliary disorders appear as one of the common causes of abdominal pain in this population[4-6].

Acute pancreatitis (AP) is a clinical condition that can be fatal, progressing from self-limiting acute inflammation of the pancreatic gland to potentially systemic involvement and as a result, multi-organ failure[7]. Considering the etiological causes, acute biliary pancreatitis in patients over 65 years old constitutes approximately 70% of all AP[8]. With increasing age, the ability of the gallbladder to contract in response to the cholecystokinin enzyme decreases and gallstone formation is triggered as a result of the increase in the cholesterol and phospholipid content of bile; moreover, the diameter of the bile duct increases leading to biliary tract diseases and biliary pancreatitis[9]. Severe Acute Pancreatitis (SAP) is defined as AP with organ failure lasting >48 hours[10]. A wide mortality rate ranging from 20% to 60% has been reported in SAP[11]. In recent years, there has been an increase in the morbidity associated with AP in the population over 65 years of age and especially in individuals over 80 years of age[12,13]. At the same time mortality, hospitalization rates and hospital costs are reported to have increased in this patient group[8, 14-16]. Initiation of effective and adequate treatment through the early recognition of SAP is the basic step to reduce the mortality due to AP in patients over 65 years of age. For this reason, various laboratory, clinical and radiological prediction scoring systems are used today in order to detect SAP in the early period, provide better care to patients, and reduce mortality[17]. CTSI, RANSON and BISAP score are disease severity scores used for this purpose.

Computed tomography helps guide the diagnosis of acute abdominal diseases and the selection of appropriate treatment[18]. Computed Tomography Severity Index (CTSI) is the radiological scoring system used for AP[19]. It has been shown to detect local complications such as pancreatic parenchymal necrosis and fluid collection. The RANSON[20] score, which includes five parameters obtained on admission and six parameters obtained 48 hours after admission, is an old score. RANSON Score is been used for long time for evaluating the severity of AP. It has the disadvantage of requiring a full 48 hours to be completed. The RANSON score calculated at admission provides triage to admit patients to critical care units. BISAP[21], proposed by Wu et al. in 2008, is a new simple bedside prognostic score that is easily calculated for the assessment of disease severity at presentation. It is an important advantage that it is formed with the data collected within the first 24 hours after admission to the hospital. However, which score can be more effective and useful early in patients with AP over 65 years of age is still controversial.

The aim of this study is to investigate the power of BISAP, RANSON (on admission) and CTSI scores to predict the development of SAP and mortality on admission to the emergency department in patients over 65 years of age diagnosed with acute biliary pancreatitis.

MATERIALS AND METHODS

Patients

This retrospective observational study was conducted in Adana City Training and Research Hospital as a single center. The study was carried out in the emergency department of a tertiary hospital between 01/10/2017-01/10/2020. It was initiated following the approval of the lokal ethics committee (Number of ethics committee meetings: 103, date: 07.04.2022, decree no: 1883) and was carried out according to the Declaration of Helsinki and Good Clinical Practice Guidelines. The data were collected retrospectively from patients hospital electronic database records. Patients over the age of 65 hospitalized in the emergency department with the diagnosis of acute biliary pancreatitis according to the Revised Atlanta Classification[10] were included in the study.

Inclusion criteria were;

1. Patients over the age of sixty-five
2. Patients meeting at least two of the following criteria: abdominal pain consistent with AP and/or elevation of serum amylase and/or lipase more than three times the upper normal range, and/or abdominal ultrasound or computed tomography findings suggestive of AP,

3. Patients having gallstones or sludge in the gallbladder or common bile duct (biliary pancreatitis) after excluding alcohol, hyperlipidemia, etc. and other etiological causes.

Exclusion criteria were;

1. Patients diagnosed with non-biliary pancreatitis,
2. Patients whose files and laboratory data could not be fully accessed,
3. Patients who did not have contrast-enhanced abdominal computed tomography image.

The sample size was estimated with G*Power for Mac OS X (version 3.1.9.2; Universität Dusseldorf, Germany). Accordingly, with a Type-1 error of 5%, a Type-2 error of 5% (power 95%), and a two-sided analysis, the sample size was determined as 98 patients. Considering a possible protocol bias, adding 10% patients to each arm was planned; hence, 108 were determined as the minimum number of volunteers to be included.

Data collection

The patients included in the study were divided into two groups as 65-79 years old and over 80 years old to analyze age-related clinical differences. The patients' demographic characteristics, clinical findings, laboratory parameters, radiological findings, length of hospital stay, local and systemic complications, in-hospital outcome data were obtained from the patient files and the hospital electronic data processing system and recorded in the case form.

Scoring systems

Revised Atlanta classification

AP diagnosis was made based on the following symptoms mentioned in the Revised Atlanta Classification[10]:

- Abdominal pain consistent with AP,
- Elevation of serum amylase and/or lipase higher than three times the upper normal range and/or,
- Abdominal ultrasound or computed tomography findings suggesting AP

Patients who met at least two of the above criteria were defined as AP patients.

According to the Revised Atlanta classification[10], the severity of AP in the patients was defined and classified as based on the following:

- Mild pancreatitis; absence of organ failure and local or systemic complications,
- Moderate pancreatitis; temporaray organ failure (resolved within 48 hours), local or systemic complications not accompanied by temporary and/or permanent organ failure (>48 hours),
- Severe pancreatitis defined as permanent organ failure in which one organ or more organs are involved (>48 hours).

Of the acute pancreatitis;

- Local complications were defined as acute peripancreatic fluid collections, pancreatic pseudocyst, acute necrotic collection and organized necrosis (walled-off necrosis),
- Systemic complications were defined as shock, renal failure, respiratory failure, cardiac complications, metabolic complications (hyperglycemia, hypocalcemia, hypomagnesemia), main bile duct, adjacent organ (duodenum, colon, ureter) obstruction, small bowel ileus, gastrointestinal bleeding, fat necrosis. The presence of these complications was recorded.

Organ failure was defined using the modified Marshall[22] scoring system. Organ failure was defined in patients with ≥2 points out of three systems (cardiovascular, pulmonary, renal). If the organ failure score remained high for more than 48 hours, it was defined as permanent organ failure.

Bedside Index for Severity in Acute Pancreatitis (BISAP)[21]

This score was calculated upon admission to the emergency department. BISAP score criteria are thus: BUN>25 mg/dL, impaired mental status, SIRS≥2, age >60, presence of pleural effusion. 1 point is given for each criterion. Total point is 5. The cut-off point taken for the estimation of SAP based on BISAP score is 3. BISAP score of ≤ 2 is classified as mild acute pancreatitis and BISAP score of ≥ 3 is classified as severe acute pancreatitis (SAP).

RANSON score

The RANSON[20] score has 11 criteria for the diagnosis of the severity of acute biliary pancreatitis, 5 of which are used at the time of admission and 6 of which are used within the next 48 hours. In our study, we used the RANSON first admission score because we investigated the effectiveness of the scores at the time of admission to the emergency department.

RANSON biliary pancreatitis admission criteria at the time of admission were thus: age>70 years, WBC count >18000 cells/mm, blood glucose >220mg/dL, serum AST >250IU/L, serum LDH >400IU/L. 1 point is given for each criterion. Total RANSON (On admission) point is 5. The cut-off point taken for the estimation of SAP based on RANSON score is 3.

Computed Tomography Severity Index (CTSI)

The patients included in the study were screened with multi-detector CT scanner (a 64-channel) Philips Ingenuity Core 128. Radiologists with at least 5 years of experience interpreted contrast-enhanced abdominal computed tomography images without knowing the laboratory findings and clinical features of the patients. In the light of these comments, Computed Tomography Severity Index (CTSI)[19] was calculated. CTSI;

- Grading of pancreatitis (Balthazar score); A: normal pancreas: 0 point, B: enlargement of pancreas: 1 point, C: inflammatory changes in pancreas and peripancreatic fat: 2 point, D: ill-defined single peripancreatic fluid collection: 3 point, E: two or more poorly defined peripancreatic fluid collections: 4 points.
- Pancreatic necrosis; None: 0, ≤30%: 2, >30-50%: 4, >50%: 6 points.
- The maximum score that can be obtained is 10 points. CTSI was assigned according to the total points: mild pancreatitis 0-3; moderate pancreatitis 4-6; severe pancreatitis 7-10.

Outcome

The primary outcome of this study is to reveal the power of these scores to predict SAP in patients with AP over the age of 65 in the emergency department in the early period, and the secondary outcome is to reveal the power of these scores to predict mortality.

Statistical analysis

Data analyzes were conducted through examining demographic, clinical, laboratory and radiological differences between the age groups. Mean, standard deviation, median lowest, highest, frequency and ratio values were used in the descriptive statistics of the data. The distribution of variables was measured with the Kolmogorov-Smirnov test. Independent sample t-test and Mann-Whitney U test were used in the analysis of quantitative independent data. Fisher's exact test was used when Chi-square ($\chi 2$) and Chi-square ($\chi 2$) conditions were not met in the analysis of qualitative independent data. ROC analysis and curve were performed to find out the power of BISAP, RANSON, CTSI scores to predict SAP and mortality. The Youden index, which takes the highest sensitivity and specificity point on the ROC curve, was used to determine the cut-off value. A binary logistic regression analysis was carried out to identify predictors of SAP and mortality. SPSS 25.0 (SPSS 25.0 for Windows, Chicago, IL, USA) and MedCalc programs were used in the analysis. For all analyzes a p value of <0.05 was considered statistically significant.

RESULTS

While a total of 710 patients were diagnosed with AP in the emergency department during the course of the study, 212 of these patients were over 65 years of age. Of the 212 patients, 22 patients were referred to other hospitals because there were not any rooms available, 4 patients did not accept to sign admission papers, 8 patients did not have abdominal computed tomography, and 18 patients had AP due to other reasons (6 had post-ERCP, 2 were alcoholic, 4 had pancreatitis tumor, and 6 were idiopathic) and therefore they were all excluded from the study. No hyperlipidemic pancreatitis was observed in patients over 65 years of age.

One hundred and sixty patients over 65 years of age (68.1% female, mean age 79±5.9 years) with acute biliary pancreatitis were included in the study. 53.1% of the patients were Group 1 (65-79 years) and 46.9% were Group 2 (≥80 years) patients. Statistically, pulse rate ($p<0.001$) was higher and mean arterial pressure (MAP) ($p=0.039$) was lower in Group 2 patients.

Considering the analysis of laboratory parameters between age groups, while urea, creatinine (Cr), leukocyte, neutrophil, C-reactive protein (CRP) and lactate values (0.009, 0.001, 0.044, 0.001, 0.011, 0.001, repectively) were statistically significantly higher in patients in Group 2, albumin and calcium values were found to be statistically significantly low (<0.001, 0.012, repectively). Data comparing demographic characteristics and laboratory parameters between age groups are presented in Table 1.

Table 1. Comparison of demographic data, vital parameters and laboratory parameters of Group 1 and Group 2

	Total N: 160	**Group 1 n: 85**	**Group 2 n: 75**	**p**
Sex				
Female	109 (68.1 %)	62 (72.9%)	47 (62.7 %)	0.178
Male	51 (31.9 %)	23 (27.1%)	28 (37.3 %)	
Age (year)	79±5.9	74.2±3.3	84.5±2.5	< 0.001
Vital Signs				
Fever (°C)	36.7±1.7	36.6±0.6	36.8±2.3	0.466
Pulse (beats/min)	89±17	84±16	94.6±16.6	< 0.001
MAP (mmHg)	89.3±16.9	92.2±16.9	86.5±17.8	0.039
GCS	14.8±0.4	14.9±0.4	14.8±0.4	0.139
Saturation (%)	95±2	96±2	95±3	0.562
Comorbidities				
Presence of comorbidity	134 (83.8%)	66 (77.6%)	68 (90.7%)	0.032
HT	114 (71.3%)	53 (62.4%)	61 (81.3%)	0.009
DM	48 (30%)	26 (30.6%)	22 (29.3%)	1.000
CAD	61 (38.1%)	27 (31.8%)	34 (45.3%)	0.103
COPD	8 (5%)	4 (4.7%)	4 (5.3%)	1.000
CVD	10 (6.3%)	3 (3.5%)	7 (9.5%)	0.190
CKD	5 (3.1%)	4 (4.7%)	1 (1.3%)	0.372
Cancer	1 (0.6%)	0 (0%)	1 (1.3%)	0.469
Symptoms onset to the first admission. (day)	2.9±1.6	2.9±1.8	3±1.4	0.489
Laboratory Parameters				
LDH (5-247 U/L)	412±187.2	409.4±212.4	414.9±155.2	0.853
Glucose	171.6±76.4	174.3±72.8	168.6±80.6	0.635
Ure	52.8±31.2	46.7±29.4	59.6±32	0.009
Creatinine (0.51-0.95 mg/dl)	1.1±0.7	0.9±0.5	1.2±0.9	0.001
Calcium	9.1±0.8	9.2±0.7	8.9±0.8	0.012
Amylase	1539.8±1119.5	1656.6±1261.2	1407.4±924.1	0.153
Lipase	3534.9±3137.8	3758.1±3117.7	3281.9±3162.2	0.340
ALT	143.8±165.4	147.7±108.8	139.1±130.7	0.731
AST	209.6±200.3	222.4±235.8	195.1±150.5	0.379
INR	1.1±0.4	1.1±0.5	1.1±0.2	0.587
ALP	179.8±164.7	147.7±108.8	216.1±205.8	0.011
GGT	212±203	194.9±193.9	231.3±212.5	0.260
Leukocyte (3.8-11.8 103/µl)	13.5±4.4	12.8±3.9	14.2±4.9	0.044
Neutrophils (1.9-8.2 103/µl)	11.4±5.5	10.1±4.4	12.9±6.2	0.001
Lymphocytes (1.1-3.1 103/µl)	1.3±1.1	1.4±1.1	1.2±1.2	0.177
NLR	15.5±17.3	12.5±14.4	19±20	0.017
Lactate	1.9±1.1	1.7±1.1	2.2±1.1	0.001
Total Bilirubin	2.3±3.5	2±4.3	2.6±2.3	0.267
Direct Bilirubin	1.1±1.3	0.7±0.9	1.4±1.5	0.003
CRP (0-5 mg /l)	43.7±52.8	33.6±47.8	55±56	0.011
Albumin (35-55 g/l)	35.7±5.1	37.1±4.5	33.9±5.2	< 0.001
CAR	1.4±1.8	1±1.5	1.8±2	0.004

Group 1; Patients with 65-79 years old, Group 2; Patients with over 80 years old, MAP: Mean arterial pressure, GCS: Glasgow Coma Scale, HT: Hypertension, DM: Diabetes Mellitus, CAD: Coronary Artery Disease, COPD: Chronic Obstructive Pulmonary Disease, CVD: Cerebrovascular Disease CKD; Chronic Kidney Disease, LDH: Lactate dehydrogenase, ALT: Alanine aminotransferase, AST: Aspartate Aminotransferase, INR: International Normalized Ratio, ALP: Alkaline phosphatase, GGT: Gamma glutamyl transferase, NLR; Neutrophils/Lymphocytes Ratio, CRP; C-reaktive protein, CAR: CRP/Albumin Ratio

Local and systemic complications between age groups were analyzed in Table 2. As a result of the analysis, statistically significant local complications (0.003) developed in 41.3% of Group 2, and peripancreatic fluid developed most frequently in 40% (p=0.003). When systemic complications were examined in detail, fluid loss/shock in 21.3% (p=0.002), acute kidney injury in 24% (p=0.017) and hypocalcemia in 12% (p=0.025) were observed in Group 2 and they were statistically significant.

Of the total patients, 48.1% were followed up in the ward and 51.9% were followed up in the intensive care unit. 60% of Group 1 was treated in the ward and 65.3% of Group 2 was hospitalized in the intensive care unit, which was statistically significant (p=0.002). Considering the average number of hospitalization days of the patients, it was determined that Group 1 was hospitalized for 6.3±4 days and Group 2 was hospitalized for 8.1±4.5 days (p=0.009). While 85.6% of our total patients were discharged, 14.4% died. When the groups were compared in terms of mortality, a statistically significant difference was found (p=0.001). Mortality was 5.9% in Group 1 and 24% in Group 2. The relationship between advanced age and mortality rate was found to be statistically significant (p=0.001) (Table 2).

Table 2. Comparison of local and systemic complications, mortality and morbidity data of Group 1 and Group 2 patients

	Total N:160	**Group 1 n: 85**	**Group 2 n: 75**	**p**
Presence of Complications	86 (53.8%)	42 (49.4%)	44 (58.7%)	0.268
Local	47 (29.4)	16 (18.8%)	31 (41.3%)	0.003
Peripancreatic fluid	45 (28.1%)	15 (17.6%)	30 (40%)	0.003
Acute Necrotic collection	8 (5%)	2 (2.4%)	6 (8%)	0.148
Systemic	78 (48.8)	37 (43.5%)	41 (54.7%)	0.205
Loss of fluid/shock	20 (12.5%)	4 (4.7%)	16 (21.3%)	0.002
ARDS	5 (3.1%)	1 (1.2%)	4 (5.3%)	0.187
ARF	26 (16.3%)	8 (9.4%)	18 (24%)	0.017
Hypocalcemia	11 (6.9%)	2 (2.4%)	9 (12%)	0.025
Hyperglycemia	55 (34.4%)	32 (37.6%)	23 (%30,7)	0.406
NIMV Requirement	9 (5.6%)	4 (4.7%)	5 (6.7%)	0.735
MV Requirement	19 (11.9%)	2 (2.4%)	17 (22.7%)	<0.001
RRT	8 (5%)	3 (3.5%)	5 (6.7%)	0.476
Vasopressor Requirement	36 (22.5%)	11 (12.9%)	25 (33.3%)	0.002
ERCP	50 (31.3%)	27 (31.8%)	23 (30.7%)	1.000
MRCP	39(24.4%)	30 (35.3%)	9 (12%)	<0.001
Surgical Treatment	6 (3.8%)	5 (5.9%)	1 (1.3%)	0.215
Lenght of Hospital Stay	7.1±4.4	6.3±4	8.1±4.5	0.009
Outcome				
Service	77 (48.1%)	51 (60%)	26 (34.7%)	0.002
ICU	83 (51.9%)	34 (40%)	49 (65.3%)	0.001
Mortality	23 (14.4%)	5 (5.9%)	18 (24%)	
SAP	26 (16.3%)	9 (10.6%)	17 (22.7%)	0.032

Group 1; Patients with 65-79 years old, Group 2; Patients with over 80 years old; ARDS: Acute respiratory distress syndrome, ARF: Acute Renal Failure, NIMV; Non-Invazive Mechanical Ventilator, MV: Mechanical Ventilator, RRT: Renal Replacement Therapy, ERCP: Endoscopic Retrograde Cholangiopancreatography, MRCP: Magnetic Resonance Cholangiopancreatography, ICU: İntensive Care Unite, SAP: Severe Acute Pancreatitis

Patients were classified as mild, moderate and severe AP according to the Revised Atlanta classification. Of the total patients, 44.4% were classified as mild, 39.4% were defined as moderate, and 16.3% were defined as SAP. There was no statistically significant difference between the groups in the classification of severity (p=0.075). However, 65.4% of SAP were found to be Group 2 patients. While no death was observed in patients with mild AP, 53.8% of SAP patients were found to be mortal (p<0.001). When the relationship between mortality and scores is examined, the mean BISAP score was 1.7±0.8 in survivors and 3.5±0.8 in non-survivors (p<0.001). While the mean CTSI score was 1±1.5 in survivors, it was 4.3±2.3 in non-survivors (p<0.001). While the mean RANSON score was 2±1 in survivors, it was 3.2±1.1 in non-survivors (p<0.001) (Table 3).

Table 3. Comparison of Revised Atlanta, BISAP, RANSON and CTSI scores between non-survivor and survivor patients

	Total N:160	Survivor n: 137	Non-Survivor n: 23	p
BISAP	1.9±1	1.7±0.8	3.5±0.8	<0.001
CTSI	1.5±2	1±1.5	4.3±2.3	<0.001
RANSON	2.2±1.1	2±1	3.2±1.1	<0.001
Revised Atlanta				< 0.001
Mild	71 (44.4%)	71 (51.8%)	0 (0%)	
Moderate	63 (39.4%)	52 (48.2%)	9 (100%)	
Severe	26 (16.3%)	12 (8.8%)	14 (60.9%)	

SAP: Bedside Index for Severity in Acute Pancreatitis, CTSI: Computed Tomography Severity Index

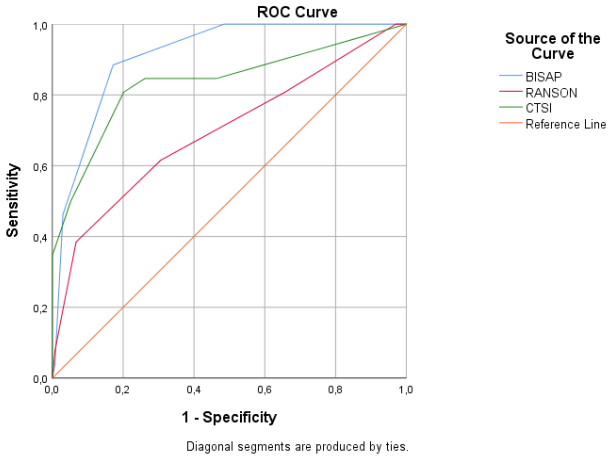

Figure 1. ROC curves showing comparisons of BISAP, RANSON and CTSI score in predicting Severe Acute Pancreatitis (SAP)

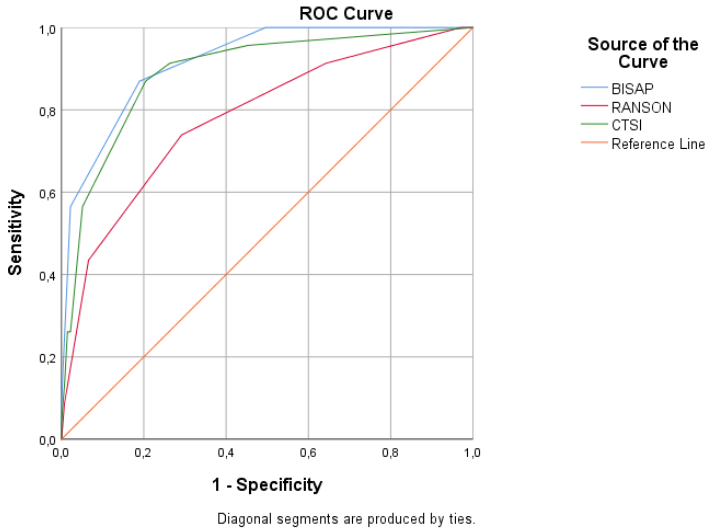

Figure 2. ROC curves showing comparisons of BISAP, RANSON and CTSI score in predicting Mortality.

The graphic of ROC analysis performed to determine the SAP predictive characteristics of BISAP, RANSON and CTSI score in the total patients has been presented in Figure 1. ROC analysis was performed to detect the properties of BISAP, CTSI and RANSON scores to predict SAP in total patients. AUC values of the BISAP score were highest (AUC 0.911, 95% CI 0.861-0.962, p<0.001). Considering the cut-off values determined for SAP, when the BISAP score is taken as 2.5, sensitivity is 88.5% and specificity is 82.8% (Table 4).

The graphic of ROC analysis performed to determine the mortality predictive characteristics of BISAP, RANSON and CTSI score in the total patients has been presented in Figure 2. ROC analysis was performed to determine the properties of BISAP, CTSI and RANSON scores to predict mortality in total patients. AUC values of the BISAP score were highest (AUC 0.918, 95% CI 0.864-0.9722, p<0.001). Considering the cut-off values determined for mortality, when the BISAP score is taken as 2.5, sensitivity is 87% and specificity is 81% (Table 4).

Table 4. ROC analysis to determine the predictive properties of SAP and Mortality of BISAP, CTSI and RANSON scores in patients with acute biliary pancreatitis

	Scores	AUC	SE	95% CI	Cut-off	Sensitivity	Specificity	p
SAP	BISAP	0.911	0.026	0.861-0.962	2.5	88.5	82.8	<0.001
	CTSI	0.836	0.052	0.733-0.938	2.5	80.8	79.9	<0.001
	RANSON	0.696	0.063	0.573-0.819	2.5	61.5	69.4	<0.001
Mortality	BISAP	0.918	0.028	0.864-0.972	2.5	87	81	<0.001
	CTSI	0.891	0.037	0.819-0.963	2.5	87	79.6	<0.001
	RANSON	0.781	0.055	0.674-0.888	2.5	73.9	70.8	<0.001

SAP: Severe Acute Pancreatitis; AUC: Areas Under The Curve, SE: Standart Error, CI: Confidence Interval,
BISAP: Bedside Index for Severity in Acute Pancreatitis, CTSI: Computed Tomography Severity İndex, RANSON;

Binary Logistic Regression Analysis was applied using age, BISAP, CTSI and RANSON scores determined in our study to find out the effective predictors for SAP and mortality. The analysis indicated a 4.7-fold increased risk for SAP and a 12.3-fold increased mortality for each unit increase in BISAP Score value in acute biliary pancreatitis patients (respectively OR=4.7, 95% CI: 2.121-10.499, p<0.001: OR=12.3, 95% CI: 3.252-46.178, p<0.001). Other data are presented in Table 5.

Table 5. Binary logistic regresyon analysis for SAP and mortality

	Variables	Odds Ratio	95% Confidence Interval	p
SAP	BISAP	4.7	2.121-10.499	<0.001
	CTSI	1.6	1.164-2.317	0,005
	RANSON	1.4	0.818-2.320	0.228
	Age	1	0,927-1.151	0,558
Mortality	BISAP	12.3	3.252-46.178	<0,001
	RANSON	2.7	1.285-5.779	0.009
	CTSI	1.6	1.064-2.282	0,023
	Age	1.2	1.008-1.398	0.039

Binary Logistic Regression by Mortality; Variable(s): Age, BISAP, RANSON, CTSI
SAP; Severe Acute Pankreatitis, BISAP: Bedside Index for Severity in Acute Pancreatitis, CTSI: Computed Tomography Severity İndex

DISCUSSION

The relationship between advanced age and SAP has been acknowledged by many authors[1, 23]. The mechanism that puts the older adults patient at risk of severe disease is still unknown. Among the underlying causal mechanisms, causes such as the loss of protective pancreatitis-related proteins[24], increased systemic inflammation and thrombosis[25], presence of comorbidities that negatively affect decreased physiological functions, presence of polypharmacy, and systemic exacerbation of comorbidities with increasing age can be enumerated. A wide mortality rate ranging from 20% to 60% has been reported in the presence of SAP in patients[11]. While most studies[7] indicate a mortality rate of up to 20% in patients older than 55 years, a similar study reported that AP-related mortality increased threefold in patients aged 70 years compared to those younger than 60 years[26]. Koziel et al. defined 3 age subgroups as under 65 years old, 65-79 years old and over 80 years old in their studies and found that mortality risk increased in patients over 65 and especially over 80 years of age[27]. Our data showed that patients over 80 years of age had increased rates of SAP, higher rates of admission to intensive care unit and mortality. Based on these these results, we think that earlier and more effective triage should be performed in patients over 65 years of age with AP applying to the emergency department. Mortality can thus be reduced by allowing rapid and early management of these patients.

Early determination of the disease severity of AP in the more fragile population aged 65 and over also enables the need for intensive care to be evaluated. Belated admission of critically ill patients to intensive care is known to increase mortality[28, 29]. Many scoring systems such as RANSON[20], APACHE II[30], CTSI[19], BISAP[21], Glasgow (Imrie's)[31], and Harmless Acute Pancreatitis Score[32] have been developed to detect SAP. Early awareness of critically ill patients with high risk thanks to these scores, tighter clinical follow-up and effective treatment can reduce mortality. However, which score can be more effective and useful early in patients with AP over 65 years of age is still controversial. For this very purpose, we investigated the SAP and mortality predictive power of BISAP, RANSON and CTSI scores calculated at the time of admission to the emergency department in patients over 65 years of age, in whom early detection is even more crucial.

CTSI is a score that indicates the morphological severity of AP and was developed by Balthazar et al. It was later expanded by Silverman, Banks et al. in 2004 and is a simplified score for monitoring organ failure[19, 33]. Contrast-enhanced abdominal CT is a convenient scoring system for both diagnostic accuracy and for demonstrating the extent of disease and for guiding interventional procedures[34]. It has been shown to detect pancreatic parenchymal necrosis with a diagnostic sensitivity rate of 87% and an overall detection rate of 90%[33]. In studies, CTSI is presented as a good predictor for both mortality and AP severity[35,36]. Because pancreatic parenchymal necrosis occurs 48 hours after symptoms on contrast-enhanced CT, the latest guidelines of the AP recommend CT scanning 72-96 hours after the onset of symptoms, and even earlier in case of diagnostic uncertainty[37-39]. In our study, patients applied to the emergency department within an average of 2.9±1.6 days after the onset of symptoms. Therefore, we think that the contrast-enhanced CT taken at the time of admission to the emergency department can detect local complications and predict SAP in the early period. Contrast-enhanced CT in the early period may be useful to both eliminate diagnostic uncertainty and detect the presence of local complications of acute pancreatitis in patients over 65 years of age applying to the emergency department with abdominal pain. However, difficult access to CT, the fact that it has high contrast and radiation risk, and the need for radiological expertise for calculation are the negative aspects of this score. Careful evaluation of patients is required before CT is performed.

RANSON[20] is a complex and old score that can predict SAP but has 11 criteria that must be completed within 48 hours. The RANSON score calculated at the time of admission provides triage to admit patients to critical care units, guides initial management and resuscitation efforts. The RANSON score, completed after 48 hours, helps to predict SAP and mortality by guiding the management of the patient in the later period[40]. In our study, since we studied with the scores calculated during application to the emergency department, first application RANSON score was calculated. According to our data, the mean RANSON (on admission) score was 2.2±1.1, and it was statistically associated with both SAP and mortality. However, since the 48th hour total score was not calculated, its sensitivity and specificity may be lower than other scores. This makes us think that the RANSON (on

admission) score calculated at the time of admission to the emergency department is not sufficient for the estimation of SAP and mortality.

BISAP score is a valuable tool in estimating the severity of acute pancreatitis because it is simple, easy, cost-effective and can be used efficiently during admission. Wu et al. in 2008[21] (n:18.256) showed that In the validation cohort, the BISAP AUC was 0.82 (95% CI 0.79 to 0.84). In a 2016 meta-analysis[41], a RANSON score greater than 2 had a median specificity 67.4%, and the BISAP score of greater than 2 had a 87.6% median specificity. In one study[42], the AUC for mortality based on the BISAP score was 0.88, and the sensitivity was 92% and the specificity was 76% when the cut-off value of the BISAP score was 3. In a study by Dancu et al.[43], the AUC for SAP based on the BISAP score was 0.77, and the sensitivity was 61% and the specificity was 88% when the cut-off value of the BISAP score was ≥2. Kim et al.[44] showed that BISAP is more accurate in predicting the severity of acute pancreatitis than CTSI scores in a Korean population. The accuracy of BISAP (≥ 2) at predicting severe acute pancreatitis was superior to CTSI score (≥4)[44]. In a meta-analysis including prospective cohort studies, BISAP was found to perform well in predicting SAP across different patient populations and severity levels[45].

In 2018, the European Society of Gastrointestinal Endoscopy (weak recommendation and moderate-quality evidence) recommends using the BISAP score within the first 24 hours of admission as an early indicator of severity and mortality in AP[46]. In our study, although the power of RANSON (on admission) and CTSI scores to predict both SAP and mortality was statistically significant, they were found to have no superiority compared to the BISAP score as a result of the regression analysis. In our study, when the cut-off value of the BISAP score was taken as 2.5 for SAP, sensitivity was 88.5% and specificity was 82.8%. If it was taken as 2.5 for mortality, sensitivity was 87% and specificity was 81%. In addition, our analyzes showed that in patients over 65 years of age with acute biliary pancreatitis, the risk of SAP increases by 4.7 times and the risk of mortality increases by 12.3 times with each unit increase in the BISAP score. We think that the BISAP score, used at the time of admission in the emergency department in patients over 65 years of age is an effective tool for estimating both SAP and mortality. Having the BISAP score available at the time of application may ensure closer observation in the first evaluation of patients in the emergency department and may be beneficial for intensive care triage.

With this single-center and retrospective study, generalizing for all geriatric patients with biliary pancreatitis may be misleading. This is a limitation of our study. The strongest aspects of our study are that the reliability and validity of all the scores we used were tested and demonstrated. As one of the items of the BISAP score was represented by age 65, the score might have overestimated the true severity of AP in the older adults, However, the observation of high mortality rates with high scores in our geriatric group may also indicate the accuracy of the score. Prospective and multicenter studies on the geriatric population are therefore needed to confirm the validity of our study.

The mortality of acute pancreatitis increases with advanced age. BISAP score, which is easily and quickly calculated in the emergency department, may detect severe acute pancreatitis and provides a stricter clinical follow-up and adoption of an adequate treatment protocol. This may reduce mortality.

Yazar Katkıları: Çalışma konsepti/Tasarımı: SA, SS, AT; Veri toplama: SA, SS, MG, BTF, DAS, AT; Veri analizi ve yorumlama: SA, SS, AT, MG; Yazı taslağı: SA, SS, MG, BTF, DAS, AT; İçeriğin eleştirel incelenmesi: SA, SS, MG, BTF, DAS, AT; Son onay ve sorumluluk: SA, SS, MG, BTF, DAS, ADT; Teknik ve malzeme desteği: SA, SS, MG; Süpervizyon: SA, SS, AT; Fon sağlama (mevcut ise): yok.
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