

## BİLİYER PANKREATİT HASTALARININ PROGNOZUNDA SARKOPENİNİN ETKİSİ

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### ÖZET

#### Anahtar Kelimeler

- Pankreatit,
- Sarkopeni,
- Obezite,
- Ranson kriterleri,
- BISAP,
- BT şiddet indeksi

#### Makale Hakkında

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**Amaç:** Bu çalışmada akut biliyer pankreatit hastalarında prognozun belirlenmesi için kullanılan mevcut sistemlerin karşılaştırılması ve hastaların nutrisyonel durumlarının prognoza olan etkisini araştırmak amaçlanmıştır.

**Gereç ve Yöntem:** 70 akut biliyer pankreatit hastasının Ranson, 'Harmless Acute Pancreatitis Score' (Zararsız Akut Pankreatit Skoru) (HAPS), 'Bedside Index of Severity in Acute Pancreatitis' (Akut Pankreatitte Yatak Başı Şiddet İndeksi) (BISAP), Glasgow-Imrie skorları ve Bilgisayarlı tomografi (BT) şiddet indeksi değerleri hesaplanarak kaydedildi. Biyoelektrik impedans analizleri yapıldı. Tomografi görüntüleri üzerinden ölçülen psoas kasının kesitsel alanı kullanılarak sarkopeni ölçümleri yapıldı.

**Bulgular:** Pankreatit skorlamalarından BISAP ( $p=0,024$ ) ve BT şiddet indeksi ( $p=0,050$ ) uzun hastane yatışı ile ilişkilendirildi. Ranson, HAPS, Glasgow-Imrie skorlamaları hastaların yatış süresi ve komplikasyon gelişimine etkisiz bulundu. Vücut yağ yüzdesi yüksek olan hastalarda komplikasyonlar daha yüksek olarak görüldü ( $p=0,039$ ). BT şiddet indeksi yüksek olan hastalarda komplikasyon oranlarının arttığı görüldü ( $p=0,000$ ). Yaş ortalamasına göre sarkopeni prevalansı beklenenden yüksek bulundu (%47). İleri yaş ( $p=0,027$ ), komorbid hastalıklar ( $p=0,032$ ) ve düşük kilonun ( $p=0,012$ ) sarkopeni için risk faktörü olduğu istatistiksel olarak kanıtlandı. Sarkopeni ve obezite ile pankreatit prognozu arasında ilişki bulunamadı.

**Tartışma:** Pankreatit prognozunu öngörmek için BISAP ve BT şiddet indeksinin kullanılması tarafımızca önerilir. Sarkopeni ve obezite ile pankreatit prognozu arasındaki ilişkinin daha net ortaya koyulması için konuyla ilgili daha kapsamlı çalışmalar yapılması gerekmektedir.

## THE EFFECT of SARCOPENIA on the PROGNOSIS of BILIARY PANCREATITIS PATIENTS

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### ABSTRACT

**Aim:** To compare the current scoring systems used for predicting acute biliary pancreatitis prognosis and to determine the importance of sarcopenia in prognosis.

**Materials and Methods:** 70 acute biliary pancreatitis patients' Ranson's, Harmless Acute Pancreatitis Score (HAPS), Bedside Index of Acute Pancreatitis Severity (BISAP) Glasgow-Imrie scores and computed tomography (CT) severity index results were recorded. Patients bioelectrical impedance were analyzed and psoas muscle cross-sectional areas were measured on CT images to determine the presence of sarcopenia.

**Results:** Increased BISAP ( $p = 0.024$ ) and CT severity index ( $p=0.050$ ) scores were associated with longer hospitalization. Ranson's, HAPS and Glasgow-Imrie scores were ineffective to predict hospitalization length and complications. High body fat percentage ( $p=0,039$ ) and CT severity index ( $p=0.000$ ) were associated with increased complications. The prevalence of sarcopenia according to age was higher than expected in the patient group (47%). There was no relationship between sarcopenia and the prognosis of pancreatitis.

**Conclusion:** BISAP and CT severity index are reliable scoring systems to determine the prognosis of acute biliary pancreatitis. Understanding the effect of sarcopenia in acute pancreatitis warrants further

## INTRODUCTION

Acute pancreatitis (AP) is an inflammatory condition of the pancreas, which is defined by abdominal pain and increased pancreatic enzymes. AP constitutes the majority of gastrointestinal hospitalizations worldwide (1).

The incidence of AP varies between 5 and 80 per 100,000. Although the vast majority of patients experience a mild and self-limiting course, 10-20% undergo prolonged hospitalization due to severe pancreatitis with increased morbidity and mortality (2). The overall mortality rate for AP is 5%, which increases to 27% when pancreatic necrosis occurs (3). Gallstones are the most common cause (40-70%). Other common causes of AP include alcohol consumption, hypertriglyceridemia, endoscopic retrograde cholangiopancreatography (ERCP), hereditary pancreatitis, drug-induced pancreatitis, and pancreatic duct injuries (4).

Regardless of its etiology, pancreatic inflammation, triggered by the activation of pancreatic enzymes in acinar cells, resolves spontaneously in 80-90% of cases. However, in the remaining 10-20% of cases, pancreatic damage leads to persistent local and systemic inflammation (5). Due to the potential rapid progression of AP resulting from systemic inflammation, it is crucial to identify patients with a poor prognosis. Ranson's criteria, Harmless Acute Pancreatitis Score (HAPS), Bedside Index of Acute Pancreatitis Severity (BISAP), Glasgow-Imrie scores, and the computed tomography (CT) severity index are some of the most commonly used clinical tools to evaluate AP patients, yet none of these modalities include parameters to assess the patients' nutritional status.

Sarcopenia, characterized by a loss of muscle mass and function associated with advancing age, has a prevalence that increases with age, reaching 5-13% for ages 60-70 and 11-50% for ages over 80 (6). Sarcopenia has a negative impact on the prognosis of many chronic and acute diseases, serving as an independent factor that reduces the survival of various gastrointestinal, gynecologic, and urologic cancer patients (7, 8). Elderly sarcopenic patients also experience more frequent and severe acute diseases (9). In this study, our objective is to evaluate existing prognostic scoring systems for AP and determine the significance of sarcopenia in prognosis.

## MATERIALS AND METHOD

This study received approval from the Haseki Training and Research Hospital Ethical Committee. Diagnostic criteria for AP included sudden onset abdominal pain and elevated amylase/lipase levels. The study included 70 patients with gallstone-related pancreatitis who underwent intravenous contrasted abdominal CT examinations during admission. Exclusion criteria comprised non-biliary acute pancreatitis, chronic pancreatitis, renal disease, contrast allergy, morbid obesity preventing tomographic imaging, recurrent pancreatitis, pancreatitis due to ERCP, and pancreatitis due to hepatobiliary cancer.

Demographic and laboratory findings of the patients were recorded upon admission. CT images were assessed for pancreatic enlargement, pancreatic edema, peripancreatic fluid, necrosis, pleural effusion, pulmonary infiltrations, and extra pancreatic collections. Height, weight, and body mass index values were documented, and bioelectrical impedance analysis was performed on 69 patients. The analysis was not feasible for one patient admitted to the intensive care unit. Ranson's, HAPS, BISAP, Glasgow-Imrie scores, and CT severity index results were calculated for all patients.

Sarcopenia coefficients of patients were calculated using their cross-sectional right psoas muscle area,

measured on axial CT slices at the mid-level of L4 vertebra images manually with Fufilm Synapse (PACS) v4.2 Workstation (Figure 1), divided by their height. Female patients with coefficients below 34.3 cm<sup>2</sup>/m<sup>2</sup> and male patients with coefficients below 41.4 cm<sup>2</sup>/m<sup>2</sup> were classified as sarcopenic.

**Figure 1.** Cross-sectional psoas muscle area measurement.



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The average length of hospital stay served as the threshold value for evaluating the impact of parameters on patients' hospitalization duration. For patients who underwent cholecystectomy or ERCP, the hospital stay length was determined by the number of days until their operations. Possible complications of pancreatitis during the study included pulmonary effusion, pneumonia, pancreatic necrosis, pseudocyst formation, intra-abdominal fluid collection, cholangitis, intraabdominal hypertension, pulmonary failure, and death.

Statistical analysis was performed using SPSS 15.0 software. Descriptive statistics included presenting categorical variables as numbers and percentages, and numerical variables as mean, standard deviation, minimum, and maximum. Independent two-group comparisons were conducted using the Student's t-test for variables that met the normal distribution condition, and the Mann-Whitney U test for variables that did not meet the normal distribution condition. Group rates were analyzed with Chi Square. A statistically significant alpha level was set at  $p < 0.05$ .

## RESULTS

The study included 48 female and 22 male patients, with a mean age of 54.7 years. Out of the 70 patients, 14 underwent cholecystectomy, 4 underwent ERCP, 1 died in the intensive care unit, and 51 patients were discharged after conservative treatment. The average hospital stay was 4.8 days (minimum 2, maximum 19). Comorbid diseases were present in 28 patients, and 5 patients had positive peritonitis findings during their initial examinations.

Patients' height, weight, body mass index (BMI), psoas muscle cross-section area (CSA), sarcopenia coefficients, and bioelectrical impedance measurement results (Fat %) are presented in Table 1. CT findings indicated pancreatic edema in 36% (51.4%), peripancreatic fluid in 26% (37.1%), necrosis in 1% (1.4%), pleural effusion in 5% (7.1%), pulmonary infiltration in 3% (4.3%), and extra pancreatic collection in 8% (11.2%) of patients. Complications developed in 31 patients, including pulmonary effusion (5), pneumonia (3), pancreatic necrosis (3), pseudocyst (1), abdominal fluid collection (27), cholangitis (1), intraabdominal hypertension (1), pulmonary insufficiency (1), and death (1).

**Table 1:** Patients' height-weight measurements, bioelectrical impedance results, obesity and sarcopenia calculations.

		Mean ± SD
<b>Height</b>		159.6 ± 8.6
<b>Weight</b>		80.4 ± 15.2
<b>BMI</b>		31.7 ± 5.8
<b>Fat %</b>		34.0 ± 9.7
<b>Psoas CSA</b>	<b>Male</b>	125.7 ± 26.4
	<b>Female</b>	82.0 ± 25.2
<b>Sarcopenia Coefficient</b>	<b>Male</b>	44.7 ± 9.5
	<b>Female</b>	33.5 ± 9.0
		n (%)
<b>Sarcopenia</b>		34 (47.6)
<b>Obesity</b>		42 (60.0)
<b>Sarcopenic Obesity</b>		19(27.1)

BMI: Body Mass Index

CSA: Cross Section Area

SD: Standard Deviation

Patients' Ranson's, HAPS, BISAP, Glasgow-Imrie scores, CT severity index results, and their correlations with hospitalization length and complications are shown in Table 2. Statistically significant results were found between the BISAP scoring system and the length of stay (p=0.024). The average BISAP score of patients hospitalized for less than 4 days was 0.13, while it was 0.47 for patients who stayed for more than 4 days. The average CT severity score for patients who stayed less than 4 days was 1.00, compared to 1.70 for those who stayed for 4 days or more. A statistically significant relationship was observed between the CT severity index and length of stay (p = 0.05) (Table 2).

**Table 2:** Pancreatitis scoring results, relations with hospital stay length and complications.

Scoring System	Hospital stay <4	Hospital stay>4 days	p	Patients without	Patients with	p
	days (n=23)	(n=47)		complications (n=39)	complications (n=31)	
	Mean ±SD	Mean ±SD		Mean±SD	Mean±SD	
Ranson's	1.65±0.83	1.94±1.03	0.254	1.87±0.894	1.81±1.078	0.787
48 hour Ranson's	1.70±0.88	2.17±1.00	0.058	1.97±0.932	2.06±1.063	0.707
HAPS	0.61±0.58	0.60±0.65	0.936	2.06±0.595	0.61±0.667	0.879
BISAP	0.13±0.34	0.47±47	<b>0.024</b>	0.31±0.521	0.42±0.672	0.436
Glascow-Imre	0.78±0.67	0.98±0.94	0.376	0.90±0.852	0.94±0.892	0.856
CT severity index	1.0±1.3	1.70±1.48	<b>0.050</b>	0.49±0.79	2.71±1.13	<b>0.000</b>

HAPS: Harmless Acute Pancreatitis Score

BISAP: Bedside Index Score for Acute Pancreatitis

CT: Computerized Tomography

SD: Standard Deviation

When each scoring system was analyzed according to its predictive value of complications, CT severity index had the only statistically significant results (p=0.000).

Patients bioelectrical impedance, sarcopenia, and sarcopenic obesity results were evaluated according to their effect on hospital stay length and complications (Table 3). Statistically significant relation was observed between bioelectrical impedance results and complications (0.039).

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**Table 3:** Bioelectrical impedance, sarcopenia, and sarcopenic obesity results effect on hospital stay length and complications.

	Hospital stay <4	Hospital stay>4	p	Patients without	Patients with	p
	days (n=23)	days (n=47)		complications (n=39)	complications (n=31)	
	Mean ±SD	Mean ±SD		Mean ±SD	Mean ±SD	
Fat %	35.27±10.45	33.41±9.38	0.459	31.29±10.15	36.13±8.93	<b>0.039</b>
	n	n	p	n	n	p
Sarcopenia	12	22	0.681	20	14	0.617
Obesity	16	26	0.540	27	15	0.082
Sarcopenic obesity	8	11	0.322	12	7	0.451

SD: Standard Deviation

## DISCUSSION

Determining the severity of pancreatitis is of paramount importance for patient management. Numerous studies have been conducted to determine AP severity and forecast patient prognosis.

While Ranson's criteria are the most commonly used pancreatitis scoring system due to their simplicity, it is argued that the system provides low clinical insight. Current studies suggest that the system is inadequate for predicting hospital stay length (11) or disease severity (12). In our analysis of patients according to Ranson's criteria, we observed that patients with longer hospitalization periods and higher complication rates also had higher Ranson's scores at 48 hours; however, this correlation lacked statistical significance.



Lankisch et al.'s retrospective study involving 394 cases highlighted the success of the HAPS in diagnosing patients with better prognoses (13). Our results indicated that HAPS had no direct effect on hospital stay length, although the score was lower in patients without complications. These findings aligned with current HAPS studies, but statistical significance was not achieved.

The BISAP scoring system is known to be more effective than Ranson's criteria in determining AP severity, organ failure, and mortality (14). Upon analyzing patients according to their BISAP scores, we observed a statistically significant correlation between the system and hospital stay length. Higher BISAP scores were also associated with higher complication rates, although this relationship could not be statistically proven.

Regarding the Glasgow-Imrie scoring system, studies suggest that it adequately predicts mortality and hospital stay length in AP patients but lacks predictive value for complications (15, 16). Our patient group exhibited no correlation between Glasgow-Imrie scores, hospital stay length, or complication rates.

The success of the CT severity index in predicting complications (17, 18), hospital stay length (19), and its ease of use makes it the most frequently recommended pancreatitis scoring system in current studies. However, the system's major drawback is its reliance on contrasted tomography imaging. Our evaluation of the CT severity index yielded statistically significant results concerning hospital stay length and complication rates, rendering it the most reliable prognostic system in our study.

In terms of bioelectrical impedance measurements, a study involving intensive care patients suggested that it provides better mortality perception than intensive care unit mortality scoring systems (20). Madico et al. demonstrated, in their study of 112 AP patients, that intra-abdominal fat percentage is an independent factor in pancreatitis severity (21). Our examination of body fat percentage values obtained through bioelectrical impedance measurements revealed that patients with higher fat percentages experienced longer hospitalization periods and higher complication rates. The correlation between fat percentage and complication development was statistically proven.

Recent studies have unveiled sarcopenia's negative prognostic effect on pancreas pathologies like adenocarcinoma and chronic pancreatitis (22, 23). Olessen et al. propose that sarcopenia results from malnutrition due to exocrine pancreatic insufficiency in chronic pancreatitis patients (23). Shintakuya et al.'s study further supports the association between pancreatic insufficiency and sarcopenia (24). Yoon et al.'s study with 203 AP patients demonstrated significantly elevated body fat/muscle ratios in severe pancreatitis cases (25). Advanced age ( $p = 0.027$ ), comorbid diseases ( $p = 0.032$ ), and low body weight ( $p = 0.012$ ) were identified as risk factors for sarcopenia in our study. No correlation between sarcopenia and hospitalization period or complication rate was identified.

Upon detailed examination of the patient group, we observed that 80% of the women and 20% of the men in our study were sarcopenic. The sarcopenia rate, expected to be 16% based on the age group of our patients, reached 47% in our study. While no evidence supporting the effect of sarcopenia on AP prognosis was found, the high number of sarcopenic patients suggests that sarcopenia may indeed be a risk factor for pancreatitis.

A retrospective study involving 1302 AP patients found no correlation between obesity and mortality or pancreatic necrosis but established it as an independent factor for organ failure (26). Two different meta-analyses on the subject yielded differing results, advocating increased complication rates and

mortality in obese pancreatitis patients (27, 28). Among our patients, 60% were obese. However, we observed no significant effect of obesity on hospital stay length or the development of complications. The limited number of patients may account for the results contradicting previous studies that also focused on obesity in AP patients.

## CONCLUSION

The prediction of acute pancreatitis patients' prognosis holds paramount significance for their management. The presence of extra pancreatic collections ( $p = 0.036$ ), high BISAP scores ( $p = 0.024$ ), and an elevated CT severity index ( $p = 0.050$ ) have been associated with longer hospitalization. Complications are more prevalent in patients with a high body fat percentage ( $p = 0.039$ ). A statistically significant relationship between the CT severity index and the presence of complications exists ( $p = 0.000$ ). No correlations were identified between sarcopenia, obesity, and pancreatitis prognosis. The high prevalence of sarcopenic patients in our study group (47%) suggests that sarcopenia may indeed be a risk factor for pancreatitis.



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