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Is it possible to reduce the surgical mortality and morbidity of peptic ulcer perforations?

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ABSTRACT

Objective: Peptic ulcer perforation is a life-threatening situation requiring urgent surgical treatment. A novel vision in peptic ulcer perforation is necessary to fill the gaps created by antiulcer medication, aging of the patients, and presentation of resistant cases in our era. In this study, we aimed to share our findings regarding the effects of various risk factors and operative techniques on the mortality and morbidity of patients with peptic ulcer perforation.

Material and Methods: Data from 112 patients presenting at our Training and Research Hospital Emergency Surgery Department between January 2010 and December 2015 who were diagnosed with PUP through physical examination and laboratory and radiological tests and operated at the hospital have been retrospectively analyzed. Patients were divided into three groups based on morbidity (Group 1), mortality (Group 2), and no complication (Group 3).

Results: Of the 112 patients included in the study, morbidity was observed in 21 (18.8%), mortality in 11 (9.8%), and no complication was observed in 80 (71.4%), who were discharged with cure. The differences between group for the average values of the perforation diameter and American Society of Anesthesiologists, Acute Physiology and Chronic Health Evaluation II, and Mannheim Peritonitis Index scores were statistically significant ($p<0.001$ for each). The average values for the group with mortality were significantly higher than those of the other groups.

Conclusion: In this study where we investigated risk factors for increased morbidity and mortality in PUPs, there was statistically significant difference between the average values for age, body mass index, perforation diameter, and Acute Physiology and Chronic Health Evaluation II and Mannheim Peritonitis Index scores among the three groups, whereas the amount of subdiaphragmatic free air did not differ.

Keywords: Mortality, perforation, peptic ulcer perforation, risk factors

INTRODUCTION

With regard to creating a novel vision for former diseases, our memorizationsshould be updated. Some diseases and their outcomes, which have been previously very well known, are nowadays almost always presented as unexpected cases because of new technologies and evolvements in medicine due to resistant events. Thus, antiulcer medication and presentation of elderly patients have changed in peptic ulcer perforation (PUP) and, transforming the patient profiles with PUP in our era. Therefore, a novel vision to avoid gaps is necessary to evaluate the patients with PUPsas surgeons are coming across newer patient profiles in last decades. Peptic ulcers are focal defects in the stomach and the duodenum extending below the mucosa or deeper (1, 2). They can be acute or chronic; the etiology of the condition is the disruption of balance between gastric acid effect and mucosal defense mechanisms (2, 3). Although medical treatments such as H2 receptor antagonists, proton pump inhibitors, and *Helicobacter pylori* eradication through antibacterial drugs, have decreased the number of surgeries in non-complicated peptic ulcer cases, the number of patients presenting to the emergency clinics with peptic ulcer perforation has not decreased (1-5).

Peptic ulcer perforation is still an important health problem, despite the decreasing incidence of peptic ulcer disease. The aim of this study was to investigate factors affecting the mortality and morbidity of PUPs and specifically determine approaches to decrease mortality.

MATERIAL AND METHODS

The data from 112 patients operated with the diagnosis of PUP at our Training and Research Hospital between January 2010 and December 2015 were retrospectively analyzed. Patient age, gender, weight, height, American Society of Anesthesiologists (ASA) score, symptoms, time interval between symptom onset and surgery, accompanying diseases, length of hospital stay, operative technique, laboratory findings, site and diameter of perforation, Acute Physiology and Chronic Health Evaluation (APACHE) II and Mannheim Peritonitis Index (MPI) scores, preoperative shock state, morbidity, and mortality were recorded. MPI (Table 1) and APACHE II scores were calculated for all patients. Patient age, chronic health status, rectal temperature, mean arterial blood pressure, heart rate, respiratory rate, arterial pH, partial oxygen pressure, serum sodium, serum potassium, serum creatinine, hematocrit, white blood cell count, and Glasgow coma score were recorded for determining the APACHE II score.

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All patients were operated with the open technique. After the aspiration of the intraabdominal free fluid, the intraperitoneal cavity was irrigated with at least 1000 mL of isotonic saline and aspirated. The surgical procedure was determined by the operating surgeon and either one of omental patch with Graham's procedure, bilateral truncal vagotomy with pyloroplasty or, antrectomy and gastroenterostomy was applied. Patients were divided into three groups based on morbidity (Group 1), mortality (Group 2), and no complication (Group 3).

Table 1. Mannheim peritonitis index

Risk factor	Weighting if present
Age >50 years	5
Female sex	5
Organ failure	7
Malignancy	4
Preoperative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Fecal	12
Definitions of organ failure	
Kidney	Cratine level >177µmol/L Urea level>167 mmol/L Oliguria <20 mL/h
Lung	PO_2<50 mmHg PCO_2>50 mmHg
Shock	Hypodynamic or hyperdynamic
Intestinal obstruction	Paralysis >24 h or complete mechanical obstruction

PO^2: PCO^2

Written informed consent of the included patients and local ethics committee approval were obtained.

Statistical Analysis

Statistical Package for Social Sciences software version 15.0 (SPSS Inc.; Chicago, IL, USA) was used for statistical analysis. Descriptive statistics were presented with number and percentage for categorical variables and mean, standard deviation, minimum, maximum, and median values for numerical variables. Comparisons between more than two independent groups were made using the one-way Anova test for normal distribution of numerical values and the Kruskal-Wallis test when normal distribution was not present. Subgroup analyses were carried out with the Tukey test for parametric tests and the Mann-Whitney U test for non-parametric tests and interpreted using the Bonferroni correction. The ratio of categorical variables between groups was tested using the chi square analysis. Risk factors for morbidity and mortality were evaluated using Cox regression analysis. Statistical significance level was accepted as $p<0.05$.

RESULTS

Of the 112 patients included in the study, morbidity was observed in 21 (18.8%) and mortality in 11 (9.8%). Eighty (71.4%) patients were discharged with cure, free of complications. Ninety-seven (86.6%) of 112 patients were male and 15 (13.4%) were female. No significant difference in the gender distribution of the groups was detected (p=0.252). There was statistically significant difference between the mean age of the groups ($p<0.001$). The mean age of the group with mortality was significantly higher than the that of the morbidity and no complication groups, and the mean age of the morbidity group was significantly higher than that of the no complication group. The demographic data and subgroup analyses are presented in Table 2-4.

Table 2. Demographics

		Non-complicated		Morbidity		Mortality		p
Gender	Male	71 (88.8)		18 (85.7)		8 (72.7)		0.252
	Female	9 (11.3)		3 (14.3)		3 (27.3)		
		Mean±SD	**Median**	**Mean±SD**	**Median**	**Mean±SD**	**Median**	
Age		30.7±12.8	29	53.0±16.6	60	70.2±15.1	73	<0.001
Weight		67.5±14.0	66	80.8±11.6	82	82.1±4.6	83	<0.001
Height		175.6±7.6	175	169.0±6.6	169	167.6±7.6	169	<0.001
BMI		22.0±5.2	21.2	28.5±4.9	28.1	29.4±2.9	30.1	<0.001
Time from onset of symptoms		1.5±1.3	1	3.0±2.0	2	4.6±1.6	4	<0.001
Duriation of hospital stay (days)		5.3±1.1	5	11.7±11.3	7	9.2±6.2	10	<0.001
Perforation diameter (mm)		5.8±3.4	5	10.0±7.6	5	18.2±8.4	15	<0.001
ASA		1.1±0.3	1	2.1±0.9	2	3.6±0.9	4	<0.001
APACHE II score		2.0±2.5	1	4.5±3.2	5	10.2±5.3	9	<0.001
MPI score		2.4±3.6	0	9.2±6.5	6	18.5±6.4	17	<0.001

BMI: body mass index; ASA: American Society of Anesthesiologists; APACHE: acute physiology and chronic health evaluation; MPI: Mannheim peritonitis index

The mean body mass index (BMI) of the patients were significantly different among groups (p<0.001). The average BMI in the mortality and morbidity groups was significantly higher than that in the no complication group.

Table 3. Subgroup analyses of demographics

	Non-complicated vs Morbidity	Non-complicated vs Mortality	Morbidity vs Mortality
	p	p	p
Age	<0.001	<0.001	0.003
Weight	<0.001	<0.001	0.842
Height	0.001	0.003	0.875
BMI	<0.001	<0.001	0.858
Time from onset of symptoms	<0.001	<0.001	0.013
Duriation of hospital stay (days)	<0.001	0.110	0.857
Perforation diameter (mm)	0.001	<0.001	0.003
ASA	<0.001	<0.001	<0.001
APACHE II score	0.001	<0.001	0.001
MPI score	<0.001	<0.001	0.001

BMI: body mass index; ASA: American Society of Anesthesiologists; APACHE: acute physiology and chronic health evaluation; MPI: Mannheim peritonitis index

There was significant difference between groups with regard to time interval between symptom onset and surgery (p<0.001). The time interval was significantly higher in the mortality group than in the morbidity and no complication groups, and significantly higher in the morbidity group than in the no complication group. Statistically significant difference was observed in duration of hospital stay (p<0,001). The average duration of hospital stay in the group with morbidity was significantly longer than that in the no complication group.

The differences between the average values of the diameter of perforation and ASA, APACHE II and MPI scores among groups were statistically significant (p<0.001 for each). The average values for the group with mortality were significantly higher than those for the morbidity and no complication groups. Likewise, the average values for the morbidity group were significantly higher than those for the no complication group. In 98 (87.5%) patients, subdiaphragmatic free air was detected in the initial erect abdominal X-ray. There was no statistically significant difference between the rate of presence of free air between the groups. The white blood cell (WBC) count was 17.045±13.517 for Group 1, 13.347±6.434 for Group 2 and 14.608±3.857 for Group 3. No statistically significant difference was detected between the groups (p=0.734). The laboratory findings and subgroup analyses of the groups are displayed in Table 5, 6.

The presence of accompanying diseases showed a statistically significant difference between groups for all but ischemic

Table 4. Subgroup analyses of findings

		Non-complicated		Morbidity		Mortality		
		n	%	n	%	n	%	p
Accompanying disease		9	11.3	12	57.1	9	81.8	<0.001
	DM	2	2.5	1	4.8	3	27.3	0.014
	HT	7	8.8	8	38.1	6	54.5	<0.001
	CRF	0	0.0	1	4.8	2	18.2	0.005
	ARF	0	0.0	2	9.5	3	27.3	0.001
	CHF	0	0.0	0	0.0	5	45.5	<0.001
	IHD	0	0.0	1	4.8	1	9.1	0.081
	COPD	0	0.0	3	14.3	1	9.1	0.008
	GI hemorrhage	1	1.3	0	0.0	1	9.1	0.214
	Cancer	0	0.0	3	14.3	0	0.0	0.011
Surgical procedure	Graham's raphe omentoplasty	78	97.5	14	66.7	5	45.5	<0.001
	Graham's procedure+additional procedures	2	2.5	5	23.8	5	45.5	
	Other	0	0.0	2	9.5	1	9.1	
Site of perforation	Duodenum 1st segment	51	63.8	9	42.9	6	54.5	0.001
	Prepyloricareal	29	36.3	7	33.3	5	45.5	
	Other	0	0.0	5	23.8	0	0.0	
Free air	70	87.5	18	85.7	10	90.9	0.899	
Shock state	3	3.8	7	33.3	11	100	<0.001	

DM: diabetes mellitus; HT: hypertension; CRF: chronic renal failure; ARF: acute renal failure; CHF: congestive heart failure; IHD: ischemic heart disease; COPD: chronic obstructive pulmonary disease; GI: gastrointestinal

Table 5. Laboratory findings

	Non-complicated		Morbidity		Mortality		
	Mean±SD	Median	Mean±SD	Median	Mean±SD	Median	p
Glucose	130.9±41.8	121	133.6±52.6	123	136.8±38.4	137	0.783
Urea	33.0±13.6	32.2	59.6±33.4	52.7	108.0±43.1	90.4	<0.001
Creatinine	1.0±1.3	0.78	1.4±1.0	1.14	2.4±1.7	2.1	<0.001
AST	25.8±14.6	22	31.0±21.1	26	36.8±21.1	28	0.013
ALT	18.6±8.9	17	30.3±48.3	18	16.1±6.9	14	0.547
GGT	20.7±15.6	17	41.5±24.1	34	29.5±18.0	26	<0.001
LDH	233.8±139.3	194	242.3±91.2	234	318.1±106.2	323	0.009
ALP	75.2±39.3	67	101.8±55.2	83	89.6±23.8	89	0.001
Total protein	7.5±0.4	7.4	7.1±0.9	7.1	5.4±0.7	5.44	<0.001
Albumin	4.0±0.4	3.9	3.6±0.5	3.8	2.6±0.5	2.6	<0.001
Calcium	9.3±0.5	9.42	9.0±0.5	9.04	8.5±0.9	8.31	<0.001
Sodium	136.2±3.0	136	135.0±3.7	134	136.2±6.2	133	0.192
Potassium	4.1±0.4	4.075	4.2±0.3	4.22	4.9±0.9	4.8	0.007
CRP	26.0±50.2	4.4	60.2±97.5	15.58	174.6±190.1	95	<0.001
Amilase	83.8±70.6	65.1	77.9±33.6	80.4	117.9±104.9	100.9	0.460
WBC	13.6±4.2	13.4	11.6±3.9	11.7	13.0±6.4	11.7	0.222
HGB	14.7±2.0	14.6	13.9±2.2	14.2	12.2±3.3	11.3	0.026
HCT	44.2±5.6	44.55	43.0±5.3	42.8	37.1±10.4	34.5	0.150
PLT	257.0±69.5	242	281.6±70.1	272	333.4±209.7	289	0.250

AST: aspartate aminotransferase; ALT: alanine aminotransferase; GGT: gamma glutamyl transferase; LDH: lactate dehydrogenase; ALP: alkaline phosphatase; CRP: C reactive protein; WBC: white blood cells; HGB: hemoblobin; HCT: hematocrit; PLT: platelet

Table 6. Subgroup analyses of laboratory findings

	Non-complicated vs morbidity	Non-complicated vs mortality	Morbidity vs mortality
	p	p	p
Urea	<0.001	<0.001	0.002
Creatinine	0.039	<0.001	0.047
AST	0.186	0.004	0.190
GGT	<0.001	0.097	0.147
LDH	0.140	0.006	0.031
ALP	0.001	0.027	0.984
Total protein	0.285	<0.001	<0.001
Albumin	0.012	<0.001	<0.001
Calcium	0.005	<0.001	0.057
Potassium	0.199	0.004	0.025
CRP	0.002	<0.001	0.007
HGB	0.127	0.015	0.226

AST: aspartate aminotransferase; GGT: gamma glutamyl transferase; LDH: lactate dehydrogenase; ALP: alkaline phosphatase; CRP: C reactive protein; HGB: hemoblobin

heart disease and gastrointestinal hemorrhage. The presence of accompanying diseases was most frequent in the mortality group, with chronic obstructive pulmonary disease (COPD) being the most common accompanying condition.

The preferred surgical approach showed a statistically significant difference between the groups. In the morbidity and mortality groups, additional procedures to the Graham's procedure were applied. The distribution of the site of perforation was significantly different among groups (p=0.001). In the morbidity group, hemorrhage from other sites was more common. State of shock was another variable showing statistically significant difference in distribution. All patients in the mortality group were in shock state.

In the model developed for determining factors affecting morbidity with single variables (age, BMI, ASA score, accompanying diseases, perforation diameter, MPI score, urea, GGT, ALP, calcium, and WBC) the most significant variables were BMI, GGT, and ALP (Table 7, 8). In the multivariate regression analysis for factors affecting morbidity, age was determined to be a significant parameter using the enter and backward method (Table 9).

In the model developed for determining factors affecting mortality with single variables; age, BMI, ASA score, accompanying diseases, perforation diameter, MPI score, APACHE II score, urea, creatinine, total plasma protein, albumin, calcium, potassium, CRP, hemoglobin, hematocrit levels and platelet counts were determined to be significant predictors (Table 10). In the multivariate regression analysis for factors affecting mortality, age and APACHE II score were determined to be significant parameters using the enter and backward method (Table 11).

Table 7. Univariate logistic regression analysis for morbidity

	p	OR	95 % C.I.	
Age	<0.001	1.046	1.020	1.073
Gender (female)	0.894	1.097	0.280	4.296
BMI	<0.001	1.219	1.095	1.358
ASA	0.002	2.022	1.288	3.174
Accompanying disease	0.001	5.407	1.976	14.794
Perforation diameter	0.088	1.059	0.992	1.130
APACHE II score	0.122	1.091	0.977	1.218
MPI score	0.006	1.095	1.026	1.168
Free air	0.784	0.825	0.209	3.264
Shock state	0.064	2.750	0.942	8.027
Glucose	0.853	1.001	0.990	1.012
Urea	0.034	1.014	1.001	1.027
Creatinine	0.515	1.103	0.822	1.480
AST	0.349	1.012	0.987	1.037
ALT	0.195	1.023	0.988	1.059
GGT	0.002	1.053	1.019	1.088
LDH	0.957	1.000	0.996	1.004
ALP	0.033	1.011	1.001	1.022
Total protein	0.681	0.890	0.510	1.553
Albumin	0.138	0.564	0.264	1.201
Calcium	0.070	0.481	0.218	1.061
Sodium	0.143	0.895	0.771	1.038
Potassium	0.875	0.929	0.371	2.324
CRP	0.477	1.002	0.997	1.006
Amilase	0.559	0.997	0.989	1.006
WBC	0.073	0.897	0.797	1.010
HGB	0.348	0.910	0.748	1.108
HCT	0.827	0.992	0.922	1.067
PLT	0.500	1.002	0.997	1.006

BMI: body mass index; ASA: American Society of Anesthesiologists; APACHE: acute physiology and chronic health evaluation; MPI: Mannheim peritonitis index; AST: aspartate aminotransferase; ALT: alanine aminotransferase; GGT: Gamma glutamyl transferase; LDH: lactate dehydrogenase; ALP: alkaline phosphatase; CRP: C reactive protein; WBC: white blood cells; HGB: hemoblobin; HCT: hematocrit; PLT: platelet

Table 8. Most significant variables for morbidity

	p	OR	95.0% C.I.	
BMI	0.001	1.223	1.085	1.379
GGT	0.003	1.045	1.015	1.076
ALP	0.075	1.015	0.999	1.031

BMI: body mass index; GGT: gamma glutamyl transferase; ALP: alkaline phosphatase

Table 9. Multivariate logistic regression analysis for morbidity

		p	OR	95.0% C.I.	
Enter method	Gender	0.702	0.728	0.143	3.705
	Age	0.017	1.050	1.009	1.092
	Time from onset of symptoms	0.969	0.993	0.706	1.396
	MPI score	0.158	1.117	0.958	1.302
	APACHE II score	0.133	0.840	0.670	1.055
	Perforation diameter	0.442	0.964	0.877	1.059
	Free air	0.526	0.598	0.122	2.925
Backward method	Age	<0.001	1.046	1.020	1.073

Model: gender, age, time fromonset of symptoms, MPI score, APACHE II score, perforationdiameter, freeair
MPI: Mannheim peritonitis index; APACHE: acute physiology and chronic health evaluation

DISCUSSION

Perforation is the second most common complication of peptic ulcer disease following hemorrhage, with an incidence ranging from 3.77 to 14 in 100,000 (6-10). High rates of morbidity (20%-50%) and mortality (3%-40%) have been reported for patients surgically treated for PUP (11-14). There are many studies about the risk factors for these high mortality and morbidity rates. In our study, there were statistically significant differences between groups with regard to the average values for age, BMI, perforation diameter, APACHE II score, and MPI score (p<0.001).

The diagnosis of PUP is most often made using the initial plain abdominal X-ray (15-17). In our study, 98 (87.5%) patients were diagnosed using the initial plain abdominal X-ray. The presence of subdiaphragmatic free air did not have a statistically significant relationship with mortality or morbidity. Wakayama et al. (18) reported WBC counts below 9500/mm^3 was a significant predictor of mortalityHowever, no significant effect of WBC count on mortality or morbidity was observed in our study.

Ninety-seven (86.6%) of the 112 patients included in the study were male and 15 (13.4%) were female. Most (71.4%-94.5%) of the patients with PUP are reported to be male (19-23). However, Sonnenberg (24) has displayed in his study that the ratio of females is increasing and has claimed that female gender is a risk factor for postoperative morbidity. On the contrary, Nomani et al. (25) reported the negative effect of male gender on mortality and morbidity. In our study, no prognostic value of gender was detected. Testini et al. (26) have reported that patients aged 65 years or more have significantly higher rates of mortality compared with younger patients and explained this finding with the increased incidence of accompanying diseases in the elderly patients. Similarly, in our study, older age was determined to have a significant effect on mortality and morbidity. In the study of Kim et al. (2), it was determined that the presence of accompanying diseases did not have a significant effect on postoperative mortality and morbidity. On the other hand, numerous studies have shown that the presence of accompanying diseases has a significant effect on postoperative mortality and morbidity. In these studies, pulmonary diseases, hypertension (HT), diabetes mellitus (DM), and cardiac diseases were found to be of importance with varying frequency (5, 27, 28). In our study, the presence of DM, HT, renal failure, heart failure, COPD, and malignancies was observed to be related with a significantly increased risk of postoperative mortality and morbidity.

Table 10. Univariate logistic regression analysis for mortality

	p	OR	95 % C.I.	
Age	<0.001	1.125	1.058	1.197
Gender (female)	0.169	2.781	0.648	11.945
BMI	0.004	1.254	1.074	1.465
ASA	<0.001	10.203	3.505	29.699
Accompanying disease	0.001	17.143	3.441	85.401
Perforation diameter	<0.001	1.212	1.107	1.326
APACHE II score	<0.001	1.625	1.286	2.053
MPI score	<0.001	1.366	1.181	1.580
Freeair	0.720	1.477	0.174	12.512
Glucose	0.696	1.003	0.990	1.016
Urea	<0.001	1.051	1.027	1.076
Creatinine	0.043	1.474	1.012	2.147
AST	0.090	1.023	0.996	1.050
ALT	0.352	0.960	0.882	1.046
GGT	0.474	1.010	0.983	1.037
LDH	0.083	1.003	1.000	1.007
ALP	0.514	1.004	0.992	1.017
Total protein	<0.001	0.033	0.006	0.174
Albumin	<0.001	0.011	0.001	0.096
Calcium	0.001	0.130	0.039	0.434
Sodium	0.836	1.019	0.856	1.212
Potassium	<0.001	7.524	2.549	22.207
CRP	0.001	1.010	1.004	1.016
Amilase	0.136	1.005	0.998	1.011
WBC	0.871	0.988	0.857	1.140
HGB	0.004	0.703	0.552	0.894
HCT	0.003	0.876	0.802	0.955
PLT	0.039	1.006	1.000	1.012

BMI: body mass index; ASA: American Society of Anesthesiologists; APACHE: acute physiology and chronic health evaluation; MPI: Mannheim peritonitis index; AST: aspartate aminotransferase; ALT: alanine aminotransferase; GGT: gamma glutamyl transferase; LDH: lactate dehydrogenase; ALP: alkaline phosphatase; CRP: C reactive protein; WBC: white blood cells; HGB: hemoblobin; HCT: hematocrit; PLT: platelet

Table 11. Multivariate logistic regression analysis for mortality

		p	OR	95.0% C.I.	
Enter method	Gender	0.236	10.320	0.217	490.9
	Age	0.172	1.063	0.974	1.161
	Time from onset of symptoms	0.125	1.875	0.840	4.186
	MPI score	0.530	1.090	0.832	1.428
	APACHE II score	0.159	1.489	0.855	2.594
	Perforation diameter	0.197	1.101	0.952	1.273
	Free air	0.080	79.742	0.589	10793.3
Backward method	Age	0.035	1.079	1.006	1.159
	Time from onset of symptoms	0.069	1.593	0.965	2.629
	APACHE II score	0.026	1.506	1.051	2.157

Model: Gender, age, time from onset of symptoms, MPI score, APACHE II score, perforation diameter, free air
MPI: Mannheim peritonitis index; APACHE: acute physiology and chronic health evaluation

There are many scoring systems for predicting risk of morbidity and mortality in PUP, with ASA and Boey scoring methods being the most commonly used ones (29-32). However, ASA score is used as an overall surgical risk score rather than just for predicting the risks of PUP. Also in many studies, high MPI and APACHE II scores were found to be related with increased mortality and morbidity. Some studies have only investigated the effects of preoperative shock state on morbidity and mortality, concluding it to be an important risk factor (26, 33-35) We used the ASA, MPI, and APACHE II scoring methods as variables in our study. According to the statistical analysis, we concluded that all three scoring methods could be used to predict the risk of mortality and morbidity.

Nomani et al. (25) have reported a worse prognosis in patients with a perforation diameter greater than 5 mm. Consistent with the literature, we found that a large perforation diameter significantly increases morbidity and mortality (26-36). Duration of postoperative hospital stay of patients operated for PUP ranges between 7 and 12.5 days (37-39). In our study, the mean duration of hospital stay was 11.7±11.3 days in the morbidity group and 5.3±1.1 days in the no complication group. The duration of postoperative hospital stay in the morbidity group was significantly longer than that in the no complication group ($p<0.001$). In their study with 2668 patients, Buck et al. (40) have calculated a two-fold risk of mortality for underweight patients operated for PUP, and determined that being obese has no positive or negative effect on mortality. In our study, for patients with an increased BMI, mortality and morbidity were also significantly increased in both univariate and multivariate analysis ($p<0.001$).

CONCLUSION

Peptic ulcer perforation continues to be an important cause of mortality and morbidity. We think that a novel vision to avoid gaps is necessary to evaluate the patients with PUPsas surgeons are coming across new types of patient profile in last decades. Mortality and morbidity are increased in patients with older age and higher BMI, perforation diameter, and APACHE II and MPI scores. We hypothesize that through closer follow-up of these patients, rates of mortality and morbidity can be decreased.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Haseki Training and Research Hospital.

Informed Consent: Written informed consent was obtained from patient who participated in this study.

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