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Research Article

Factors Affecting Postoperative Morbidity and Mortality in Chronic Hemodialysis Patients

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Abstract

Objectives: Hemodialysis (H/D) is the most common renal replacement therapy for patients with end-stage renal failure (ESRD). Although cardiac and neurological complications associated with the treatment are known to increase mortality, the effect of surgical interventions on patients is not fully elucidated. Therefore, we aimed to determine the effect of surgery on morbidity and mortality in H/D patients as a specific group.

Methods: The data of 117 patients who received HD treatment for ESRD were analyzed retrospectively.

Results: Among the surgical subgroups, medium-sized (43.5%), elective (66.6%) and extra-abdominal (58.1%) surgeries were performed at the highest rate. Those undergoing emergency surgery were older and had a higher rate of anemia, lower albumin levels, and higher C-reactive protein (CRP) levels compared to other groups ($p<0.05$). Similarly, the mean age and creatinine levels of those who underwent major surgery were higher ($p<0.05$). The mean age and CRP levels of those undergoing abdominal surgery were higher compared to other groups ($p<0.05$). The multivariate analysis has shown that advanced age, low albumin levels, and emergency, intra-abdominal and major surgeries are independent prognostic risk factors for ICU admission. Advanced age, low albumin level, and emergency surgery were the determining factors for 1-month postoperative mortality.

Conclusion: Emergency, major, and intra-abdominal surgery significantly increase morbidity and mortality in chronic H/D patients. Further, hypoalbuminemia and advanced age are independent prognostic factors for higher intensive care unit admission. Preoperative elevation of albumin levels along with close postoperative follow-up may positively affect survival in these patients.

Keywords: Dialysis, surgery, mortality, kidney

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Chronic kidney disease (CKD) is a comprehensive clinical condition that causes the progressive and irreversible deterioration of homeostasis due to several underlying factors. The most important indicator of this deterioration in renal functions is declined glomerular filtration rate (GFR).[1] End-stage renal disease (ESRD) develops when GFR falls below 15 ml/min/1.73 m^2. The most common cause of CKD is diabetes mellitus, followed by idiopathic and other causes.[2] The life expectancy of patients with CKD has increased in the last 20 years in line with advances in diagnosis and treatment, with the average age increasing up to 64 years.[3] Consequently, higher life expectancy has increased the frequency of elderly CKD patients among both society and CKD patients, increasing the incidence of surgery in correlation.[4,5]

Unfortunately, CKD patients progress to ESRD over time due to the lack of sufficient management of the underlying

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etiological factor, as well as the formation of new adverse factors combined with aging. This ultimately results in the application of one or more of the renal replacement therapy modalities including HD, peritoneal dialysis, or renal transplantation. Each modality prolongs the life span of patients, but carries its own potential side-effects and complications. Therefore, patients with ESRD should be closely monitored by the clinician. H/D is a dialysis method in which solutes move passively down their concentration gradients, from one fluid compartment into the other (either blood or dialysate). Major HD-related complications include intradialytic hypotension, dialysis dementia, disequilibrium syndrome, angina and air embolism, which are also associated with survival.[6-8] The most common cause of mortality in ESRD is cardiovascular events. Adjusted rates of all-cause mortality are 6.4–7.8 times higher for ESRD patients compared to individuals in the general population, which is followed by cerebrovascular events and malignancies.[9] In addition, the mortality rates for ESRD patients undergoing surgery is 3 times higher than those with no history of surgery.[10]

A review of available studies has shown that factors affecting postoperative mortality were investigated in ESRD patients who received any RRT or in H/D patients in small patient groups. Although both HD-related and disease-related complications are well known in ESRD patients undergoing HD, there is a limited number of studies showing how different types of surgery affect morbidity and mortality. Investigating the factors affecting the survival of chronic H/D patients as a specific group may eliminate the confusing factors that may arise from other RRTs. In this regard, our study aimed to investigate the effect of surgery in patients undergoing H/D due to CKD.

Methods

Between 2009-2014, patients who were diagnosed with CKD and hospitalized in general surgery, orthopedics, urology, and neurosurgery services in Haydarpaşa Numune Training and Research Hospital were analyzed retrospectively. Using the hospital's medical record system, patients who were hospitalized in these wards and operated on, had the ICD codes N18.0, N18.8, N19 registered, and underwent H/D at least 2 times, one of which was preoperatively in the hospital, were included in the study. In line with the following exclusion criteria, a total of 118 patients, 75 male and 43 female, aged between 21 and 88 were included in the study (Table 1).

Inclusion criteria;

- Being an ESRD patient receiving H/D treatment for any reason,
- Undergoing any of the general surgery, urology, brain surgery, orthopedic operations,
- Undergoing the operation after the start of dialysis

Exclusion criteria;

- Patients undergoing peritoneal dialysis
- Surgical intervention other than general surgery, urology, neurosurgery, orthopedic surgery
- Patients who were hospitalized for arteriovenous fistula opening and H/D catheter insertion
- Kidney transplant operations
- The operation was performed before the start of the H/D

Primary kidney disease, comorbidity, surgical specialty, and type of surgery were expressed in subgroups numerically

Table 1. Clinical and laboratory findings recorded in the preoperative and postoperative period

Preoperative		Postoperative	
Clınical Features	**Laboratory**	**Clınical Features**	**Laboratory**
• Age	• Hemoglobin	• Postoperative life time	• PH
• Gender	• Leucocyte	• Length of stay in hospital	• HCO3
• Duration of hemodialysis (month)	• Platelet	• Postoperative complication	• PCO2
• Primary kidney disease	• International Normalized Ratio (INR)	• Mortality	
• Diabetes mellitus (DM)	• Albumin		
• Coronary artery disease (CAD)	• Creatinine		
• Cerebrovascular disease (CVD)	• Blood urea nitrogen (BUN)		
• Peripheral vascular disease (PVD)	• C-reactive protein (CRP)		
• Other cardiac events	• Parathyroid hormone (PTH)		
• Dysrhythmia	• Ferritin		
• Chronic obstructive pulmonary disease (COPD)	• Potassium (K) • Sodium (Na)		
• Gastrointestinal system bleeding	• Calcium (Ca)		
	• Phosphor (P)		

and as percentages. The patients were divided into groups according to whether the surgery was emergency or elective, intra-abdominal or extra-abdominal, minor, medium, or major. Preoperative and postoperative clinical and laboratory findings of the patients were recorded (Table 1).

Emergency surgery was accepted as any form of surgical intervention to treat a condition that may cause permanent damage or death in case of delay where no alternative treatment method is available other than surgery. Other non-emergency surgeries were considered elective surgery.[11]

Classifications of surgeries as minor, medium and major were made on the basis of the interventional procedures list of the Ministry of Health's interventional procedures directive.[12]

Pneumonia, bleeding and intensive care requirements were accepted as postoperative complications.

Statistical Analyses

Patient data were obtained from the hospital's health information system and recorded. Continuous variables were defined using mean and standard deviation while discrete variables were defined using percentages. The study groups (Emergency-Elective; Minor-Medium-Major; Inra-Abdominal-Extra- Abdominal) were compared with each other in terms of continuous and discrete variables. Data analysis was performed using the SPSS 20.0 Windows for Mac package software. The Chi-Square test was used to compare categorical variables, the Student's t-test and Mann Whitney-U tests were used for pairwise comparisons of independent groups, and One-Way ANOVA and Kruskal-Wallis tests were used for triple comparisons. The Pearson and Spearmen correlation tests were used to assess the relationship between continuous variables. Multivariate analysis was performed to identify risk factors related to surgical outcomes and mortality. Univariate analysis was performed for variables, which were found significant in the multivariate analysis, to investigate significance. Kaplan-Meier method was used for survival analysis, and log-rank analysis was used for group comparisons. A p-value of <0.05 was considered statistically significant.

Results

The age of 117 patients included in this study ranged from 21 to 88 years. There were 75 male and 43 female patients. Other demographic data are summarized in Table 2.

Anatomical distribution of surgeries has shown that the most common surgical intervention was parathyroidectomy (22%), followed by small and large intestine surgery (16%) and hepatobiliary tract surgery (15%) (Fig. 1).

Table 2. Distribution of General Demographic Characteristics of Hemodialysis Patients

Variables	N	%
Age*	57.6±15.2	21-88
Gender		
Male	75	63
Female	43	37
Primary disease		
Diabetic Nephropathy	33	30
Hypertensive Kidney Disease	21	19.1
Primary Glomerulonephritis	4	3.6
Interstitial Nephritis	3	2.7
Renal Artery Disease	1	0.9
Others	48	43.6
Duration of Hemodialysis (month)	52.5±54.9	
Comorbid condition		
Diabetes Mellitus	35	29.4
Coronary Artery Disease	19	16
Cerebrovascular Disease	3	2.5
Peripheral Vascular Disease	11	9.2
Other cardiac events	10	8.4
Chronic obstructive pulmonary disease	3	2.5
Gastrointestinal bleeding	5	4.2
Chronic Liver disease	7	5.9
Cancer	22	18.5
Hypertension	56	47.1
Clinics		
General Surgery	82	69.5
Orthopedics	16	13.5
Urology	16	13.5
Neurosurgery	4	3.4

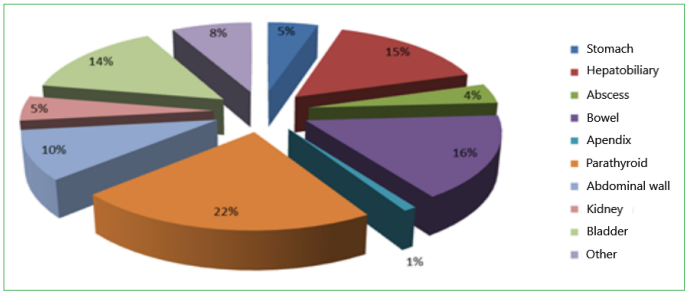

Figure 1. Distribution of surgeries by anatomical regions.

Evaluation of surgery groups has shown that medium-sized (51, 43.5%), elective (78, 66.6%), and extra-abdominal (68, 58.1%) surgeries were the most performed (Table 3).

Comparison between emergency and non-emergency surgeries has shown that patients undergoing emergency surgery were older (p=0.001), more anemic (p=0.030), had lower serum albumin levels (p=0.003), and had higher C-reactive protein (CRP) levels (0.030) (Table 4).

Comparison between surgery size has shown that the mean

Table 3. Distribution of Hemodialysis Patients in Surgery Groups

	Extra-abdominal n=68	Intra-abdominal n=49
Minor, n=27		
Emergency, n=5	7	4
Elective, n=22	11	5
Middle, n=51		
Emergency, n=14	1	13
Elective, n=37	31	6
Major, n=39		
Emergency, n=20	7	13
Elective, n=19	11	8

Table 4. Distribution of Patient Subgroups by Emergency and Elective Surgery

Variables	Emergency n=44	Elective n=73	p
Mean age	63±13	54±15	0.001*
Male (%)	33.8	66.2	NS
Length of stay (days)	12.8±9.7	13.8±14	NS
Hemoglobin (gr/dl)	10.5±2	11.3±2	0.030*
Platelets (µL)	223170±102	221198±106	NS
Sodium (mg/dl)	133.2±19.4	136.7±3.8	NS
Potassium (mg/dl)	4.4±0.8	4.3±0.8	NS
Calcium (mg/dl)	11.8±19.5	8.8±1.4	NS
BUN (mg/dl)	44.4±25.7	38.6±20.2	NS
Serum creatinine (mg/dl)	4.7±1.8	5.1±2.6	NS
CRP mg/dl	16.1±14.7	7.4±8.4	0.030*
Albumin (g/dl)	2.6±1	3.1±0.8	0.003*
Ferritin (ng/ml)	1720±1435.6	1101.2±1152.2	NS

*Statistically significant. NS: Not statistically significant; BUN: Blood urea nitrogen; CRP: C-reactive protein.

age was lower in medium-sized surgery (p=0.042), while anemia was more common (p=0.040), as well as serum creatinine and serum albumin levels were lower (p=0.016 and p=0.000) in major surgery. CRP and INR levels were higher in patients who underwent major surgery (p=0.016 and p=0.013), (Table 5).

Comparison between intra-abdominal and extra-abdominal surgeries has shown that those undergoing abdominal surgery were older (p=0.027), had a shorter hospital stay (p=0.048) and had higher CRP levels (p=0.04) (Table 6).

Multivariate analysis of the factors related to intensive care requirement among post-operative complications in all groups has demonstrated that intensive care requirement was higher among patients undergoing intra-abdominal surgery compared to other types (78.6% vs. 21.4%; p=0.003); in major surgery compared to minor and medium surgery (71.4% vs. 7.1%, 21.4%; p=0.004), and in emergency (78.6% vs. 21.4%; p=0.001) surgery compared non-emergency operations. In addition, advanced age and low albumin were independent prognostic risk factors. The present findings were also supported by the univariate analysis (Table 7).

Analysis of the survival rates by patient groups with the Kaplan-Meier test has shown that survival was shorter among patients undergoing emergency surgery compared to non-emergency surgery (p=0.000); major surgery compared to small and medium-sized surgery (p=0.001), and intra-abdominal surgery compared to other types of surgery (p=0.006) (Fig. 2).

13.5% of the patients died within the first month after surgery. When the factors affecting 1-month mortality due to any reason were examined by multivariate analysis, it was

Table 5. Distribution of Patient Subgroups by the Size of the Surgery

Variables	Minor	Medium	Major	P
Mean age	59±18	53±16	61±10	0.042*
Male (%)	20.3	47.3	32.4	NS
Length of stay (days)	11.9±19.7	13.7±9.1	14.1±10.2	NS
Hemoglobin (gr/dl)	11.04±2.23	11.45±1.9	10.3±2	0.040*
Platelet (µL)	208259.2±101382.2	198546±91701	261423±113300	NS
Sodium (mg/dl)	135.9±4.7	137.5±2.9	132.4±12.3	NS
Potassium (mg/dl)	4.4±0.9	4.4±0.8	4.3±0.9	NS
Calcium (mg/dl)	8.8±1	9±1.4	12±20.7	NS
BUN (mg/dl)	46±27.4	37.2±23.2	41.8±16.9	NS
Creatinine (mg/dl)	5.4±2.4	5.3±2.2	4.2±1.5	0.016*
CRP (mg/dl)	6.9±7.7	7±8.8	16.4±14	0.016*
Albumin (g/dl)	3±0.8	3.2±0.8	2.5±0.8	0.000*
Ferritin (ng/ml)	972±1062	969±1174.8	1858.2±1342	NS
INR	1±0.1	1±0.15	1.2±0.2	0.013*

*Statistically significant. NS: Not statistically significant, BUN: Blood urea nitrogen, CRP: C-reactive protein, INR: International normalized ratio.

Table 6. Distribution of Patient Subgroups by Intra-Abdominal or Extra-Abdominal Surgery

Variables	Intra-Abdominal n=44	Extra-Abdominal n=73	p
Mean age (years)	61.3±14.2	55±15.6	0.027
Male (%)	32.2	60.8	NS
Length of stay (days)	10.8±8.2	15.4±14.6	0.048
Hemoglobin (gr/dl)	10.9±2	11±2.1	NS
Platelets (µL)	225357±109429	219452±101840	NS
Sodium (mg/dl)	134.9±18.6	135.7±3.9	NS
Potassium (mg/dl)	4.4±0.7	4.3±0.9	NS
Creatinine (mg/dl)	5±2	4.9±2.1	NS
CRP (mg/dl)	13.7±13.7	7.1±8.0	0.04
Albumin (g/dl)	2.8±0.9	3±0.9	NS

*Statistically significant. NS: Not statistically significant, CRP: C-reactive protein.

found that age, H/D duration, emergency surgery, and low albumin negatively affected survival. The effect of age and albumin was observed to become stronger in the univariate analysis (Table 8) (Figs. 3 and 4).

Discussion

Several studies have reported CKD to be an independent risk factor for postoperative morbidity and mortality.[4,13,14] Many factors such as adequate preoperative dialysis, presence of anemia, blood pressure, heart failure, blood glucose, fluid and electrolyte levels, nutrition, presence of catheter or fistula, type of surgery, age, and infection contribute to the prolongation of hospitalization in the perioperative and postoperative period, in addition to intensive care requirement, as well as increased mortality. Postoperative mortality is around 4% in ESRD patients undergoing general surgery.[15,16] Mortality following emergency surgery is found to be 5 times greater than other operations.[17] In a study evaluating 5 H/D patients, the postoperative mortality rate was observed to be around 4%, similar to ESRD patients.[18] In this single-center study, we retrospectively evaluated the effects of operations performed on 117 H/D patients on postoperative morbidity and mortality by comparing the surgical groups.

General demographics have shown that 63% of the patients were male. Although the most common comorbidity

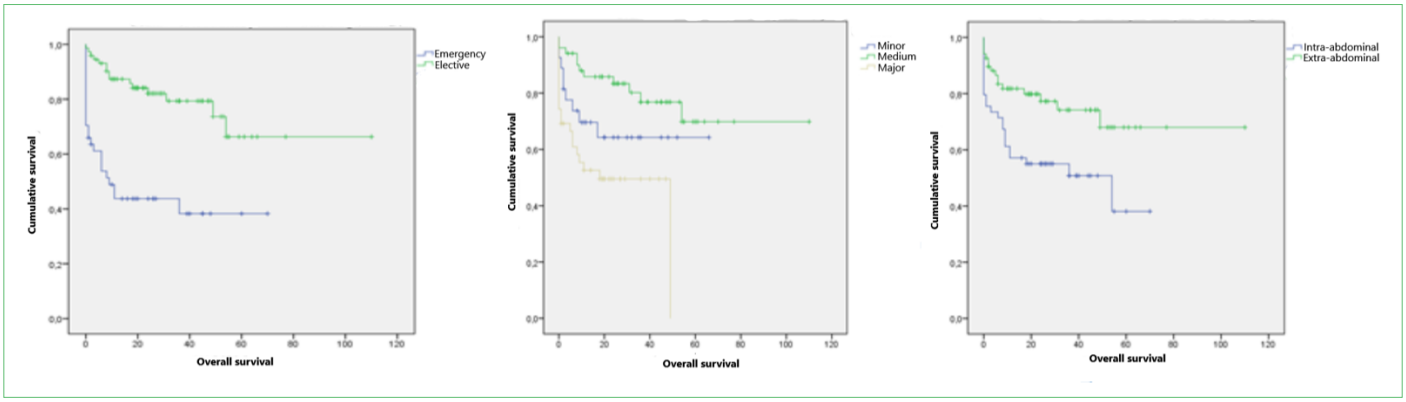

Figure 2. The one-year survival of patients undergoing emergency surgery compared to elective surgery was 43.7% versus 87.3%, respectively (p<0.005) (Left). According to the size of the surgery, the 1-year survivals of those who had minor-medium-major surgery were 69.6%, 85.8%, and 52.6%, respectively (p=0.001) (Middle). The one-year survivals of those who had intra-abdominal and extra-abdominal surgery were 57.1% and 81.8%, respectively (p=0.006) (Right).

Table 7. Factors Affecting the Need for Postoperative Intensive Care

	Multivariate		Univariate		
Variables	OR	P	OR	p*	% 95 CI
Advanced age	8.6	0.004*	6.2	0.014*	59.2 - 75
H/D (month)	1.4	0.241	1.4	0.241	0.733 - 0.211
Emergency surgery	11.8	0.001*	12.9	0.301 - 0.459	
Abdominal surgery	9.6	0.003*	9.7	0.002*	0.381 - 0.467
Major surgery	9.5	0.003*	9.2	0.003*	1.260 - 2.024
Albumin	8.6	0.004*	8.9	0.004*	1.9 - 2.8

* Statistically significant. CI: Confidence interval, H/D: Hemodialysis, OR: Odds ratio.

Table 8. Factors Affecting One-Month Postoperative Mortality

	Multivariate		Univariate		
Variables	**OR**	**p***	**OR**	**p***	**% 95 CI**
Age	11	0.001	12.5	0.001	62.4 - 76.3
HD (month)	1.5	0.217			
Emergency surgery	23.3	0.000	20.4	0.000	0.097 - 0.364
Abdominal surgery	3.17	0.078			
Major Surgery	3.16	.078			
Albumin	8.5	0.005	11.5	0.001	2.87 - 3.21

* Statistically significant. CI: Confidence interval, H/D: Hemodialysis, OR: Odds ratio.

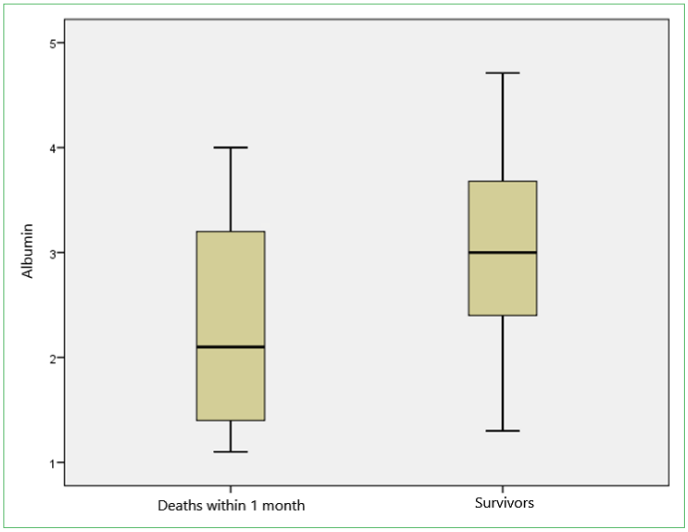

Figure 4. Mean albumin levels (g/dl) of those who died and survived in one month postoperatively.

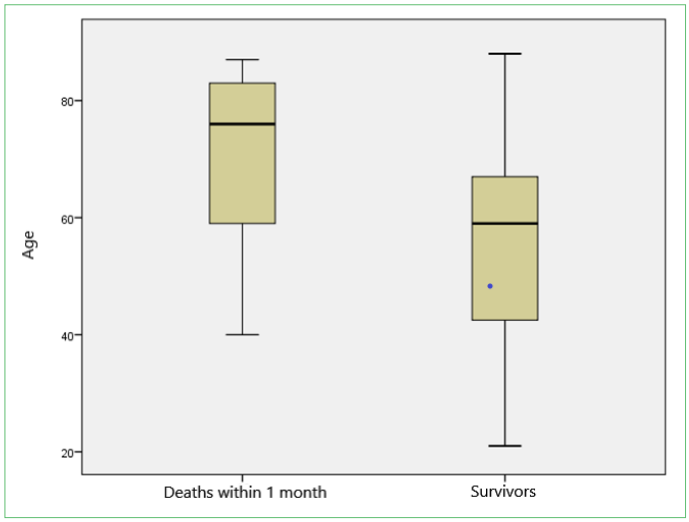

Figure 3. Mean ages of those who died and survived in one month postoperatively.

was diabetes mellitus, the most common primary kidney disease was other causes with 43.6%. This may be due to the selected sample and the relatively low number of patients. The most common surgical specialty was observed to be general surgery with 69.5%. Evaluation of the surgery groups has shown that parathyroidectomy was the most common surgical operation, followed by small and large intestine surgery (16%) and liver and biliary tract surgery (22%). Classification of operations involving multiple elements such as parathyroid and thyroid, gastrointestinal and hepatobiliary system, spleen, and the abdominal wall under the specialty of general surgery; in addition, the fact that intestinal system disorders such as secondary hyperparathyroidism caused by uremia, susceptibility to peptic ulcer, GI bleeding are more common in these patients seems to explain the higher rate of general surgery procedures. Consistent with our study, available studies conducted with ESRD patients report higher rates of general surgery procedures.[17,19]

Comparison of the patients who underwent emergency and elective surgery with each other has shown that those undergoing emergency surgery were older, more anemic, and had lower albumin levels. Evaluation of the causes of emergency surgery has revealed intraabdominal pathologies such as acute appendicitis, acute cholecystitis, duodenum, and diverticulum perforations. Chronic intestinal disorders and rapid inflammatory response associated with these pathologies may be the cause of low albumin and high CRP. Increased femur and other bone fractures, diverticulum perforation, and other intra-abdominal pathologies in line with age are thought to be associated with the higher mean age in patients undergoing emergency surgery.[20,21] Lower hemoglobin values in those undergoing emergency surgery may be associated with a higher mean age of the patients and blood loss due to intestinal pathologies.

Hemoglobin, serum creatinine, and albumin levels were lower among the patients undergoing major surgery, while the mean age, INR, and CRP levels were found to be higher. The causes of major surgery included pathologies such as il-

eal resection, gastrectomy, colectomy, and below-knee amputations in addition to protein-calorie malnutrition caused by CKD that may be associated with low albumin and high INR, one of the markers of liver synthetic function. A correlation was found between the severity of the disease and the CRP level, an indicator of acute inflammatory response, which was also considered to be another cause of low albumin levels in patients undergoing major surgery. Although the mean hemoglobin levels were low among all patients, anemia was deeper among those who had major surgery. The higher mean age of patients undergoing major surgery, higher rates of intra-abdominal surgery, and the inflammatory process may be the cause of low hemoglobin in these patients, which occurs as a result of the common effects of factors such as underlying iron-deficiency anemia, anemia of chronic disease, and EPO deficiency.

The length of hospital stay was longer among patients undergoing extra-abdominal surgery compared to those undergoing intra-abdominal surgery. The longer hospitalization was associated with the presence of orthopedic surgery among non-abdominal surgeries, and hungry bone syndrome that may develop after parathyroidectomy. The fact that inta-abdominal surgery exhibits high mortality in the early period was also thought to contribute to this difference. High CRP levels in abdominal surgery patients were attributed to the fact that the majority of the patients in this group underwent major and emergency surgery.

Considering postoperative complications, it was observed that the need for intensive care was 9.6 times higher in those undergoing intra-abdominal surgery compared to non-abdominal surgery, 9.5 times higher undergoing major surgery compared to medium and minor surgery, and 11.8 times higher undergoing emergency surgery compared to elective surgery. Borlase et al. compared ESRD patients who underwent emergency or elective abdominal surgery where they determined morbidity and mortality rates increased 5 and 8 times among those who underwent emergency surgery compared to those who underwent elective surgery.[17] In another study, dialysis patients who underwent coronary artery bypass graft were compared with another group undergoing CABG operations in which the hospital mortality was found 4.4 times higher in patients receiving dialysis treatment. It was observed that the patients undergoing dialysis were older, had more comorbidities, and had severe cardiac conditions. Multivariate analysis with these factors has shown that mortality increased 3.1 times following CABG in dialysis patients.[10]

Evaluation of the 1-month postoperative mortality rates has shown that advanced age, low albumin and emergency surgery were associated with higher mortality compared to elective surgery. It was determined that H/D duration, abdominal surgery and surgery size did not affect early mortality. Changes in the cardiovascular and pulmonary systems with aging and the effect of surgery are considered as other factors affecting ICU admission. Inflammatory markers are associated with high mortality in HD patients, and pathologies leading to emergency surgery further increase inflammation.[22,23] In our patients, factors such as inflammatory response and malnutrition leading to hypoalbuminemia appear to be associated with increased ICU admission. Infection (catheter, fistula, metastatic infections), which are chronic complications of H/D, protein-energy malnutrition seen in these patients, cardiac events that may occur during or after surgery due to intravascular calcium phosphate accumulation may be associated with an increase in the need for intensive care.[24,25] The need for postoperative intensive care is known to increase in COPD patients.[26] In our study, although COPD was not found to be associated with intensive care admission, it was concluded to be another effective factor providing that the number of patients is sufficient.

In another retrospective study, 87 ESRD patients who underwent abdominal surgery were divided into two surgery groups as emergency and elective; in which overall complication and mortality rates were 41.8% and 5.7%, respectively. Complication and mortality rates in those undergoing emergency surgery were 58.3% versus 16.6% and 33.3% versus 1.5%, respectively. Comparison of these results with the results of our study shows that both studies have similar mortality rates. In our study, patients who were taken to H/D at most 24 hours before the operation were selected, while the patients in the mentioned study were selected from those who were not taken to H/D, although mortality rates were found to be similar.[27] In patients with ESRD, the most common postoperative complication is hyperpotassemia, followed by infections, hemodynamic instability, bleeding, and arrhythmias.[17,18,28] In our study, postoperative carbon dioxide, bicarbonate, and PH values were not found to be associated with mortality and complications. Therefore, we thought that the contribution of other risk factors may be higher such as age, comorbid diseases, hypoalbuminemia, preoperative blood transfusion, wound infection, and ASA score, which contribute to mortality independent of H/D.

Analysis of the survival rates by patient groups with the Kaplan-Meier test has shown that patients undergoing emergency surgery had lower survival rates than patients, who have undergone non-emergency surgery (p=0.000); patients undergoing major surgery lived less than patients undergoing minor and medium-sized surgery (p=0.001), and patients with intra-abdominal surgery had lower

survival rates than patients with other types of surgeries (p=0.006). Type of surgery was observed to exert a significant negative effect on survival, similar to mortality.

Our study investigated risk factors affecting postoperative mortality and morbidity based on the type of surgery, comorbidities and specific laboratory findings. The retrospective design and relatively low sample size of the study make it difficult to draw general conclusions. Other important limitations of the study are the lack of knowledge on whether the patients had peroperative blood transfusion, ASA score, postoperative wound infection and sepsis, as well as the blood potassium level, volume status, which indicates the adequacy of H/D performed in the pre- and postoperative period. Although COPD, which is one of the comorbid diseases affecting postoperative morbidity and mortality, is borderline effective, it may be appropriate to consider H/D patients with COPD who are scheduled for surgery as high-risk.

Conclusion

Emergency, major, and abdominal surgeries that require intervention significantly increase morbidity and mortality in chronic H/D patients. In addition to the type of surgery, hypoalbuminemia and advanced age were found to be independent prognostic risk factors that increase the need for intensive care. In addition to determining the preoperative risks of chronic H/D patients independent of the operation, the type of surgery to be performed seems to be important in terms of the outcomes in the postoperative period. Prospective studies with a greater number of patients are required to verify our results.

Disclosures

Ethics Committee Approval: Our retrospective study is based on laboratory parameters data collected from databases and is not directly associated with patients. For this reason, ethics approval from the Human Research Ethics Committee was not required for this study.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – M.T.; Design – S.A., F.F.; Supervision – S.A.; Materials – F.F.; Data collection and/or processing – F.F., S.A.; Analysis and/or interpretation – M.T., S.A., F.F.; Literature search – F.F.; Writing – F.F., M.T.; Critical review – M.T., S.A., F.F.

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