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To cite this article: Leyla Ozel, Osman Krand, Mustafa Sefa Ozel, Ahmet Burak Toros, Jülide Sağiroğlu, Melih Kara, Erdal Erdoğan, Bülent Yiğit, Pınar Ata, Faruk Çavdar & Mesut İzzet Titiz (2011) Elective and Emergency Surgery in Chronic Hemodialysis Patients, Renal Failure, 33:7, 672-676, DOI: [10.3109/0886022X.2011.589940](https://doi.org/10.3109/0886022X.2011.589940)

To link to this article: <https://doi.org/10.3109/0886022X.2011.589940>



Published online: 25 Jul 2011.



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CLINICAL STUDY

Elective and Emergency Surgery in Chronic Hemodialysis Patients

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Abstract

Purpose: Aim of this study was to report our experience in elective and emergency surgery on chronic hemodialysis (CH) patients for end-stage renal disease (ESRD). **Methods:** All patients on CH for ESRD who underwent various surgical procedures in our unit within the past 9-year period (2001–2010) were included in this study. These patients were divided into two groups according to the type of surgery performed: elective or emergency. Demographic data, indications for surgery, primary causes of ESRD, surgical procedures, postoperative complications, and mortality rates were studied. **Results:** Of 130 patients, 121 underwent elective surgery while 10 were addressed for emergency operation. In the elective surgery group, the most common diseases were secondary hyperparathyroidism, kidney diseases, cholelithiasis, and diabetic foot gangrene. Complications occurred in nine patients (morbidity rate, 7%) and only one patient died (mortality rate, 0.8%). In the emergency surgery group, the most common diseases were diabetic foot gangrene and obstructed sigmoid colon cancer. In this group, complications occurred in seven patients (total morbidity rate, 70%) and two patients died (mortality rate, 20%). **Conclusions:** Elective surgery in patients on CH for ESRD can be performed with acceptable surgical risks provided careful preoperative preparation, intraoperative, and postoperative precautions are taken.

Keywords: Elective surgery, emergency surgery, end-stage renal disease, chronic hemodialysis, surgical risk

INTRODUCTION

Maintenance hemodialysis has become an accepted method of treatment for patients with end-stage renal disease (ESRD). The number of patients with ESRD who receive chronic hemodialysis (CH) treatment is steadily increasing. However, associated with the prolongation of life achieved by the improvements in dialytic techniques, many of these patients present with the usual surgical and medical problems.¹ Nevertheless, few reports focusing on this increasingly important issue of surgery have been published recently.^{2,3} In this study, we reported our experience of elective and emergency surgery on maintenance CH patients.

PATIENT AND METHODS

Total 130 ESRD patients on CH who underwent various surgical procedures in our clinic from 2001

to 2010 were retrospectively analyzed. These patients were designated into elective (group 1) and emergency (group 2) applications according to the type of surgical procedure they underwent. Of 130 patients, 121 underwent elective surgery and 9 underwent emergency operation. Medical records of both groups regarding preoperative clinical characteristics, surgical procedures, postoperative complications, and mortality rates were retrospectively analyzed and compared. In group 1, all patients underwent consecutive hemodialysis on the presence of acidosis, volume overload, hyperkalemia 1 and 2 days preoperatively, and heparin was avoided to reduce the risk of excessive bleeding. Group 2 patients underwent hemodialysis on the day of their operation in case of an increase in blood urea nitrogen, serum creatinine, serum potassium (K) levels, and volume overload. Preoperative blood transfusion was given to patients during hemodialysis to raise the hematocrit value to at

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Received 23 January 2011; Revised 29 April 2011; Accepted 29 April 2011

least 25%. In group 1, anticoagulant and antiaggregant drugs were discontinued 1 week preoperatively and patients were started on low-molecular-weight heparin. American Society of Anesthesiologists (ASA) grade was used for assessment of fitness for both groups. General anesthesia was the technique of choice in most of the patients. However, spinal anesthesia was preferred for the patients with high ASA score, comorbid disease, or for those who were candidates for groin, perianal and lower extremity surgery.

Crystalloid solutions were usually preferred to correct fluid and electrolyte imbalance during the perioperative period. In our study, intravenous fluids were given at the rate of 20–30 cc/h and measured losses were replaced with appropriate electrolyte solution. All patients were taken to hemodialysis postoperatively according to their daily laboratory results and volume overloads.

Statistical analysis was performed by SPSS, version 17.0. Data were expressed as mean and standard error of mean.

RESULTS

A total of 131 operations were performed. Preoperative clinical features are given in Table 1. The most common cause of ESRD was chronic glomerulonephritis (25%). Half of the patients in group 1, and all patients in group 2 had comorbid diseases. Cardiovascular disorders were the most commonly seen comorbid disease group. All patients in Group 2 demonstrated ASA score greater than 3. Group 1 and group 2 demonstrated statistically significant difference with respect to ASA score. Statistically significant difference was not recorded between groups with respect to other parameters.

Blood transfusion was administered during the final preoperative dialysis in 15 patients in order to raise the hematocrit value to 25%. Postoperative blood transfusions were administered to eight patients. Anal fissure ($n = 1$), leg amputation ($n = 4$), and inguinal hernia ($n = 1$) were performed under spinal anesthesia and all other patients received general anesthesia. The rates of postoperative complications and mortality are shown in Tables 2 and 3, together with the indications for surgery and the operative procedures performed. In group 1, surgical operations were total or subtotal parathyroidectomy (41%), unilateral or bilateral native nephrectomy (31%), transplant nephrectomy (13%), cholecystectomy (7%), lateral internal sphincterotomy (0.8%), mesh repair for inguinal hernia (0.8%), diabetic foot amputation (5%), gastric mucosal resection (0.8%), and ileostomy closure (0.8%). In the emergency group, surgical operations were diabetic leg amputation ($n = 4$), sigmoid resection ($n = 3$), colostomy and perineal debridement ($n = 1$), and nephrectomy and open ileostomy ($n = 1$) for spontaneous intrarenal hematoma immediately preceding ileus, in the same

patient. The most common indications were hyperparathyroidism for elective surgery and diabetic foot gangrene for emergency surgery.

There were no intraoperative complications in patients. A-V fistula thrombosis was seen within the early postoperative period in three patients in group 1, and in one patient in group 2. Thrombectomy was performed in early postoperative period in two patients and A-V fistula revision was preferred in the other two patients on postoperative day 1.

In the elective group, complications of parathyroidectomy were cervical subcutaneous hematoma in one patient and transient recurrent nerve paralysis in one patient. Wound infection was seen in one patient who underwent native nephrectomy and in two patients who underwent leg amputation for diabetic foot gangrene. Atelectasia developed in one patient who was operated for early gastric cancer. In the emergency group, wound infection was seen in two patients who underwent leg amputation, in one patient who underwent sigmoid resection, in one patient who underwent perineal debridement for Fournier gangrene, and in one patient who underwent ileostomy closure. Atelectasia was recorded in one patient who underwent sigmoid colon resection. One patient who underwent multiple operations for acute abdomen developed pancreatic fistula.

One patient who underwent parathyroidectomy in group 1 and two patients who underwent diabetic leg amputation in group 2 died. The complication and mortality rates were 7% and 0.8% in group 1, 70%, and 20% in group 2, respectively. The complication and mortality rate in group 2 were significantly higher than that in group 1 ($p < 0.05$).

DISCUSSION

During recent years there has been a continuous increase in the number of patients with end-stage renal failure who require long-term dialysis. Therefore, a higher number of surgical operations are performed in this expanding population. However, there are many underlying problems that influence the outcome of surgical care for hemodialysis patients, such as cardiac failure and atherosclerotic heart disease, diabetes, hypertension or hypotension, electrolyte imbalance and acidosis, hematopoietic disorders and bleeding tendency, infection, and impaired wound healing.⁴ Therefore, these problems must be corrected as much as possible by preoperative hemodialysis.

The principal aims of the preoperative dialysis were to ensure maximum metabolic control and avoid fluid overload, hyperkalemia, and excessive bleeding.² Consequently, many of the problems observed in our patients had been corrected to a reasonable degree preoperatively. All of patients in this study who underwent surgery received hemodialysis preoperatively.

Table 1. Preoperative clinical characteristics in groups.

	Group 1 (<i>n</i> = 121)	Group 2 (<i>n</i> = 9)	<i>p</i>
Male/female	65/56	5/4	0.675
Age (years)	43.7 ± 2.1	55.3 ± 1.2	0.09
Mean time on hemodialysis (months)	45.2 ± 3	41.5 ± 6.1	0.132
Preoperative data			
BUN (mg/dL)	38.7 ± 26.1	42 ± 7.2	0.210
Creatinine (mg/dL)	6.31 ± 2.70	6.46 ± 1.4	0.231
K (mEq/L)	4.6 ± 0.6	5.9 ± 0.8	0.510
Total protein (mg/dL)	5.7 ± 0.2	5.2 ± 0.3	0.05
Hematocrit (%)	26.6 ± 1.6	22.6 ± 1.6	0.09
Platelet (10 ³ /L)	248.2 ± 76.2	198 ± 52.4	0.06
Etiology of ESRD (<i>n</i>)			
Chronic glomerulonephritis	28 (23 %)	2 (22%)	
Diabetes mellitus	24 (20%)	3 (33%)	
Primary nephrosclerosis	14 (12%)	2 (22%)	
Chronic pyelonephritis	14 (12%)	1 (11%)	
Polycystic kidney	8 (6%)		
Vesicoureteral reflux	14 (12%)		
No etiology of patients with ESRD (<i>n</i>)	19 (15%)	1 (11%)	
Comorbid disease (<i>n</i>)			
Cardiovascular disorders	24 (20%)	5 (55%)	
Respiratory disease	19 (16%)	3 (33%)	
Diabetes	22 (18%)	4 (44%)	
ASA score			
<3	93	0	0.01
>3	28	9	0.05

Note: Each patient is affected by more than one comorbid disease.

Table 2. Indications for group 1, the type of operations, complications, and mortality in patients on maintenance hemodialysis.

Indications	Number of patients	Elective operations	Complications	
Secondary hyperparathyroidism	20 (17%)	Total parathyroidectomy	Cervical hematoma (1) Recurrent nerve paralysis (1) Fistula thrombosis (1)	1
Secondary hyperparathyroidism	30 (24%)	Subtotal parathyroidectomy	Fistula thrombosis (1)	
Nephrolithiasis, polycystic kidney, infection, and renal cell carcinoma	37 (31%)	Unilateral native nephrectomy (30) Bilateral native nephrectomy (7)	Wound infections (1) Fistula thrombosis (1)	
Transplant kidney	16 (13%)	Transplant nephrectomy		
Cholelithiasis	8 (7%)	Cholecystectomy		
Chronic anal fissure	1 (0.8%)	Lateral internal sphincterotomy		
Inguinal hernia	1 (0.8%)	Mesh hernioraphy		
Diabetic foot gangrene	6 (5%)	Amputation	Wound infections (2)	
Early gastric cancer	1 (0.8%)	Gastric mucosal resection	Atelectasia (1)	
Patient with ileostomy	1 (0.8%)	Ileostomy closure		
Total patient number; complication and mortality rates	121	121	9 (7%)	1 (0.8%)

The most common indication for early institution of dialysis following operation was high serum potassium levels. The serum potassium levels are elevated by infection, catabolic disease, blood transfusions, and intra-operative tissue trauma. This problem was most easily managed by repeated dialysis sessions. In our study, all patients were taken to hemodialysis on the first postoperative day in order to maintain normal electrolyte levels and avoid volume overloads.

Hypertension during or immediately after operation is usually directly related to excessive fluid infusion. Severe hypertension can usually be controlled with adequate ultrafiltration and sodium removal by the artificial kidney. Hypotension and related A-V fistula dysfunction was commonly seen as a postoperative complication in our patients. Loss of a vascular access during the postoperative period frequently leads to delayed management of fluid resuscitation and results with

Table 3. Indications for group 2, the type of operation, complications, and mortality in patients on maintenance hemodialysis.

Indications	Number of patients	Emergency operations	Complications	Mortality
Diabetic foot gangrene	4 (44%)	Amputation	Wound infections (1)	2
Sigmoid colon obstruction due to sigmoid carcinoma	2 (22%)	Sigmoid resection	Atelectasia (1), wound infection (1)	
Fournier gangrenous	1 (11%)	Kolostomi and perineal debridement	Wound infection (2)	
Sigmoid volvulus	1 (11%)	Sigmoid resection	Fistula thrombosis (1)	
Spontaneous intrarenal hemorrhage	1 (11%)	Nephrectomy + splenectomy (iatrogenic laceration of spleen) Ileostomy	Pancreatic fistula (1)	
Complication and mortality	9	10	7 (70%)	2 (20%)

enhanced risk for complications. Shunts or fistulas used for dialysis should be carefully protected by avoiding intravenous fluid administration in that arm, avoiding excessive pressure to the area during surgery, and avoiding hypotension or dehydration intraoperatively or postoperatively.

Various degrees of anemia seen in all patients on CH is related to several factors, including depressed erythropoietin production, decreased red cell survival, nutritional factors, and uremic toxic depression of the bone marrow. The chronic anemia which is usually present in most of these patients need not to be corrected and blood transfusions are required mostly to compensate for blood loss. Fresh frozen and thawed cells have been the preferred blood product. Blood transfusions are preferably avoided for the patients awaiting transplantation because of the risk of sensitization. In our study, 15 patients with anemia received preoperative blood transfusions.

Patients with ESRD develop hemostatic disorders mainly in the form of bleeding diatheses. Hemorrhage can occur at cutaneous, mucosal, serosal, intracranial, or retroperitoneal sites. Uremic platelet dysfunction is the main cause of this hemorrhagic diathesis.⁵ In our study, one patient in group 2 developed spontaneous intrarenal bleeding due to hemorrhagic diathesis and eventually was taken to emergency operation for nephrectomy.

In our study, complications seen as infections and impaired wound healing were most likely related to uremia. Uremia, malnutrition, and presence of diabetes mellitus make patients with chronic renal failure more vulnerable to infections. Lymphocyte depletion and resulting cellular immune deficiency is characteristic in uremia. Shindo⁶ reported a delay in the beginning of the healing process in uremic rats. As a matter of fact, ESRD patients should be cared for effective prophylaxis and treatment of present infections during the preoperative preparations. Appropriate antibiotic doses must be adjusted according to the mode of the drug excretion.

Generally, septic problems secondary to infection occur most frequently with ESRD patients and

contribute heavily to the increased mortality. Two patients in our study died from sepsis following diabetic foot amputation. In the present study, the complication and mortality rates were 7% and 0.8% in the elective group, and 70% and 20% in the emergency group, respectively. In our opinion, complication and mortality rates in the emergency group were higher than the elective group due to wound infection and sepsis.

There is limited literature on survival of dialysis patients with ESRD who require surgery. Yasushi et al. reported that although abdominal surgery can be performed for hemodialysis patients with relative safety in the elective situation, very high mortality rate is presently associated with emergency operations. Yasushi et al. also reported that 70% of the patients who underwent emergency surgery had associated intraabdominal bacterial infections. They reported 15% complication rate and 10% mortality rate in their elective abdominal surgery cases, while the rates were 70% and 50%, respectively, for their emergency cases.³

Borlase et al. also reported a similar 12% complication rate and 6% mortality rate in their elective abdominal surgery cases. The results in the emergency abdominal surgery group are very different with 62% complication and 47% mortality rates.⁷ It appears that group 2 had higher prevalence of morbidity and mortality than group 1.

In conclusion, elective surgery in CH patients with ESRD can be performed with acceptable morbidity and mortality rates, provided that careful preoperative preparation, intraoperative, and postoperative precautions are taken.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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