

## EARLY SURGICAL COMPLICATIONS IN KIDNEY TRANSPLANT RECIPIENTS - A SINGLE CENTRE STUDY

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### ABSTRACT

End-stage renal disease (ESRD) is becoming a significant global public health issue. The preferred course of treatment for people with ESRD is kidney transplantation, although its associated surgical complications raise serious doubts about the success rate of the procedure. Renal transplant surgical complications are frequently observed and can significantly affect graft performance, survival, and patient morbidity. This study aimed to analyze the frequency of early surgical complications, diagnoses, and treatment options in renal transplant patients. This retrospective cohort study included all transplanted patients with surgical complications from April 2017 to April 2022 at the Renal Transplant Unit of the Dow University of Health Sciences, Karachi, Pakistan. Out of 500 kidney transplant recipients, 86 patients (17.2%) experienced early post-transplant surgical complications. The most common complication was Lymphorrhea (n=38, 7.6%) followed by wound infection (n=25 patients, 5%). The occurrence of these complications was associated with delayed graft function, indicating the need for careful monitoring and timely intervention in these cases. Future studies are needed to explore the predictors and risk factors of surgical complications in kidney transplantation and to identify strategies for reducing the incidence and improving the outcomes of these complications.

**Key Words:** Kidney transplantation, early post-transplant surgical complications, lymphocele, wound infection

## INTRODUCTION

Chronic renal failure is a devastating ailment and the number of cases are increasing globally with the rise in the chronic diseases such as diabetes and hypertension. Its effects are greater in economically underdeveloped third-world countries, where the majority of patients and their families are unable to access, or afford renal replacement treatments. Kidney transplantation is a life-saving treatment for end-stage renal disease (ESRD) patients, who are on dialysis or have severe kidney dysfunction. It has become the preferred treatment option over the years due to its superior outcomes, including better quality of life, reduced morbidity and mortality(1), and lower healthcare cost (2,3). However, kidney transplantation is not completely risk free, it is associated with post-transplant surgical complications. These surgical complications may result in graft loss, delayed graft failure, patient morbidity, and even death(4). The initial post-transplant period is a critical time when patients are at a high risk of developing surgical complications, which can significantly affect their outcomes(4). The rate of surgical complications after renal transplant vary from 4.2% to 34%, depending the region of the reporting center (5,6).

### RENAL TRANSPLANTATION TECHNIQUE:

Our kidney transplant program is a live- related program, which means all donors are live- related. A single team of surgeons conducts all of the transplants, using standard surgical techniques for kidney transplantation(7). Donor nephrectomy is performed by an open surgical method using a flank incision, and the graft is perfused with custodial solution. Bench dissection is then carried out to prepare the graft for anastomosis. The majority of kidneys are placed in the right iliac fossa using an extra-peritoneal approach. However, if the iliac vessels are blocked on the right side due to history of femoral catheterization, the kidney is placed in the left

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iliac fossa(8). The graft vessels are anastomosed with external or common iliac vessels by end-to-side method. In cases where there are multiple arteries in the allograft, they are either dealt with separately or made double barrel before anastomosis to the recipient vessel. Prolene 6/0 is used for fine suturing of the anastomosis. For ureteric anastomosis, standard leich-gregoid techniques are used in all cases. A double J stent is placed in the majority of patients during ureteric anastomosis, which is removed after 2-4 weeks. All recipients are given broad-spectrum antibiotic prophylaxis before induction, but anti-coagulant therapy is not used routinely post-operatively unless there is some medically or surgically indicated reason(9).

After surgery, kidney transplant patients are shifted to the surgical ICU for close clinical and biochemical monitoring. Routine color Doppler ultrasound is performed on the first post-operative day, but in case of emergency, it can be done per-operatively or immediately after surgery to check graft perfusion and any collection. Per-operative surgical complications are dealt with accordingly, while post-operative surgical complications are dealt with as emergencies. For immediate post-operative vascular complications, color Doppler studies, CT with contrast, and MRI are performed to confirm the diagnosis. Other surgical complications like Lymphorrea and wound-related issues are diagnosed clinically(10).

After being discharged, patients are followed up in the Out Patient Department (OPD) initially on a weekly basis for one month, then biweekly the next month, and then after three months for one year. During each visit, routine blood tests and urine DR are done, and ultrasound and color Doppler are only done if clinically indicated. The most frequently used immune-suppression medications are cyclosporine, tacrolimus, mycophenolate, and prednisolone(11).

#### **EARLY POST TRANSPLANT SURGICAL COMPLICATIONS:**

Kidney transplant surgical complications can be classified into urological, vascular, wound related and others.

##### ***UROLOGICAL COMPLICATIONS:***

Common urologic complications following kidney transplantation may affect patient graft function, survival, and morbidity. In the literature, the incidence of urologic complications ranges from 3.4% to 11.2%(12–21). Urine leak, ureteral stricture, DJ stent encrustation or misplacement, urolithiasis, obstruction of the bladder outlet, and bladder rupture are reported complications. Urinary leak is a common complication that can occur due to faulty anastomosis or damage to the ureter during surgery. Leakage of urine from the site of anastomosis or from the ureter can occur, requiring additional surgical intervention. Urinary obstruction can occur due to blood clots, swelling, or scar tissue formation, while DJ stent Encrustation can happen naturally as a result of high amounts of certain minerals in the urine (such as calcium, oxalate, and phosphorus), or it can be triggered by the presence of urease-producing organisms, which can result in urolithiasis formation. Bladder injury is iatrogenic complication but patients rarely experience bladder injury during renal transplantation.

##### ***VASCULAR COMPLICATIONS:***

Vascular complications account for 3% to 15% of all cases and are usually associated with graft loss(22). Vascular complications following kidney transplantation can occur in the form of renal artery stenosis, renal vein thrombosis, bleeding, or aneurysm of the renal artery. Renal artery stenosis is the narrowing of the artery that supplies blood to the transplanted kidney, which can lead to decreased kidney function. Renal artery and vein thrombosis occur when a blood clot blocks the blood vessels, which can result in decreased blood flow to the transplanted kidney. Bleeding can occur due to surgical complications or anticoagulation therapy, while aneurysm of the renal artery is a rare complication that can occur due to weakening of the artery wall.

##### ***HAEMORRHAGIC COMPLICATION:***

Any bleeding associated with a surgical transplant process that required additional intervention, aspiration, or blood transfusion was referred to as a post-operative bleeding complication. Incidence rates of bleeding after kidney transplantation surgery has been reported as around 12% (23).

##### ***WOUND RELATED COMPLICATIONS:***

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Wound complications are indeed common after kidney transplantation, incidence of surgical wound infection range from 2% to 26% of patients(24,25). They can be categorized into superficial and deep wound complications, each with its own characteristics.

### 1. **Superficial Wound Complications:**

Superficial wound infections can occur as a result of bacterial contamination during or after the surgery. These infections may manifest as redness, swelling, warmth, pain, or drainage from the wound site. Wound dehiscence refers to the partial or complete separation of the wound edges. It can be caused by factors such as poor wound closure technique, excessive tension on the incision, or infection. Seroma is the accumulation of fluid in the wound area, resulting in swelling and a fluid-filled cavity. It can occur due to disrupted lymphatic drainage or inadequate closure of the wound layers.

### 2. **Deep Wound Complications:**

Any wound that required a second treatment to close it and had an infection that reached the facial and musculature layers is labelled as a deep wound.

o *Hematoma:* A hematoma is a collection of blood within the wound or surrounding tissues. It can occur due to bleeding from blood vessels during the surgery or as a result of clot formation.

o *Abscess Formation:* An abscess is a localized collection of pus within the wound or surrounding tissues. It can occur due to infection and can present with symptoms such as pain, swelling, and fever.

o *Wound Breakdown:* Wound breakdown refers to the complete disruption of the wound, resulting in an open wound. It can occur due to factors such as poor wound healing, infection, or excessive pressure on the incision site.

Despite efforts to minimize surgical wound complication through improved surgical techniques, perioperative antibiotics, targeted therapy and optimized immunosuppression, these wound complication remain a major clinical challenges(26–28). These wound complications can cause discomfort, delay healing, prolong hospital stays, and increased risk of other complications. Proper wound care, including regular monitoring, infection prevention measures, and timely intervention, is crucial to manage these complications effectively.

### **LYMPHATIC COMPLICATION:**

A *lymphocele* is an accumulation of lymph around the graft. It usually appears within the first six months following the transplant, increasing at six weeks. Depending on the series, the mean incidence of lymphocele varies between 0.5% and 20%(29). *Lymphorrhoea* is the prolong drainage of fluid after transplant and cause morbidity and long hospital stay. Risk factors include age, BMI, fluid overload, hemodialysis period, diabetes, acute rejection, use of steroids and diuretics and coagulopathy(30–34).

### **OTHERS COMPLICATIONS:**

**Gastrointestinal injury:** Intestinal perforation is a rare but serious complication that can occur during or after kidney transplantation. It is estimated to occur in about 1% to 2% of patients according to various reports(35). This complication can occur due to various factors, including surgical trauma to the intestines, vascular compromise leading to ischemia.

### **GRAFT LOSS:**

Early graft loss defined as graft loss occurring within 30 days after kidney transplantation, is relatively uncommon and occurs in approximately 5% of kidney transplants(36). However, it is a physically and emotionally devastating outcome for both the recipient and the transplant team. Despite advancements in transplantation techniques and immunosuppressive medications, graft loss can occur due to various factors. These factors may include medical and surgical factors, medical factors include acute rejection, chronic rejection, infections, while surgical factor include vascular complications. Prompt identification and management of the underlying causes are crucial in minimizing the risk of graft loss and preserving the long-term success of kidney transplantation.

### **MANAGEMENT OF EARLY POST TRANSPLANT COMPLICATIONS:**

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Early recognition and prompt management of surgical complications are critical in improving outcomes and reducing morbidity and mortality. Failure to identify and manage surgical complications can lead to graft dysfunction, loss of the transplanted kidney, and even death. Therefore, close monitoring and prompt interventions are essential during the post-transplant period.

**Management of Urological Complications:**

**Urinary Leak:** This complication is typically managed conservatively through measures like bed rest, bladder drainage, and urinary diversion using a urethral catheter or percutaneous nephrostomy. Severe cases might necessitate surgical intervention or open repair of the ureter.

**Urinary Obstruction:** Management involves stent placement or percutaneous nephrostomy tube insertion to alleviate the obstruction. If these methods fail, surgical intervention, such as revision or re-implantation of the ureter, may be required.

**DJ Stent Obstruction:** This is managed by either removing and replacing the stent or repositioning it using a cystoscope.

**Bladder Rupture:** Urgent surgical intervention is typically necessary, involving repair or reconstruction of the bladder.

**Management of Vascular Complications:**

**Renal Artery Stenosis:** Managed through angioplasty and stent placement. If unsuccessful, surgical intervention like renal artery bypass grafting might be needed.

**Renal Vein Thrombosis:** Managed by surgical exploration.

**Bleeding:** Management includes blood transfusions and/or surgical intervention, such as vascular repair or embolization.

**Management of Wound Complications:**

**Superficial Wounds:** Managed with wound care, including daily dressing changes or wound irrigation. Antibiotic therapy may be necessary in some cases.

**Deep Wounds:** May require surgical intervention like debridement, drainage, and wound closure. Antibiotic therapy might also be needed.

**Management of Fluid Collection Complications:**

**Lymphocele/Lymphorrhea:** Conservative management involves pyodine or ethanol instillation. If unsuccessful, surgical intervention like laparoscopic or open drainage might be considered.

**Hematoma:** Managed with observation and monitoring for bleeding or infection signs. Surgical intervention, such as drainage or hematoma evacuation, may be required in certain cases.

**Management of Gastrointestinal Injury Complications:**

Managed through surgical intervention, including repair or reconstruction of the injured gastrointestinal tract. Antibiotics and supportive care are provided for associated complications like sepsis.

This retrospective study aimed to evaluate the rate and types of surgical complications within the first month after kidney transplantation, as well as their impact on graft and patient outcomes. The study also attempted to identify the risk factors associated with surgical complications to help guide clinicians in identifying patients who are at a high risk of developing surgical complications and instituting appropriate preventive measures.

**METHODS**

This retrospective cohort study was conducted at the Renal Transplant Unit of Dow University of Health Sciences, Ojha campus, Karachi, Pakistan. The study included all patients who had undergone kidney transplantation and experienced surgical complications between April 2017 and April 2022. The sample size was 500 determined by the number of patients who had a kidney transplantation. All transplanted patients were included while pediatric patients, second transplants, transplants in augmented bladders, and positive cross match transplants were not included in the study.

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Data were collected from the medical records of patients who had undergone kidney transplantation and experienced surgical complications. A standardized checklist was used to collect information on patient age, gender, and descriptions of the surgical complications, diagnosis, and their management. The medical records of patients who met the inclusion criteria were reviewed, and the data were extracted from the system of Renal Transplant Unit of Dow University of Health Sciences.

Ethical clearance was obtained from the Institutional Review Board (IRB) of Dow University of Health Sciences. The findings of this study will contribute to the body of knowledge on early post-transplant surgical complications among kidney recipients, which may ultimately lead to improved patient outcomes and better-informed decision-making by healthcare professionals.

### Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics were calculated to present the basic demographic characteristics of the study population, including the mean, standard deviation ( $\pm$ SD), and range for continuous variables, and the frequency and proportion for categorical variables. The relationship between the demographic and clinical characteristics of the study population and the incidence of post-transplant surgical complications was evaluated using the chi-square test for categorical data. A P-value of  $<0.05$  was considered statistically significant.

## RESULTS

Majority of the kidney transplant patients in the study were males (70.9%) and aged between 21 to 50 years. The most common blood group among the patients was A+ (44.1%) and the majority had a Body Mass Index (BMI) within the normal range (67.4%). A summary is given in Table 1. In terms of residence, most of the patients were from Sindh (43.0%) and 38.4% were married. In terms of occupation, the most common occupation among the patients was being a businessman (25.5%) or unemployed (23.2%), and most patients belonged to the upper class (51.1%).

Most frequent cause of renal failure was hypertension, accounting for 32 (37.2%) cases, followed by diabetes mellitus identified in 28 (32.6%) cases, whereas, 26 (30.2%) cases had both comorbid conditions, hypertension and diabetes mellitus (Figure 1).

Out of 500 kidney transplant recipients, 86 patients (17.2%) experienced early post-transplant surgical complications. The most common urological complications were urinary leak ( $n=5$  cases) and DJ stent encrustation ( $n=3$  cases). Vascular complications included renal artery stenosis ( $n=1$  case), renal vein thrombosis ( $n=1$  case), and bleeding ( $n=2$  cases). Wound complications were observed in 25 (5%) of cases, with 20 cases of superficial wound complications and 5 cases of deep wound complications. Prolong Fluid drainage (Lymphorrhoea) were observed in 38 (7.6%) cases, out of which 30 patients were treated conservatively at bed side with povidone or ethanol and only 5 cases needed exploration. Hematomas were observed in 5 patients out of which 2 patients were treated conservatively and 3 patients need re-exploration and drainage of hematoma. Gastrointestinal injury occurred in 1 case, and graft loss was observed in 1 case (Table 2). Out of the 500 patients, only 1 patient died within the study period, resulting in a 0.2% mortality. The cause of death were graft loss in this patient.

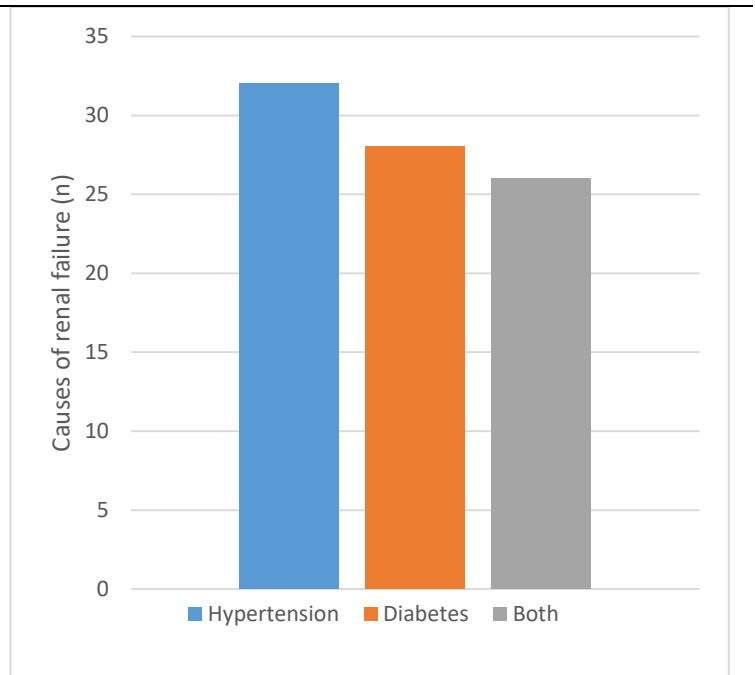
## DISCUSSION

Our study presented a low rate of complications in patients undergoing renal transplant, whereas only 0.2% of mortality. Previously reported studies such as study by Berhe and another study by Salamin et al, reported a 26% and 34.9% respectively, which is a little higher than the rate reported in our study (37,38). The Berhe et

al reported data from Ethiopian transplant recipients, while Salamin et al. Swiss patients experienced complications within the first year of transplantation. This suggests that surgical complications are a significant issue globally, regardless of the setting.

**Table 1. Socio-demographic characteristics of kidney transplant patients developed complications**

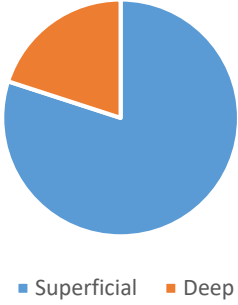
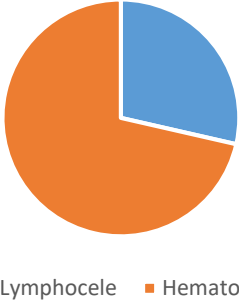
Characteristics	N (%)
<b>Age in years</b>	
<20	10(11.6)
21-30	30(34.9)
31-40	21(24.4)
41-50	25(29.0)
<b>Gender</b>	
Males	61(70.9)
Females	25(29.1)
<b>Blood group</b>	
A (+ve)	38(44.1)
B (+ve)	19(22.0)
AB (+ve)	29(33.7)
<b>Body Mass Index (BMI)</b>	
18.1-25	58(67.4)
>25	28(32.5)



**Figure 1. Causes of renal failure in patients under renal transplant and developed post-operative complications**

**Table 2. Summary of surgical complications in patients undergoing renal transplant and developed surgical complications**

Urological complications n= 10 (2.0%)	Vascular Complications n=4 (0.8%)
<p style="text-align: center;">Urological complications</p> <p style="text-align: center;"> <span style="color: green;">■</span> Urinary leak      <span style="color: blue;">■</span> DJ stent obstruction  <span style="color: yellow;">■</span> Bladder rupture      <span style="color: darkgreen;">■</span> Ureteric stricture         </p>	<p style="text-align: center;">Vascular Complications</p> <p style="text-align: center;"> <span style="color: blue;">■</span> Renal artery stenosis      <span style="color: orange;">■</span> Renal vein thrombosis      <span style="color: grey;">■</span> Bleeding         </p>

<b>Wound complications n=25 (5%)</b>	<b>Fluid Collection n=7 (1.4)</b>
<p style="text-align: center;">Wound complications</p>  <p style="text-align: center;">■ Superficial ■ Deep</p>	<p style="text-align: center;">Fluid Collection</p>  <p style="text-align: center;">■ Lymphocele ■ Hematoma</p>
<b>Lymphorrhoea n=38 (7.6%)</b>	<b>Gastrointestinal injury n=1 (0.2%)</b>
<b>Graft loss n=1 (0.2%)</b>	

The types of surgical complications reported in our study were similar to those reported in the other studies, including urologic complications, vascular complications, and wound-related complications. Choate et al. and Ammi et al. reported urologic complications to be the most common type of surgical complications in kidney transplant recipients, while vascular complications were the second most common complication reported in the study by Ammi et al(39,40). In contrast, our study found Lymphorrhoea (7.6%) to be the most common type of surgical complication, wound-related complications were the second most common early post - transplant surgical complication. This difference could be due to the differences in the characteristics of the study population which can significantly influence the outcomes. Factors such as age, comorbidities, immunosuppressive regimens, and surgical techniques can vary across studies and contribute to variations in complication rates. The severity of the surgical complications in our study was also comparable to that reported in the other studies. Carvalho et al reported that the most severe complications were due to vascular and urologic issues, while Sugi et al reported that complications ranged from mild to life-threatening(41,42). Similarly, in our study, the majority of the complications were mild, with only one patients experiencing severe complication. This suggests that while surgical complications are common in kidney transplant recipients, the severity of the complications varies depending on the type and management.

In terms of risk factors for surgical complications, the findings of the studies were somewhat consistent. Salamin et al identified several risk factors, including recipient age, recipient BMI, and donor type, which were also identified as risk factors in our study(38). Hamed et al and Szabo-Pap et al reported that cold ischemia time and donor age were significant risk factors for surgical complications, while Bejic et al found that the use of intraoperative duplex ultrasound reduced complications in living renal donor transplantation(43–45).

Overall, the findings from our study are consistent with those of the other studies in terms of the prevalence, types, and severity of surgical complications in kidney transplant recipients. However, there were some differences in the types and order of the most common complications reported. Further research is needed to identify additional risk factors and determine the most effective strategies for managing and preventing surgical complications in kidney transplant recipients.

Our study is the largest study from the region presenting data from a single centre with five years follow-up, however the study only focused on the surgical complications and outcomes of kidney transplantation which is considered as limitation of the study.

## CONCLUSION

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The study reported overall low rate of surgical complications was relatively mild, suggesting that while complications were present, but they were not excessively high in frequency. However, the study also found that the overall graft and patient survival rates were relatively good, which underscores the importance of establishing transplant programs in developing countries to address the growing burden of end-stage renal disease. Future studies are needed to explore the predictors and risk factors of surgical complications in kidney transplantation and to identify strategies for reducing the incidence and improving the outcomes of these complications.

**CONFLICT OF INTEREST:**

Authors declare no conflict of interest

**FUNDING SOURCE:**

The study did not receive any external funding

**ETHICAL APPROVAL:**

The data was retrospective analysis of hospital record, did not require ethical approval. At the time of transplant informed consent, patients and donors also consent for utilization of their information for research purpose.

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