

**RISK FACTORS FOR THE OCCURRENCE OF EARLY
POSTOPERATIVE UROLOGICAL AND SURGICAL
COMPLICATIONS AFTER KIDNEY TRANSPLANTATION
FROM A LIVING AND CADAVERIC DONOR**

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Received on July 27, 2020

Presented by D. Damianov, Member of BAS, on September 29, 2020

Abstract

This study is based on a retrospective analysis of the medical history of 35 patients who underwent kidney transplantation at the Clinic of Urology of the “Alexandrovska” University Hospital, Sofia for the period from February 2018 to December 2019. Early postoperative complications were detected in 46% of the observed transplant patients. All possible early surgical and urological complications were followed up, including symptomatic and asymptomatic manifestations that did not require active invasive treatment. In our group of patients, possible factors, influencing the occurrence of early complications such as age and BMI of the recipient, age of the donor, preoperative hemodialysis and preoperative recipient residual diuresis, time of cold ischemia, creatinine levels at admission and discharge, hospital stay were studied. Our results show that the incidence of early postoperative urological and surgical complications correspond to the literature data from other transplant centres. We believe that higher preoperative residual diuresis is a good prognostic factor for lower rate of early postoperative complications. Prolonged time of cold ischemia does not affect the frequency of postoperative complications and allows better organization of operative activity. Obesity of the recipient is a risk factor for

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DOI:10.7546/CRABS.2023.07.14

the occurrence of postoperative complications in transplant patients. In the studied group there is only a hint of the influence of the age of the recipient on the occurrence of complications without it reaching significant values. In our study, there was no relationship between the age of the donor and the occurrence of complications. Our opinion is that the age of the recipient and the donor does not in itself play a significant role, and it is much more important to increase the cardiovascular risk with age and against the background of emerging comorbidities. Serum creatinine levels at admission do not significantly affect the occurrence of early postoperative complications, but only suggest that quality of dialysis treatment plays an important role in the success of kidney transplantation. According to the values of serum creatinine at discharge, postoperative complications have a negative impact on the function of the transplanted kidney and their timely and adequate treatment is necessary to prolong the survival of the graft. The average length of hospital stay in the Clinic of Urology of "Alexandrovska" University Hospital for transplanted patients may be extended due to the specifics of the structure and organization of healthcare in the country.

Key words: kidney transplantation, early complications, risk factors, living and cadaveric donor

Introduction. A number of postoperative surgical and urological complications still occur today, despite the continuous progress and development in the field of transplantology. They could compromise the success of this treatment method. Such postoperative complications lead to the appearance of additional ailments and additional hospitalizations for the patients.

The reasons for surgical and urological complications after kidney transplantation are multifactorial and have been a subject of numerous studies. The immunosuppressive therapy also plays a crucial role in addition to the donation criteria and the general condition of the recipient. The advanced age of the donor, as well as their cardiovascular status are among the risk factors for the occurrence of surgical and urological complications. Potential recipients often have deteriorating cardiovascular status and metabolic syndrome, suggesting atherosclerotic vascular changes. This leads to an increased risk of postoperative complications. In some cases, patients receive anticoagulation or antiplatelet therapy, which predisposes them to hemorrhage. The appearance of thrombosis and hematoma can lead to necrosis and loss of the graft, despite adequate therapeutic behaviour. Patients with obesity also have an increased risk of dehiscence, development of infection, hernia and lymphocele of the surgical wound. Timely diagnosis and appropriate treatment is of great importance for surgical and urological complications.

Our purpose and tasks are to update our knowledge in transplantology, to get acquainted with the current scientific literature on this issue, to summarize our data on early postoperative urological and surgical complications of kidney transplantation and to identify possible influencing factors that lead to these complications.

Material and methods. This study is based on a retrospective analysis of the medical history of 35 patients who underwent kidney transplantation at the Clinic of Urology of “Alexandrovska” University Hospital, Sofia, for the period from February 2018 to December 2019. The group of patients consists of 28 men and 7 women. The mean age of the patients is 43 years (median 42 years). The average age of women is 41 years. The average age of men is 44 years. One of the men received a kidney transplant for a second time. The study includes patients, transplanted from a living and cadaveric donor. Kidney transplantations from a living donor for the study period were 13 and from a cadaveric donor – 22. The follow-up time for early postoperative complications was 60 days after surgery.

T a b l e 1

Kidney transplantations performed from a living and cadaveric donor in the Clinic of Urology of “Alexandrovska” University Hospital for the period from February 2018 to December 2019

Year	2018	2019	Total
Cadaveric donor	13	9	22
Living donor	5	8	13
Total	18	17	35

The reasons for chronic renal failure in the group of patients were as follows: 21 patients – chronic glomerulonephritis, 5 patients – nephrosclerosis, 4 patients – hypertensive nephropathy, 3 patients – polycystosis, 2 patients – chronic pyelonephritis.

T a b l e 2

Reason leading to chronic renal failure (CRF) in the group of patients transplanted for the period from February 2018 to December 2019 in the Clinic of Urology of “Alexandrovska” University Hospital

Cause for CRF	Number of patients (35)
Chronic glomerulonephritis	21
Nephrosclerosis	5
Hypertensive nephropathy	4
Polycystosis	3
Chronic pyelonephritis	2

Results. All possible early surgical and urological complications were followed up, including symptomatic and asymptomatic manifestations that did not require active invasive treatment. The team was looking for complications such as ureteral stricture, urinary retention, urethral necrosis, urinoma, DJ stent problems, hematoma, vascular stenosis, thrombosis, lymphocele, urinary tract infec-

tion, hernia or inflammation in the area of the surgical wound, delayed graft function.

In the group of 35 patients there were 16 patients (46%) with early complications – 8 patients (23%) transplanted from a living donor and 8 patients (23%) transplanted from a cadaveric donor. Both urological and surgical complications together were observed in 3 patients during the follow-up period.

T a b l e 3

Frequency of early urological and surgical complications in patients transplanted for the period from February 2018 to December 2019 in the Clinic of Urology of “Alexandrovska” University Hospital

Early complications	Total	Male	Female
Number of patients	35	28	7
Number of patients with urological complications	9 (26%)	7	2
Uroinfection	9 (26%)	7	2
Number of patients with surgical complications	10 (29%)	9	1
Haematoma	8 (23%)	7	1
Lymphocele	1 (3%)	1	0
Wound infection	1 (3%)	1	0

Investigation of possible factors, influencing the occurrence of early urological and surgical complications. *Age of the recipient.* The average age of patients, transplanted from a cadaveric donor with early urological and surgical complications was 50 years, i.e. on average 3 years older than patients without complications. The average age of patients, transplanted from a living donor with early urological and surgical complications was 38 years, i.e. on average 1 year older than patients without complications. This shows a tendency that elderly patients are more prone to complications after kidney transplantation, although this statement remains statistically insignificant. The age of the recipient does not in itself play a significant role in the occurrence of postoperative complications.

BMI of the recipient. Patients, transplanted from a cadaveric donor with early complications had a BMI of 28.8 kg/m². Patients, transplanted from a cadaveric donor and did not develop complications had a BMI of 24.5 kg/m². Significantly lower BMI was observed in this group of patients compared to those transplanted from a cadaveric donor and with early complications. An increase in BMI in transplant patients from a cadaveric donor increases the likelihood of early complications.

Patients transplanted from a living donor with early complications have a BMI of 23.2 kg/m². Patients transplanted from a living donor without complications have a BMI of 24.9 kg/m². Here, the opposite trend is observed – with

an increase in BMI in transplanted patients from a living donor, the likelihood of early complications decreases. Transplant patients throughout the group who did not develop early surgical and urological complications had a BMI of 24.6 kg/m², and those with complications showed a BMI of 26.0 kg/m².

In summary, however, we conclude that as BMI increases in transplant patients, the likelihood of complications increases.

Age of the donor. The mean age of cadaveric donors in whom recipients were without early complications was 51 years and for those with complications the average age of the donors were 45 years. Our study did not demonstrate a significant effect of donor age on the occurrence of early complications in the recipient of a cadaveric donor.

The mean age of living donors in whom recipients were without early complications was 56 years and in the cases with complications the average age of the donors was 59 years.

Here, it was found that patients transplanted from a living donor and with postoperative complications were recipients of an organ that was on average from a donor 3 years older than in the cases without postoperative complications. The influence of the age of a living donor on the occurrence of early postoperative complications in the recipient could not be proven in our study and remains statistically insignificant.

Preoperative hemodialysis. Patients, transplanted from a cadaveric donor, who developed early complications underwent preoperative hemodialysis for an average of 31 months and those, without complications – for 45 months. Patients, transplanted from a living donor, who had early complications underwent preoperative hemodialysis for 20 months and those, without complications – for 22 months.

The results in the study group of patients do not show a significant difference in the duration of preoperative hemodialysis in transplanted patients from living and cadaveric donors, who develop or do not develop early postoperative complications.

Preoperative residual diuresis. Patients, transplanted from a cadaveric donor, who developed early postoperative complications had an average residual diuresis of 943 ml and those, without complications – 911 ml. The results in the study group of patients did not show a statistically significant difference of residual diuresis in transplant patients from a cadaveric donor with and without early postoperative complications.

Patients, transplanted from a living donor, who developed early complications had a mean residual diuresis of 638 ml in comparison to those, without complications – 820 ml. Patients, without complications, transplanted from a living donor had a statistically significantly higher mean residual diuresis before surgery than those, who developed complications.

Time of cold ischemia. The mean time of cold ischemia of the graft in

transplant patients from a cadaveric donor was 18.8 hours. The shortest time of cold ischemia was 10.6 hours and the longest was 25.5 hours. The mean time of cold ischemia for both women and men was 18.8 hours. Our study shows, that with increasing time of cold ischemia, fewer complications are observed in patients transplanted from a cadaveric donor. The mean time of cold ischemia in patients with complications was 17.1 hours and in those, without complications it was 19.6 hours.

Creatinine levels at admission and discharge. Patients, transplanted from a cadaveric donor and with early complications had a mean creatinine level at admission of 561 $\mu\text{mol/l}$. Transplant patients from a cadaveric donor without postoperative complications had a mean creatinine level of 539 $\mu\text{mol/l}$ at admission.

Patients, transplanted from a living donor with early complications had a mean creatinine of 858 $\mu\text{mol/l}$ at admission, whereas those without complications had a creatinine level of 835 $\mu\text{mol/l}$.

Serum creatinine values at admission are not significant for the occurrence of early complications after kidney transplantation in our group of patients. Higher levels of creatinine at admission only hint at a slight tendency for early complications, although this remains unproven.

Patients, transplanted from a cadaveric donor with early complications had an average creatinine value of 405 $\mu\text{mol/l}$ at discharge and those, without complications – 203 $\mu\text{mol/l}$. This indicates significantly higher serum creatinine levels at discharge in transplant patients from a cadaveric donor, who have developed postoperative complications.

Patients, transplanted from a living donor and with early complications had a mean creatinine level of 284 $\mu\text{mol/l}$ at discharge, whereas those without complications had a creatinine level of 126 $\mu\text{mol/l}$. This indicates significantly higher serum creatinine levels at discharge in living donor transplant patients, who develop early postoperative complications.

Hospital stay. The average hospital stay of recipients from a cadaveric donor, who had early complications was 15 days, whereas for patients without complications it was 14 days. The average hospital stay of recipients from a living donor, who developed early complications was 18 days, whereas for patients without complications it was 17 days. Our results do not show a significant difference in the mean hospital stay in transplant patients from living and cadaveric donors with or without early postoperative complications.

Discussion. Residual diuresis is taken into account in the selection of recipients in the clinic. Our results show, that transplant patients from a living donor without complications have a statistically significantly higher amount of mean residual diuresis before the transplantation, than those with early postoperative complications. This correlation is not found in transplantations from a cadaveric donor. However, our team is of the opinion that the greater amount of

residual diuresis before surgery is a good prognostic factor for lower rate of early postoperative complications.

Opinions about the significance of the time of cold ischemia for the development of postoperative complications are contradictory. Some authors have linked the occurrence of urinary tract and ureteral stenosis to the prolonged duration of cold ischemia [1]. Other studies have found no link between the time of cold ischemia and postoperative complications. Several authors published such studies with a group of 1787 patients, with a group of 901 patients and with a group of 200 patients [2-4]. Some authors also failed to prove a correlation between the time of cold ischemia and the occurrence of urological complications. They found a statistically significantly shorter time of cold ischemia in patients with ischemic strictures of the ureter. The correlation between the time of cold ischemia and postoperative complications remained unproven in a comprehensive retrospective study with a group of 41 867 transplanted patients from a living and cadaveric donor [5]. These results indicate that longer times of cold ischemia should not raise fear associated with the occurrence of postoperative complications.

In our group of patients no connection was found between the time of cold ischemia and the subsequent occurrence of postoperative complications as well. In contrast to living donor transplantations, cadaveric donation surgeries are often performed outside the normal working hours in order to decrease the time of cold ischemia. In the new literature data this fact increases the risk of surgical complications and revisions of surgical wounds due to the extremely high workload of the on-duty team [6]. Therefore, the planned postponement of the kidney transplant for the next day seems reasonable, despite the prolongation of the time of cold ischemia. Our results eloquently depict the positive effect of this course of action.

There is unanimity about the fact that the recipient obesity is a risk factor for the occurrence of postoperative complications in transplant patients. Obesity can make it difficult for the wound to heal, causing hernias, lymphocele and dehiscence. Similar results were observed in the transplanted patients in the Clinic of Urology of "Alexandrovska" University Hospital. With an increase in BMI, there is an increase in the incidence of complications in transplant patients from a cadaveric donor, as well as in the entire group of transplanted patients in the clinic. On the other hand, the increase in BMI in the group of patients, transplanted from a living donor is associated with a decrease in the incidence of postoperative complications.

The relationship between the age of the recipient and the occurrence of postoperative complications is also important and plays a controversial role in scientific research and publications. It was proved that the age of the recipient at the time of transplantation is an independent factor, favouring the occurrence of complications [7]. According to this, at-risk patients are usually young recipients under 10 years and adult recipients over 50 years. There are publications, which also found

that with increasing age, the incidence of complications increases [8,9]. Many other publications describe the age of recipients as an insignificant factor in the occurrence of complications. In the patients we observed, it was found that patients with complications had a higher average age than those without complications – in cadaveric donation by an average of 3 years, in living donation by an average of 1 year. The influence of the recipient's age on the occurrence of complications remains only implied in our study and cannot be proven significantly. The age of the recipient should not in itself restrict the patient from receiving a kidney transplant.

The age and concomitant diseases of the donor are also criteria that can affect the success of a kidney transplantation. As the age of the donor increases, so does the frequency of ureteral strictures. This is explained by the fact that with age there are arteriosclerotic changes in the vessels, reduced blood supply to the donor ureter with subsequent ischemic fibrosis and stenosis [10]. The postoperative extravasate is not affected to such an extent by the age of the donor. Many authors did not find an association between the age of the donor and the occurrence of postoperative complications [11]. In our group of patients, it was proven that patients, transplanted from a living donor and with postoperative complications were recipients of an organ from a donor that was on average 3 years older than in the same patients without complications. The influence of the age of a living donor on the occurrence of early postoperative complications fails to reach a significant level, but a similar trend is evident, which has been demonstrated in the studies of a number of other authors. In cadaveric donation, there is no relationship between the age of the donor and the occurrence of complications.

There are studies that show, that both donors and recipients, who develop postoperative arterial stenosis have a higher average age. However, a higher frequency of predisposing factors for arteriosclerosis such as diabetes mellitus, arterial hypertension, coronary ischemic heart disease is present in these cases [5]. Hemodialysis also has a negative effect on the patient's vascular system, although in our group of patients such a correlation is not evident. No significant effect of the duration of preoperative hemodialysis on the occurrence of early postoperative complications was found in the observed patients.

In a large retrospective study of 1110 transplanted patients from a cadaveric donor, a significant correlation was found between arteriosclerotic changes in the recipient's vessels and the occurrence of postoperative renal artery stenosis [12]. The degree of arteriosclerosis correlates significantly with the patient's age. Similar results were achieved in a retrospective study of 41 867 transplanted patients from a living and cadaveric donor [5]. According to some authors as the recipient's age increases, more complications from the operative wound, hernias and lymphocele are demonstrated [13]. The age of the recipient and the donor does not in itself play a significant role. The concomitant arteriosclerotic changes of the vessels in the more advanced age group are of much greater importance.

This hypothesis explained, why in many studies, self-assessment of age without taking into account the patient's cardiovascular risk did not prove a link with postoperative complications [14]. Probably for this reason, our study did not find a significant correlation between the occurrence of postoperative complications and the age of the donor and recipient at the time of transplantation.

In our study, creatinine levels were monitored on admission and discharge of transplanted patients. Higher levels of serum creatinine at admission only hint at the possibility of future early complications after kidney transplantation without this claim being proven in our study. However, our team is of the opinion that conducting quality chroniodialysis in patients with end-stage chronic renal failure is of great importance for successful kidney transplantation. Our results show significantly higher levels of serum creatinine at discharge in patients transplanted from a living and cadaveric donor with early postoperative complications. This reveals the negative impact of postoperative complications on transplanted kidney function and the need to control them adequately in order to prolong graft survival.

In our group of patients, the average hospital stay for patients with postoperative complications did not differ significantly from that for patients without postoperative complications. This may be due to the fact, that the average time for monitoring the postoperative period of transplant patients in the Clinic of Urology of "Alexandrovska" University Hospital is extended due to specific structure of the healthcare system in our country.

Conclusions. Our results show, that the frequency of early postoperative urological and surgical complications at our clinic corresponds to the literature data from other transplant centres.

- We believe that a higher amount of residual diuresis before transplantation is a good prognostic factor for lower rate of early postoperative complications.

- Prolonged time of cold ischemia does not affect the frequency of postoperative complications and allows for better organization of surgical activity.

- The average length of hospital stay in the Clinic of Urology of "Alexandrovska" University Hospital for transplanted patients may be extended due to the specific health care organization in the country.

- Obesity and abrupt weight loss on the part of the recipient is a risk factor for the occurrence of postoperative complications in transplanted patients.

- In the studied group of patients, there is only a hint of the influence of the age of the recipient on the occurrence of complications, without it reaching significant values.

- In our study there was no relationship between the age of the donor and the occurrence of complications.

- Our opinion is that the age of the recipient and the donor does not in itself play a significant role for the risk of early complications. Much more important is the increase in the cardiovascular risk and the development of various comorbidities with ongoing age.

– Serum creatinine levels at admission do not have a significant effect on the occurrence of early postoperative complications, but only hint at our belief that quality prior dialysis treatment plays an important role in the success of kidney transplantation.

– According to the values of serum creatinine at discharge, postoperative complications have a negative impact on the function of transplanted kidney and their timely and adequate treatment is necessary to prolong the survival of the graft.

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