ISSN: 2181-3337 | SCIENTISTS.UZ VOLUME 5 ISSUE 9 | SEPTEMBER 2026

HEMODYNAMIC CHANGES IN KIDNEY TRANSPLANT RECIPIENTS DURING LATE PREGNANCY AND AFTER DELIVERY

Matkarimov Zohidjon[1], Azimova Marguba[2], Abdurahmonova Nigora[3], Elmurodova Nigina[4], Komilova Dildora[5]
State Institution "Republican Specialized Scientific and Practical Medical Center of Surgery named after Academician V.Vakhidov"

DOI: 10.67620/sai.59d0007

ABSTRACT
Pregnancy after kidney transplantation is a high-risk condition in which cardiovascular adaptation may be influenced by renal and vascular factors. This comparative observational study assessed systolic and diastolic blood pressure dynamics in kidney transplant recipients during late pregnancy and after delivery and compared pre-delivery values with those of healthy pregnant women. The study included 23 women with a functioning kidney allograft and 23 healthy pregnant women. In transplant recipients, systolic blood pressure decreased from 125 ± 3.06 mmHg before delivery to 116.7 ± 2.34 mmHg after delivery, representing a statistically significant reduction ($p = 0.0368$). Diastolic blood pressure decreased from 81.96 ± 2.17 mmHg to 77.2 ± 1.57 mmHg, but this change was not statistically significant ($p = 0.0826$). Before delivery, transplant recipients had significantly higher systolic blood pressure than healthy pregnant women (125 ± 3.06 vs 110 ± 2.27 mmHg; $p = 0.000297$) and markedly higher diastolic blood pressure (81.96 ± 2.17 vs 60 ± 1.62 mmHg; $p < 0.000001$). These findings demonstrate elevated blood pressure in kidney transplant recipients during late pregnancy, with significant postpartum improvement in the systolic component, and support continued individualized blood pressure monitoring throughout pregnancy and the postpartum period.

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Keywords: *kidney transplantation; pregnancy; arterial hypertension; systolic blood pressure; diastolic blood pressure; postpartum period.*

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Introduction

Pregnancy after kidney transplantation is considered a high-risk clinical condition requiring close multidisciplinary monitoring because of the complex interaction between physiological changes associated with pregnancy and the underlying characteristics of the kidney transplant recipient (Mallett et al., 2024; Wiles et al., 2019). Pregnancy is accompanied by substantial hemodynamic adaptations, including changes in circulating blood volume, cardiac output, vascular resistance, and blood pressure (Meah et al., 2016; Troiano, 2018). In kidney transplant recipients, these physiological changes may be modified by pre-existing renal dysfunction, vascular abnormalities, and long-term immunosuppressive therapy (Wiles et al., 2019).

Arterial hypertension is common among kidney transplant recipients and represents an important factor associated with cardiovascular complications and deterioration of kidney allograft function (Loutradis et al., 2021). During pregnancy, elevated blood pressure may additionally increase the risk of pregnancy-related complications, including preeclampsia and preterm delivery (Shah et al., 2019; Wiles et

al., 2019). Therefore, assessment of blood pressure dynamics during late pregnancy and the postpartum period is an important component of monitoring women with a transplanted kidney (Mallett et al., 2024; Wiles et al., 2019).

The postpartum period is characterized by rapid hemodynamic changes associated with delivery and the transition from pregnancy to the non-pregnant state (Meah et al., 2016; Troiano, 2018). Evaluation of blood pressure before and after delivery may provide clinically relevant information regarding the cardiovascular response to these changes and may contribute to the optimization of post-transplant monitoring.

The aim of this analysis was to assess the dynamics of systolic and diastolic blood pressure in kidney transplant recipients during the last months of pregnancy and after delivery, and to compare blood pressure values before delivery with those observed in healthy pregnant women.

Materials and methods. A comparative observational study was conducted to assess arterial blood pressure dynamics in pregnant kidney transplant recipients during late pregnancy and the postpartum period. The study included 23 women with a functioning kidney allograft who subsequently delivered, as well as 23 healthy pregnant women who constituted the comparison group.

Results. Systolic blood pressure (SBP) before delivery was 125 ± 3.06 mmHg, compared with 116.7 ± 2.34 mmHg after delivery; the difference was statistically significant ($p < 0.05$). Pregnancy is associated with physiological changes in hemodynamic load, which may be reflected in higher SBP during the late gestational period. Following delivery, the cardiovascular system undergoes hemodynamic unloading, accompanied by changes in circulating blood volume and a return toward a more stable blood pressure level (Meah et al., 2016; Troiano, 2018).

Diastolic blood pressure (DBP) was 81.96 ± 2.17 mmHg before delivery and 77.2 ± 1.57 mmHg after delivery. Although a downward trend was observed, the difference did not reach statistical significance ($p > 0.05$). This may be explained by individual variability in vascular tone and the effects of immunosuppressive therapy (Loutradis et al., 2021).

Table 1.

Blood Pressure in Kidney Transplant Recipients During the Last Months of Pregnancy and After Delivery

Blood pressure, mmHg	Systolic	Diastolic
Before delivery (N=23)	125 ± 3.06	81.96 ± 2.17
After delivery (N=23)	116.7 ± 2.34	77.2 ± 1.57
p-value	Statistically significant difference (p=0.036836)	Not statistically significant (p=0.082612)

The reduction in blood pressure after delivery may be clinically relevant in kidney transplant recipients, as hypertension is an important risk factor for deterioration of allograft function (Loutradis et al., 2021). The statistically significant reduction in SBP suggests that this parameter may be more sensitive to the hemodynamic changes occurring after delivery. The absence of a statistically significant difference in DBP indicates that a larger sample size may be required to clarify this trend.

Table 1. Dynamics of blood pressure in kidney transplant recipients before and after delivery presents the mean systolic and diastolic blood pressure values with 95% confidence intervals. A statistically significant reduction in SBP was observed after delivery ($p = 0.037$), whereas the difference in DBP did not reach statistical significance ($p = 0.083$). Thus, kidney transplant recipients in the last

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months of pregnancy demonstrated relatively higher blood pressure, predominantly due to the systolic component. After delivery, a statistically significant decrease in SBP was observed ($p < 0.05$), consistent with postpartum hemodynamic changes and cardiovascular unloading (Meah et al., 2016; Troiano, 2018). DBP also showed a downward trend; however, the difference did not reach statistical significance ($p > 0.05$). These findings emphasize the importance of continuous blood pressure monitoring in kidney transplant recipients during pregnancy and the postpartum period, as hypertension remains an important risk factor for maternal complications and impaired kidney allograft function (Loutradis et al., 2021; Mallett et al., 2024; Wiles et al., 2019).

Table 2.

Blood Pressure in Kidney Transplant Recipients and Healthy Pregnant Women Before Delivery

Blood pressure, mmHg	**Systolic**	**Diastolic**
Kidney transplant recipients (N=23)	125 ± 3.06	81.96 ± 2.17
Healthy pregnant women (N=23)	110 ± 2.27	60 ± 1.62
p-value	Statistically significant difference (p=0.000297)	Statistically significant difference (p<0.000001)

Systolic blood pressure in kidney transplant recipients was 125 ± 3.06 mmHg, compared with 110 ± 2.27 mmHg in healthy pregnant women. The difference was statistically significant ($p = 0.000297$), indicating higher SBP among kidney transplant recipients during late pregnancy.

Diastolic blood pressure was 81.96 ± 2.17 mmHg in kidney transplant recipients and 60 ± 1.62 mmHg in healthy pregnant women, with a highly statistically significant difference ($p < 0.000001$). This finding indicates substantially higher DBP in the transplant recipient group.

Overall, both systolic and diastolic blood pressure were higher in pregnant kidney transplant recipients than in healthy pregnant women. The mean difference was approximately 15 mmHg for SBP and 22 mmHg for DBP, which is clinically relevant in the context of pregnancy after kidney transplantation.

These findings are consistent with recognized mechanisms contributing to elevated blood pressure in kidney transplant recipients, including long-term exposure to calcineurin inhibitors, vascular remodeling, reduced arterial compliance, and renal-related mechanisms (Loutradis et al., 2021). Hypertension in this population is an important risk factor for pregnancy-related complications, including preeclampsia, placental dysfunction, and preterm delivery, as well as for deterioration of kidney allograft function (Loutradis et al., 2021; Shah et al., 2019; Wiles et al., 2019).

Thus, blood pressure values in kidney transplant recipients were significantly higher than those observed in healthy pregnant women. The significant differences in both systolic and diastolic blood pressure highlight the increased cardiovascular and obstetric risk profile of this population and underscore the importance of careful blood pressure monitoring and timely management throughout pregnancy (Mallett et al., 2024; Wiles et al., 2019).

Conclusion.

1. Kidney transplant recipients demonstrated higher arterial blood pressure during the last months of pregnancy compared with healthy pregnant women. Mean systolic blood pressure was **125.0 ± 3.06 mmHg** versus **110.0 ± 2.27 mmHg**, respectively (**p = 0.000297**), while mean diastolic blood pressure was **81.96 ± 2.17 mmHg** versus **60.0 ± 1.62 mmHg (p < 0.000001).**

2. After delivery, a statistically significant reduction in systolic blood pressure was observed, from **125.0 ± 3.06 mmHg** to **116.7 ± 2.34 mmHg (p = 0.0368**). This finding reflects the hemodynamic changes accompanying the transition from pregnancy to the postpartum period.

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3. Diastolic blood pressure also decreased after delivery, from **81.96 ± 2.17 mmHg** to **77.2 ± 1.57 mmHg**; however, the difference did not reach statistical significance (**p = 0.0826**).

4. The observed differences in blood pressure indicate that kidney transplant recipients require careful and continued blood pressure monitoring during late pregnancy and after delivery. Particular attention should be given to systolic blood pressure, which demonstrated a statistically significant postpartum decrease in the present cohort.

5. The higher blood pressure values observed in kidney transplant recipients compared with healthy pregnant women emphasize the importance of individualized cardiovascular and renal monitoring throughout pregnancy and the postpartum period to support maternal health and preservation of kidney allograft function.

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