



ASSESSMENT OF ULTRASOUND FINDINGS IN RENAL TRANSPLANT RECIPIENTS DURING THE POSTOPERATIVE PERIOD

Norkuziev, Sherali Safaralievich.¹, Kurbanov Obid Makhsudovich.², Muminov Javokhir Asliddinovich. ¹, Ismatov Tuichiboy Akhroorkulovich ¹, Norkabilov Alisher Norbekovich ¹, Olimov Ismoilkhon Zhamolkhon ugli¹ Mamatmurodov Anvar Abdusaidovich ¹

¹ Samarkand regional multidisciplinary medical center

² Bukhara State Medical Institute

Article history:

Received: February 8th 2025

Accepted: March 7th 2025

Abstract:

This study is devoted to the analysis of morphometric and hemodynamic changes in the renal graft in the post-transplant period using ultrasound diagnostic methods. The paper presents data on 53 patients (31 men and 22 women) who underwent kidney transplantation, who underwent ultrasound examination on the first day after surgery and 3 months later. Ultrasound diagnostics was performed using Mindray Consona N9 (ZST, Zone Sonography Platform). The graft volume, parenchyma thickness, resistance index (IR) of the renal artery and renal vein patency were taken into account. The study allowed us to evaluate changes in graft volumes, parenchyma thickness, as well as renal artery resistance and venous blood flow, which made it possible to identify the dynamics of recovery and predict possible complications.

Keywords: transplant morphometry, kidney transplantation, ultrasound diagnostics

RELEVANCE

Today, kidney transplantation remains the only radical method of treating patients with terminal stage chronic renal failure [1,4,7,13,20]. This procedure ensures the highest survival rate and significantly improves the quality of life of recipients. Over 95 thousand kidney transplant operations are performed worldwide annually, which emphasizes their importance in modern medicine [2,6,11,16,17]. However, studies show that the risk of death in the early postoperative period in such patients significantly exceeds the same indicator in people on hemodialysis [1, 9,10,15,19].

Despite progress in transplantology and immunology, the incidence of complications, including irreversible transplant rejection, remains high. The introduction of innovative approaches based on the latest scientific advances allows us to minimize the risks of developing such pathologies [3,9,12,14,19].

The standard surgical technique is heterotopic kidney transplantation into the iliac region from the contralateral side (right kidney on the left, left kidney on the right) [5, 8]. Ultrasound examination (US), which combines grayscale mode, color and spectral Doppler mapping, plays an important role in the diagnosis and monitoring of the transplant condition. This method is recognized as one of the most informative and accessible in clinical practice [3,5,11,17].

Knowledge of reference parameters of ultrasound diagnostics of renal transplant in the early postoperative

period contributes to the timely detection of pathological changes in the transplanted organ and allows determining the optimal tactics of patient management without excessive diagnostic burden. This, in turn, contributes to improving the quality of life of patients and reducing the duration of their hospitalization [1,4,8,15].

The use of two-dimensional ultrasound scanning for the assessment of renal transplants began in the 1970s, and the introduction of Doppler technologies subsequently consolidated ultrasound as the method of choice in everyday clinical practice. Ultrasound is a non-invasive, accessible and safe method devoid of nephrotoxic effect, which makes it a valuable tool for diagnosis and dynamic monitoring of the transplant in the early stages of the postoperative period [5,16,17,19,20].

The method allows recording the initial parameters of the transplant for further monitoring [6,9,18,19] and plays a key role in the diagnosis of early postoperative complications. In addition to the possibility of identifying vascular disorders such as stenosis or thrombosis, ultrasound is also used to perform puncture biopsy of the transplant and to drain fluid formations [2,3,13,17]. This work highlights the basic principles and approaches to ultrasound assessment of the condition of the renal transplant.



PURPOSE OF THE STUDY

To study ultrasound parameters of the kidney transplant condition in the postoperative period, identify characteristic changes, and evaluate the effectiveness of ultrasound diagnostics in the early post-transplant period.

MATERIALS AND METHODS

The study of morphometric and functional parameters of the renal transplant was based on the analysis of archival data, including 53 protocols and ultrasound images of the renal transplant, performed in 31 men and 22 women. Diagnostic studies were carried out on the first day after transplantation, as well as 3 months after surgery in the period 2020-2025 in the Samarkand Regional Multidisciplinary Medical Center.

Surgical interventions (kidney transplantation) were performed at the Department of Angiosurgery and Transplantation. Ultrasound diagnostics of the transplanted kidney was performed using the Mindray Consona N9 ultrasound scanner (ZST, Zone Sonography Platform).

The methodological basis of the study was prospective and empirical methods. The analysis included patients with a favorable postoperative prognosis.

RESULTS AND DISCUSSION

The demographic characteristics of the studied cohort of renal allograft recipients, including parameters of gender and age structure, are systematized in Table 1.

Table 1. Distribution of patients with kidney transplant by gender and age

Age	Number of patients (n/%)	Floor	
		female (n/%)	male (n/%)
The first period of mature age (19-35)	9 / 17 , 0%	3 / 5 , 7	6 / 11.3
The second period of mature age (35-60)	28 / 52 , 8%	11 / 20 , 7	17 / 32 , 1
Old age (60-75)	16 / 30.2%	8 / 15 , 1	8 / 15 , 1
Total	53 / 100	22 / 41 , 5	31 / 58.5

The cohort analysis showed that the study group was dominated by patients in the age category of 35–60 years (second period of maturity) — 28 cases (52.8%), with gender distribution: 11 women (39.3%) and 17 men (60.7%). Statistically significant predominance of this age group ($p < 0.05$) was confirmed in comparison with the cohorts of the elderly (60–75 years) and young (19–35 years).

Among men, 11.3% ($n = 6$) corresponded to the first period of maturity (19–35 years), while in old age (60–75 years) there were an equal number of women and men - 8 cases each (15.1%).

Clinically significant ultrasound morphometric parameters of the renal graft, including graft volume (V) and parenchyma thickness (H), were analyzed dynamically: on the first day after transplantation (P/T) and after 3 months P/T (Table 2). The obtained data correlated with a favorable clinical and laboratory profile, indicating the absence of complications in the post-transplant period.

Table 2. Morphometric indices of ultrasound examination of renal transplant in patients of different age and gender groups in the early post-transplant period

Age	Ultrasound (1st day P/T)				Ultrasound (3 months P/T)			
	men		women		men		women	
	V (cm ³)	H (cm)	V (cm ³)	H (cm)	V (cm ³)	H (cm)	V (cm ³)	H (cm)
The first period of mature age (21-35 years)	195.5	1.71	217	1.6	224	1.77	228	1.6
The second period of mature age (35-60 years)	202.5	1.8	190	1.85	229	1.86	215	1.88
Old age (60-75 years)	175	1.6	160	1.8	208	1.71	196	1.83

In patients with pathological shifts in the analysis of laboratory data results, in particular, the levels of creatinine, urea and leukocyte intoxication index indicators served as a criterion for dynamic ultrasound monitoring during the following days of rehabilitation.



In men in the first period of mature age (11.3%), the increase in the median graft volume three months after transplantation was 28.5 cm³, and the increase in parenchyma thickness was 0.06 cm. In women aged 21–35 years (5.7%), the increase in graft volume over the specified period was 11 cm³, while the parenchyma thickness remained unchanged.

In men of the second period of mature age (32.1%), the median morphometric parameters demonstrated an increase in transplant volume by 26.5 cm³ and parenchyma thickness by 0.06 cm. In women of the same age group (20.7%), the transplant volume increased by 30 cm³ and the parenchyma thickness by 0.03 cm.

In elderly men (15.1%), the increase in transplant volume was 33 cm³, and in parenchyma thickness was 0.11 cm. In women of the same age category (15.1%), the transplant volume increased by 36 cm³, and the change in parenchyma thickness was minimal and amounted to 0.03 cm.

Hemodynamic parameters, including renal artery resistance index (IR) and renal vein blood flow velocity (ml/s), were assessed both on the first day after transplantation and three months later in the post-transplant period. The results are presented in Table 3.

Table 3. Hemodynamic parameters of ultrasound examination of the renal transplant in patients of different age and gender groups in the post-transplant period

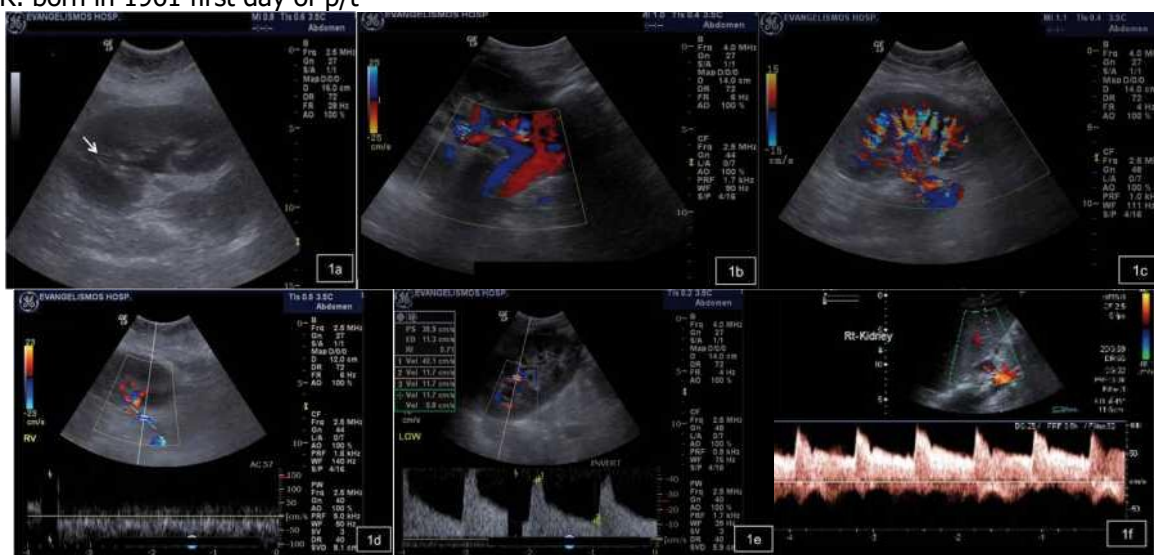
Age	Ultrasound (1st day P/T)				Ultrasound (3 months P/T)			
	men		women		men		women	
	PA (IR)	PV (ml/s)	PA (IR)	PV (ml/s)	PA (IR)	PV (ml/s)	PA (IR)	PV (ml/s)
The first period of mature age (21-35 years)	0.69	19.65	0.7	14	0.71	18.1	0.75	12.9
The second period of mature age (35-60 years)	0.74	13.69	0, 72	15.1	0.7	18.05	0.75	20.3
Old age (60-75 years)	0.66	16.7	0.77	13.25	0.7	14.96	0.77	16.55

The color Doppler mapping (CDM) method was used for a comprehensive assessment of the uniformity of vascularization and the degree of contrasting of the renal transplant vessels, including the main and arcuate arteries and veins, as well as for verification of their anatomical patency [9]. The presence of a clearly differentiated vascular pattern from the main renal artery to the arcuate branches indicates the physiological structure of the organ and the absence of ischemic damage [6]. Limitation of vascularization, manifested by a reduction in the vascular pattern at the level of peripheral branches, is associated with complications such as acute tubulointerstitial fibrosis or chronic nephropathy of the transplant [4]. An example of an ultrasound examination of a renal transplant in grayscale mode, as well as using color and spectral Dopplerography is shown in Figure 1

Figure 1: (a) Normal transplanted kidney on gray scale ultrasound showing good contrast between the cortex and medulla. Mild dilation of the collecting system and pigtail catheter (arrow) are noted. (b) Normal renal artery and vein of the transplant on color Doppler examination. (c) Homogeneous blood flow throughout the parenchyma of the transplanted kidney on color Doppler ultrasound. Interlobar, arcuate, and cortical vessel branches are visualized. (d) Normal spectral Doppler trace of the renal vein. (e) Normal spectral Doppler trace of the intrarenal artery: steep systolic rise and high diastolic flow. Resistance index is normal (RI = 0.71). (f) Normal spectral Doppler trace of the renal artery.



Patient K.R. born in 1961 first day of p/t



In men of the first mature age group (21–35 years), in all cases (100%, 6 people), the perfusion of the renal transplant parenchyma was assessed as “good”. In the group of men of the second mature age group (35–60 years), “good” perfusion was noted in 88% (15 people), the indicator corresponded to the “satisfactory” level in 6% (1 person), and a decrease in perfusion was detected in another 6% (1 person). In men of the elderly age group (60–75 years), in all cases (100%, 8 people), the parenchyma perfusion was classified as “satisfactory”.

As for women, in the age category of 21–35 years, in all observations (100%, 3 people), graft perfusion was assessed as “good”. Among women of the second mature age (35–60 years), 81.8% (9 people) had “good” perfusion, and 18.2% (2 people) had “satisfactory” perfusion. In the group of elderly women (60–75 years), 50% (4 people) had “good” perfusion, 37.5% (3 people) had “satisfactory” perfusion, and 12.5% (1 person) had “reduced” perfusion.

CONCLUSION

Based on the results of the study, which included a comprehensive analysis of the data, the following key points were established:

- The age factor plays an important role in the dynamics of restoration of the transplanted kidney. The largest proportion of patients were people of the second period of mature age (35-60 years) - 52.8%, which indicates a high frequency of transplantation in this age category.
- Morphometric analysis showed that the graft volume and parenchyma thickness increased during the first 3 months after surgery. The maximum increase in volumetric indicators was observed in elderly patients.
- Hemodynamic parameters (renal artery resistance index and renal vein blood flow velocity) changed depending on the patient's age, reflecting the processes of transplant adaptation. Younger patients had better transplant vascularization, while older patients more often had perfusion disorders.
- Graft perfusion was assessed as predominantly “good” in younger age groups, but in older patients, signs of decreased blood flow were found in some cases.



Thus, ultrasound diagnostics is an important method of dynamic monitoring of the condition of the renal transplant, allowing timely detection of deviations in morphometric and hemodynamic parameters, which makes it indispensable for predicting and preventing complications in the postoperative period.

LIST OF LITERATURE

1. Ananchenko OI, Zharikova AO, Zhdanovich VN. Ananchenko OI, Zharikova AO, Zhdanovich VN. Analysis of kidney transplant ultrasound data analysis in the post-transplant period. *Health and Ecology Issues*. 2022;19(2):30- 34. DOI: <https://doi.org/10.51523/2708-6011.2022-19-2-04>
2. Augustine J. Kidney transplant: New opportunities and challenges. *Cleve Clin J Med*. 2018;85(2):138-144. DOI: <https://doi.org/10.3949/ccjm.85gr.18001>
3. Ismatov T. A. Effectiveness of Desensitizing Therapy in Kidney Transplantation in Highly Sensitized Patients Before Transplantation. *Vol. 55 (2024): Miasto Przyszłości*. P-1231-1237.
4. Ismatov TA, Kurbonov OM Correlation of endogenous intoxication indicators on kidney morphology in sensitized recipients after kidney transplantation. *Web of Medicine: Journal of Medicine, Practice and Nursing*. Volume 2, Issue 12, December 2024. P-164-173.
5. Ismatov T.A., Kurbonov O.M., Makhmudov K.O., Norkuziev Sh.S., Muminov Zh.A., Norkabilov AN Denotements for Morphological Study of the Kidneys and Paramount Considerations . *Health & Medical Sciences* Volume: 1, Number 3, 2024, Page: 1-10.
6. Ismatov TA, Kurbonov OM, Maxmudov QO, Mardonov JN, Norqo'ziev Sh.S., Mo'minov JA, Norkabilov AN Surunkali buyrak kasalligi va transplantatsiya haqida zamonaviy qarashlar. *O`zbekiston xirurgiyasi*. 2024, No. 4(105). Bet 50-53.
7. Kable T, Alcaraz A, Budde K, Humke U, Karam G, Lucan M, Nicita G, Susal C. Kidney transplantation: Clinical guidelines of the European Association of Urology, 2010. Translated from English, edited by Perlin D.V. Moscow, RF: ABV-Press; 2010. 100 p.
8. Kurbonov OM, Makhmudov KO, Ismatov TA The Value of Biopsy in Histopathological Diagnosis . *Health & Medical Sciences* Volume: 2, Number 1, 2024, Page: 1-8.
9. Kurbonov O.M., Makhmudov K.O., Norkuziev Sh.S., Ismatov T.A., Muminov Zh.A. Clinical review on living related donor kidney transplantation. *International multidisciplinary journal for research & development*. Volume 10, issue 12 (2023), P-346-351.
10. Kurbonov O.M., Norkuziev Sh.S., Makhmudov K.O., Ismatov T.A., Muminov Zh.A., Norkabilov A.N. Morphological characteristics after renal transplantation in non-sensitized patients. *Library Progress International*. Vol.44 No. 3, Jul-Dec 2024: P.12937-12949.
11. Mocny G, Bachul P, Chang ES, Kulig P. The value of Doppler ultrasound in predicting delayed graft function occurrence after kidney transplantation. *Folia Med Cracov*. 2016;56(4):51- 62 [date of access 2021 February 10]. Available from: <https://pubmed.ncbi.nlm.nih.gov/28325953/>
12. Pesavento TE. Kidney transplantation in the context of renal replacement therapy. *Clin J Am Soc Nephrol*. 2009;4(12):2035-2039.
13. Zimmerman PRN, Schiepers C. Diagnostic imaging in kidney transplantation. *Handbook of kidney transplantation*. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2005. p. 347-368.
14. Ananchenko OI, Zharikova AO. Clinically significant morphometric and functional parameters of the renal transplant according to ultrasound examination in the early postoperative period. In : *Coll . sci . art . VII International Scientific and Practical Conference «Scientific Research in the XXI Century»*; 2020 October 16-18 ; Ottawa , Canada . Ottawa: SPC «InterConf», 2020;1:249-254.
15. Danovich GM. Kidney transplantation. Translated from English, edited by Moisyuk YaG. Moscow, RF: GEOTAR-Media; 2013. 848 p.
16. Ismatov T. A. The relationship of kidney biopsy between indications and histopathological diagnosis. *Research journal of trauma and disability studies*. Volume: 3 Issue: 4 | April –2024 ISSN:



- 2720-6866. C-322-331. <http://journals.academiczone.net/index.php/rjtds>.
17. Ismatov T.A., Kurbonov O.M., Makhmudov K.O., Norkuziev Sh.S., Muminov Zh.A., Norkobilov A.N. Indications for morphological examination of the kidneys and important considerations. Research journal of trauma and disability studies. Volume: 3 Issue: 4 | April –2024 ISSN: 2720-6866. C-332-339 . <http://journals.academiczone.net/index.php/rjtds>.
 18. Moisyuk YaG, Sharshatkin AV, Arutyunyan SM, et al. Kidney transplantation from a living related donor. *Nephrology and Dialysis*. 2001. Vol 3(3):328-334.
 19. Norkuziev Sh.S., Ismatov T.A., Muminov Zh.A., Norkobilov A.N. Yukori sensitizationlashgan bemorlarni tirik karindosh donorlardan buyrak transplantatsiyasiga tayorlashning uziga hos zhihatlari. Uzbekistan doctor association. 2024, No. 3 (116). From 15-18
 20. Norkuziev Sh.S., Makhmonov L.S., Ismatov T.A., Chernyak V.A. Instrumental diagnostics for vertebral artery compression syndrome. Association of Doctors of Uzbekistan. 2022, No. 4 (109). P. 19-24