DOI: 10.15825/1995-1191-2025-4-146-157

KIDNEY TRANSPLANTATION FROM EXPANDED CRITERIA DONORS. THE FIRST MULTICENTER COHORT STUDY IN THE RUSSIAN FEDERATION

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The use of expanded criteria donors (ECDs) is an effective strategy to increase the availability of organs for transplantation. However, in Russia, there have been no large-scale studies evaluating the outcomes of kidney transplantation (KT) from ECDs. In Moscow, through successful implementation of an original organ donation model, considerable experience has been accumulated in managing donors who meet the UNOS expanded criteria for kidney donation. This paper presents the epidemiological characteristics of donors and recipients, as well as the medium-term outcomes of KT from ECDs. The study represents the first multicenter cohort study in the Russian Federation dedicated to kidney transplants from ECDs. The database was developed using systematized donor information from the Moscow Coordination Center for Organ Donation at Botkin Hospital for the period 2021–2022. During this time, 254 donors meeting UNOS expanded criteria underwent organ explantation at 21 hospitals in Moscow. The follow-up period for KT recipients was limited to four years. Recipient survival at 4 years after transplantation was 0.882 [95% CI 0.839–0.927], while overall graft survival (loss from any cause) was 0.806 [95% CI 0.739–0.880] and death-censored graft survival was 0.887 [95% CI 0.825–0.952]. Primary graft function was observed in 61.4% of recipients who received kidneys from ECDs. The medium-term survival rates of both recipients and grafts are acceptable and comparable to those reported in international studies, confirming the safety and effectiveness of expanding donor criteria to increase the number of kidney transplants.

Keywords: kidney transplantation, extended criteria donors, brain death, graft survival.

INTRODUCTION

According to data from the Russian Transplant Society registry [1] between January 1, 2021, and December 31, 2022, a total of 630 organ transplants from deceased donors were performed in Moscow. In 2021, among 298 effective donors (23.7 per million population), 290 (97.3%) were diagnosed with brain death. In 2022, 332 organ procurements were carried out (26.3 per million population), with 313 donors (94.3%) diagnosed with brain death. Overall, 254 donors (40.3%) met the UNOS criteria for expanded criteria donors (ECDs) [2].

According to UNOS [2], ECDs are defined as individuals aged 60 years and older, or aged 50–59 years with at least two of the following risk factors: a history of hypertension, death from acute cerebrovascular accident, or a serum creatinine level exceeding 1.5 mg/dL (132.6 μmol/L).

Although numerous studies have shown that kidney transplant (KT) outcomes from ECDs are somewhat inferior to those from standard criteria donors (SCDs) [2–5], their use remains an effective and necessary strategy to increase the availability of donor organs [5–9].

There are currently no large-scale studies in Russia evaluating the outcomes of KT from ECDs. However, according to data from the Russian Transplant Society, the proportion of donors aged over 60 years has increased significantly, from 10.7% in 2018 to 22.3% in 2023 [10]. It should also be noted that the donor and recipient pools, donor conditioning protocols, organ preservation times, and other procedural factors in Russia may differ considerably from those in other countries.

The objective of this study is to provide a comprehensive characterization of kidney donors meeting the expanded UNOS criteria, as well as to evaluate the medium-term outcomes of KT using such organs.

MATERIALS AND METHODS

This was a retrospective multicenter cohort study based on data systematically collected by the Moscow Coordination Center for Organ Donation at Botkin Hospital for the years 2021–2022. During this period, organs were procured across 21 hospitals from 254 donors who met the expanded UNOS criteria.

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Descriptive statistics for quality indicators are presented as absolute frequencies and percentages. In some instances, the total number of observations may differ from n = 444 due to missing data for certain patients.

Quantitative variables were described as mean ± standard deviation for distributions close to normal, and as median (first and third quartiles) for non-normally distributed data. The normality of distribution was assessed through visual analysis of frequency histograms and quantile–quantile (Q–Q) plots.

Survival analysis was performed using the Kaplan–Meier method, with point estimates and 95% confidence intervals (95% CI) calculated. In the analysis of kidney graft survival, three types of estimates were considered: overall graft loss – defined as transplant loss due to any cause (events included recipient death with a functioning graft, surgical removal of a functioning graft for discontinuation of immunosuppressive therapy, or graft failure); death-censored graft loss – defined as graft removal or graft failure, with death of a recipient with a functioning graft treated as a censored event; graft loss only – defined as graft failure, while deaths with functioning grafts and elective removals for discontinuation of immunosuppression were treated as censored events.

RESULTS

General characteristics of donors and recipients

The general characteristics of kidney donors and recipients are presented in Table 1. Donors were slightly older than recipients, with a minimum donor age of 50 years (in accordance with the expanded donor criteria) and a minimum recipient age of 19 years. The mean body mass index (BMI) of donors exceeded 30 kg/m^2, indicating a predominance of overweight and obese individuals in this group.

The median length of hospital stay for donors was 51.5 hours [31.3; 85.8], ranging from 13.2 to 446.3 hours. In one case, organ procurement was performed on day 18 after admission; in all other cases, hospitalization did not exceed 10 days.

Most effective donors (248; 97.6%) were diagnosed with brain death due to acute cerebrovascular accident, while traumatic brain injury was identified as the cause of death in only 6 cases (2.4%).

Most donors had type O (I) or type A (II) blood – 94 (37.0%) and 95 (37.4%), respectively – whereas types B (III) and AB (IV) were less common, occurring in 42 (16.5%) and 23 (9.1%) donors, respectively.

Comorbid background of donors, conditioning and retrieval characteristics

Eighteen donors (7.1%) underwent successful cardiopulmonary resuscitation lasting from 5 to 40 minutes (median 15 [10; 20] minutes). More than half of the donors (146; 57.5%) exhibited glucose metabolism disorders, defined as either confirmed diabetes mellitus or the need for insulin administration during conditioning. In 37 cases (14.6%), diabetes mellitus had been previously diagnosed, while in 60 cases (23.6%), repeated insulin administration was required due to persistent hyperglycemia. It should be noted that glucose-containing solutions were not used during donor conditioning. The condition listed in Table 2 as systemic atherosclerosis refers to a

Table 1

General characteristics of effective organ donors diagnosed with brain death

Characteristics	Donors, n = 254	Recipients, n = 444
Age, years	58.3 (4.8), 50.0 to 74.0	51.6 (9.6), 19.0 to 72.0
Male / Female	155 (61.0%) / 99 (39.0%)	271 (60.2%) / 179 (39.8%)
Weight, kg	90.9 (18.2), 50.0 to 150.0	76.2 (16.1), 40.0 to 125.0
Body mass index, kg/m^2	30.8 (5.9), 18.4 to 54.7	25.8 (4.5), 13.6 to 38.4
Body surface area (BSA), m^2	2.1 (0.2), 1.5 to 2.7	1.9 (0.2), 1.3 to 2.6

Descriptive statistics: n (%); mean (SD), minimum and maximum; median [Q1; Q3], minimum and maximum.

Table 2

Comorbid background of organ donors

Donor characteristics	n = 254
Insulin administration during conditioning of potential donors	146 (57.5%)
Persistent hyperglycemia during donor conditioning	60 (23.6%)
Confirmed diabetes mellitus	37 (14.6%)
Signs of impaired glucose metabolism	146 (57.5%)
Confirmed arterial hypertension	251 (98.8%)
Systemic atherosclerosis	171 (67.3%)
Ischemic heart disease	242 (95.3%)
Chronic heart failure	135 (53.1%)
Administration of norepinephrine prior to organ retrieval	252 (99.2%)
Maximum norepinephrine dose, ng/kg/min	525 [330; 800], 60 to 3700
Administration of norepinephrine at the time of organ retrieval	212 (83.5%)
Norepinephrine dose at retrieval, ng/kg/min	150 [75.5; 340], 10 to 1200
Adrenaline, ng/kg/min	
0	247 (97.2%)
50	3 (1.2%)
100	2 (0.8%)
200	2 (0.8%)

Descriptive statistics: n (%); mean (SD), minimum and maximum; median [Q1–Q3], minimum and maximum.

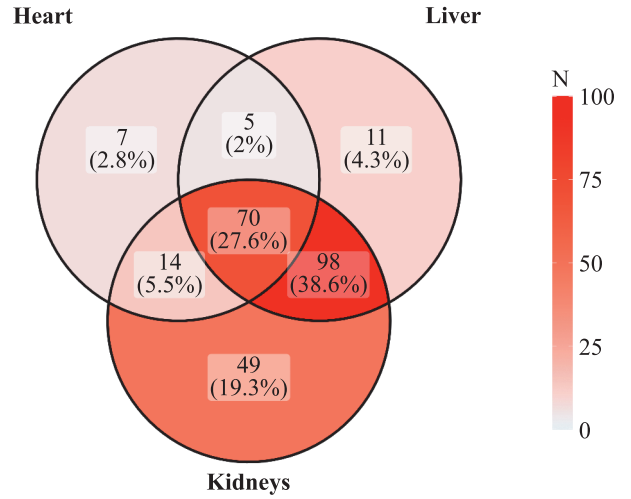

Fig. 1. Organ retrieval structure in donors

generalized form of vascular pathology characterized by multiple arterial lesions identified via instrumental diagnostic methods and visual inspection of accessible arteries during organ retrieval.

Almost all donors required vasopressor therapy (noradrenaline administration) before or during the conditioning phase. However, by the time of organ retrieval, the proportion of donors requiring noradrenaline had decreased significantly. Adrenaline was used in only 7 donors (2.8%), and none of these required its administration at the time of retrieval.

Most donors (182, 71.7%) underwent multi-organ procurement (Fig. 1). The liver was retrieved from 183 donors (71.7%), while the heart was procured from 96 donors (37.8%).

In 23 cases (9.1%), no kidneys were retrieved, and in 18 cases (7.1%), only one kidney was removed. In total, 444 kidneys were obtained from 254 donors, including 218 left and 226 right kidneys. The reasons for non-retrieval or refusal of transplantation are summarized in Table 3.

Laboratory data from 231 effective kidney donors, from whom at least one kidney was procured for transplantation, are presented in Table 4.

Recipients: causes of chronic kidney disease (CKD) and comorbidities

Predialysis transplantation was performed in 36 patients (8.4%). Before KT, 337 patients (78.4%) were on scheduled hemodialysis, 34 (7.9%) received peritoneal dialysis, and 23 (5.3%) underwent conversion of renal replacement therapy from peritoneal dialysis to hemodialysis. The duration of dialysis therapy among these patients ranged from 1 to 240 months (median 12 [12; 48] months). The causes of chronic renal failure (CRF) and the comorbidity profile of recipients are detailed in Tables 5 and 6, respectively.

Table 3

Reasons for refusal to harvest or transplant kidneys

Reason	Both kidneys (n = 23)	One kidney (n = 18)
Renal hypoplasia (shrunken kidneys)	7	4
Presence of hypoperfusion areas	4	–
Renal replacement therapy due to CKD stage 5D	3	–
Infected abdominal cavity	2	–
Presence of hypoperfusion and renal cyst areas	2	–
Shrunken kidneys and renal cysts	1	2
Renal cysts	1	5
Atherosclerotic renal artery atherosclerosis	1	3
Atherosclerotic renal artery and cyst atherosclerosis	1	–
Histologically confirmed renal formations	1	–
Hydronephrosis	–	1
Renal formation of unclear etiology	–	1
Absence of a kidney (anomaly or prior removal)	–	1
Parenchymal damage	–	1

Table 4

Laboratory parameters in effective kidney donors diagnosed with brain death

Donor characteristics	n = 231
Hemoglobin, g/L	141.2 (20.0), 75.0 to 199.0
Creatinine, μmol/L	
on admission	82.0 [67.0; 99.5], 33.0 to 262.0
maximum	92.0 [74.0; 118.5], 33.0 to 507.0
before retrieval	88.0 [70.0; 109.5], 33.0 to 507.0
Urea, mmol/L	
on admission	5.0 [4.0; 7.0], 2.0 to 15.0
maximum	7.0 [5.0; 8.0], 2.0 to 27.0
before retrieval	6.0 [5.0; 8.0], 2.0 to 27.0
Glomerular filtration rate (CKD-EPI), mL/min/1.73 m^2	
on admission	79.5 (21.0), 22.7 to 134.7
minimum	70.2 (24.4), 10.1 to 134.7
before retrieval	73.8 (23.8), 10.1 to 134.7
Alanine aminotransferase (ALT), U/L	
on admission	28.0 [23.0; 43.0], 7.0 to 406.0
maximum	31.0 [23.0; 54.0], 7.0 to 866.0
before retrieval	28.0 [21.0; 46.0], 7.0 to 866.0
Aspartate aminotransferase (AST), U/L	
on admission	25.0 [18.0; 36.0], 5.0 to 413.0
maximum	26.0 [19.0; 41.0], 5.0 to 1.090.0
before retrieval	24.5 [17.0; 36.0], 5.0 to 1.090.0

Descriptive statistics: mean (SD), minimum and maximum; median [Q1–Q3], minimum and maximum.

Recipients: immunological background

A large proportion of recipients had 3–5 HLA mismatches with their respective donors across the A, B, and DR loci. In 36 cases (8.2%), transplantation was performed despite mismatches in all three loci, whereas in 2 cases (0.5%), full HLA compatibility (no mismatches at all three loci) was observed. In 6 cases, the donor had blood group AB, a group with a notoriously limited recipient pool (Fig. 2).

More than half of the recipients (54.1%) had one mismatch at the DRB1 locus, while 19.9% had no mismatch at this locus. This distribution illustrates the positive impact of the regional regulatory framework, specifically, Order of the Moscow City Health Department No. 737 of October 19, 2017, titled "On the organization of medical

Table 5

Causes of chronic kidney disease in kidney transplant recipients

Cause of CKD	n = 444
Chronic glomerulonephritis	179 (41.6%)
Diabetic nephropathy	49 (11.4%)
Autosomal dominant polycystic kidney disease	61 (14.2%)
Hypertensive nephropathy (nephroangiosclerosis)	44 (10.2%)
Tubulointerstitial nephritis	25 (5.6%)
– Urolithiasis	14 (3.3%)
– Gout	9 (2.1%)
Secondary glomerulopathies	22 (5%)
– Anti-neutrophil cytoplasmic antibody (ANCA)-associated vasculitis	8 (1.9%)
– Antiphospholipid syndrome	3 (0.7%)
– Atypical hemolytic uremic syndrome	2 (0.5%)
– Thrombotic microangiopathy	2 (0.5%)
– Systemic lupus erythematosus	7 (1.6%)
Unknown cause	55 (12.2%)
Other	15 (3.3%)
– Nephrectomy (trauma or malignant tumor)	2 (0.4%)
– Developmental anomaly	13 (2.9%)

Table 6

Comorbid background of kidney transplant recipients

Recipient characteristics	n = 444
Arterial hypertension	428 (99.5%)
Ischemic heart disease	73 (17.0%)
Ischemic heart disease + history of coronary artery stenting	47 (10.9%)
Chronic heart failure	63 (14.7%)
Atrial fibrillation	26 (6.0%)
Diabetes mellitus	62 (14.4%)
With complications	44 (10.2%)
Without complications	18 (4.2%)
Peptic ulcer disease of the stomach and duodenum	21 (4.9%)
Chronic pyelonephritis	59 (13.7%)
Renoprivative state	30 (7.0%)
Chronic obstructive pulmonary disease	3 (0.7%)
History of acute cerebrovascular accident	15 (3.5%)
Malignant tumor	13 (3.0%)
Viral hepatitis C	35 (8.1%)
Viral hepatitis B	8 (1.9%)
HIV infection	2 (0.5%)
History of liver transplantation	1 (0.2%)
History of heart transplantation	1 (0.2%)
Hyperparathyroidism	235 (54.7%)
Multinodular goiter	7 (1.6%)
Autoimmune thyroiditis	9 (2.1%)
Thyrotoxicosis	4 (0.9%)
Gout	27 (6.3%)
Systemic lupus erythematosus	7 (1.6%)
Rheumatoid arthritis	1 (0.2%)
Thrombophilia	9 (2.1%)
Obliterating atherosclerosis of the lower extremities	5 (1.2%)

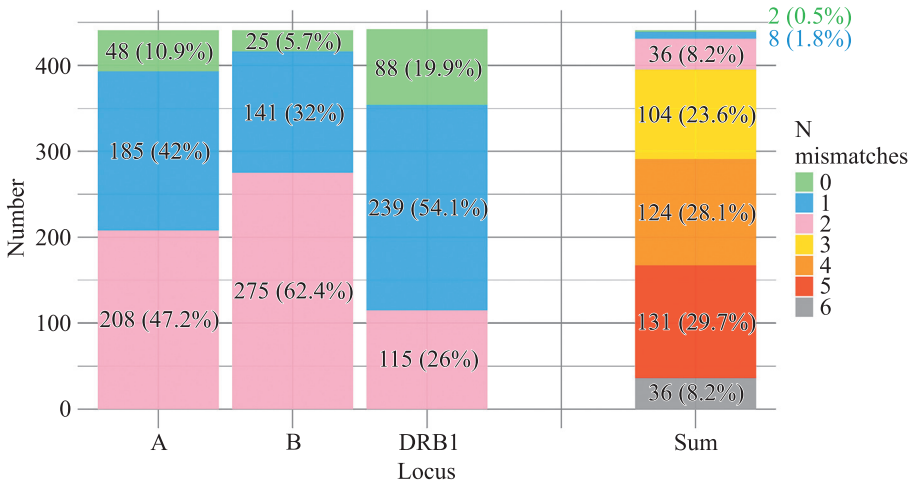

Fig. 2. Number of HLA mismatches. The number of donor antigens absent in each recipient was calculated

activities related to human organ donation and provision of surgical medical care (human organ and tissue transplantation) in the city of Moscow", which was implemented to improve the efficiency of donor-recipient matching within the transplant system of Moscow.

Pre-existing anti-HLA antibodies (mean fluorescence intensity, MFI >500 units) were identified in 73 recipients (16.4%). Class I antibodies (MFI >500) were detected in 40 recipients (9.2%), with median MFI of 2071.5 [1111.0; 3799] (range: 725–19,477). Class II antibodies (MFI >500) were found in 56 recipients (12.8%), with median MFI of 2618 [1305.5; 7269] (range: 526–20,772). For sensitization patterns, 17 recipients (3.8%) were sensitized to class I alone, 33 (7.4%) to class II alone, and 23 (5.2%) to both classes.

Recipients: characteristics of transplantation and the postoperative period

A total of 366 recipients (85.1%) underwent their first KT, 59 (13.7%) underwent their second, and 5 (1.2%) underwent their third. Median cold ischemia time was 14.4 hours [12.3; 17] (range: 6.9–26 hours). Median duration of hospitalization for recipients was 18 days [13; 26], varying between 5 and 106 days.

Induction therapy most frequently included a combination of basiliximab and methylprednisolone (362 patients, 84.2%). Antithymocyte globulin (ATG) combined with methylprednisolone was administered to 61 recipients (14.2%), while 4 (0.9%) received triple induction (basiliximab + ATG + methylprednisolone). Three patients (0.7%) received methylprednisolone alone.

Standard triple therapy – a calcineurin inhibitor (CNI), mycophenolate, and methylprednisolone – was administered to 403 recipients (93.9%). An everolimus-based regimen (everolimus + calcineurin inhibitor + methylprednisolone) was used in 24 patients (5.6%), while one recipient (0.2%) received everolimus + mycophenolate + methylprednisolone. Among those receiving CNIs, 390 (90.7%) were treated with tacrolimus, and 38 (8.8%) with cyclosporine A.

Delayed graft function (DGF), defined as the need for dialysis within the first postoperative week (regardless of the number of sessions), was observed in about one-third of recipients (147, 34.3%). The median number of hemodialysis sessions in this group was 3 [2; 6] (range: 1–26 sessions). Primary graft function was observed in 263 recipients (61.4%), while primary non-function occurred in 18 cases (4.2%).

Surgical or urological complications during hospitalization were recorded in about one-quarter of patients (109, 25.3%), while a combination of both types of complications occurred in 12 cases (2.8%). Among surgical complications, the most frequent was lymphocele of the transplant bed, diagnosed in 26 patients (5.9%). Other notable complications included retroperitoneal hematoma in 17 cases (3.8%) and postoperative wound infection in 11 cases (2.5%), of which 6 required vacuum-assisted closure (VAC). Reconstruction of transplant vessels was necessary in 9 cases (2.0%). Intraoperative bleeding and renal artery aneurysm of the transplant were each observed in one case (0.2%), and multiple surgical complications occurred in 8 recipients (1.8%).

Among urological complications, transplant pyelonephritis was the most common, developing in 40 recipients (9.0%). Ureteral necrosis occurred in 16 cases (3.6%), transplant hydronephrosis in 13 cases (3.0%), retroperitoneal urinary leakage in 12 cases (2.7%), and vesicoureteral reflux in 3 cases (0.7%). Combined urological complications were observed in 20 recipients (4.5%).

During the 4-year follow-up period, 272 recipients (61.2%) required rehospitalization between 1 and 8 times. A total of 567 rehospitalization episodes were recorded, corresponding to a frequency of 3.95 [95% CI 3.63–4.29] per 100 patient-months of follow-up. The most common reason for rehospitalization was the need for therapeutic intervention, including management of graft dysfunction or adjustment of immunosuppressive therapy, observed in 214 patients (48.2%). Combined causes included therapeutic intervention with distant surgical complications/diseases – 18 patients (4.1%); therapeutic intervention with distant urological complications/diseases – 17 patients (3.8%); urological complications/diseases alone – 14 patients (3.2%); surgical complications/diseases alone – 9 patients (2.0%).

Recipients: puncture biopsy results

During hospitalization for kidney transplantation, puncture biopsies were performed in 75 recipients (16.9%). No "zero" or routine control biopsies were performed in the early postoperative period. The indication for biopsy was graft dysfunction characterized by delayed recovery or absence of renal function.

After discharge, renal transplant biopsies were performed in 81 recipients (18.2%), as summarized in Table 7. The median time from transplantation to biopsy was 13.8 [6.1; 23.5] months, with a range of 2.9 to 44.7 months.

Recipients: recipient survival, graft survival, and graft function

Recipient survival is presented in Fig. 3. The estimated survival rates at 3 months, 1 year, 2 years, 3 years, and 4 years were 0.981 [95% CI 0.968–0.994], 0.950 [95% CI 0.929–0.971], 0.940 [95% CI 0.917–0.963], 0.910 [95% CI 0.881–0.939], and 0.882 [95% CI 0.839–0.927], respectively. During the follow-up period, 37 deaths were recorded. The leading causes of death included

acute myocardial infarction (n = 9), COVID-19 infection (n = 8), non-COVID-19-associated pneumonia (n = 8), sepsis (n = 5), and acute cerebrovascular accident (n = 3). Less common causes were peritonitis (n = 1), malignant neoplasm (n = 1), cardiac arrhythmia (n = 1), and acute hepatic failure with portal vein thrombosis (n = 1).

Kidney graft survival rates at 3 months, 1 year, 2 years, 3 years, and 4 years were as follows:

– For graft loss from any cause: 0.967 [95% CI 0.950–0.985], 0.926 [95% CI 0.900–0.952], 0.910 [95% CI 0.882–0.939], 0.876 [95% CI 0.843–0.911], and 0.806 [95% CI 0.739–0.880], respectively.
– For death-censored graft loss: 0.975 [95% CI 0.959–0.990], 0.956 [95% CI 0.936–0.977], 0.945 [95% CI 0.922–0.968], 0.936 [95% CI 0.911–0.961], and 0.887 [95% CI 0.825–0.952], respectively.
– For loss of graft function: 0.977 [95% CI 0.963–0.992], 0.958 [95% CI 0.939–0.979], 0.950 [95% CI 0.929–0.972], 0.941 [95% CI 0.917–0.965], and 0.896 [95% CI 0.835–0.961], respectively (Fig. 4).

The intensity (frequency) of events was highest during the first post-transplant year (Fig. 5).

The function of the transplanted kidney, assessed by the dynamics of estimated glomerular filtration rate (eGFR) and serum creatinine levels, is presented in Figs. 6 and 7, respectively.

Table 7

Puncture biopsy results

Biopsy result	Early period*, n = 75	Late period, n = 81
Donor pathology	30 (40.5%)	15 (18.5%)
Acute tubular necrosis	60 (81.1%)	25 (30.9%)
Focal segmental glomerulosclerosis	7 (9.5%)	20 (24.7%)
Interstitial fibrosis**	8 (10.8%)	39 (48.1%)
Percentage of interstitial fibrosis, %	22.5 [15; 35], 5 to 50	20 [15; 35], 5 to 70
Tubular atrophy	11 (14.9%)	39 (48.1%)
Calcineurin inhibitor toxicity	7 (9.5%)	8 (9.9%)
IgA nephropathy	0	3 (3.7%)
Thrombotic microangiopathy	2 (2.7%)	1 (1.2%)
Oxalosis	1 (1.4%)	0
Rejection	27 (36.0%)	41 (50.6%)
Acute cellular	11 (14.7%)	11 (13.8%)
Antibody-mediated	11 (14.7%)	15 (18.8%)
Acute mixed	5 (6.7%)	5 (6.3%)
Chronic active rejection	0	10 (12.3%)

Descriptive statistics: n (%); median [Q1–Q3], minimum and maximum. * Hospitalization for kidney transplantation. ** Among patients with interstitial fibrosis.

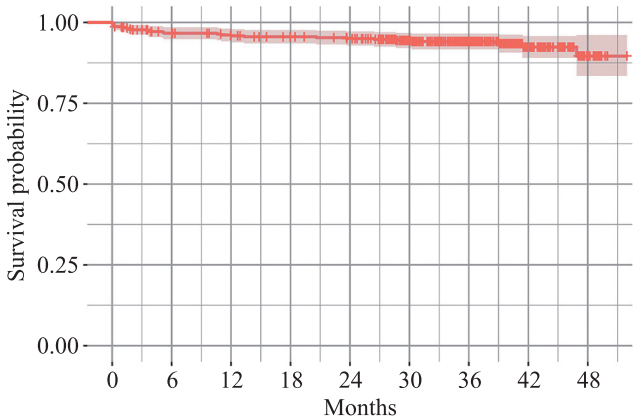

Fig. 3. Recipient survival. Survival function values are shown with 95% confidence intervals (CI)

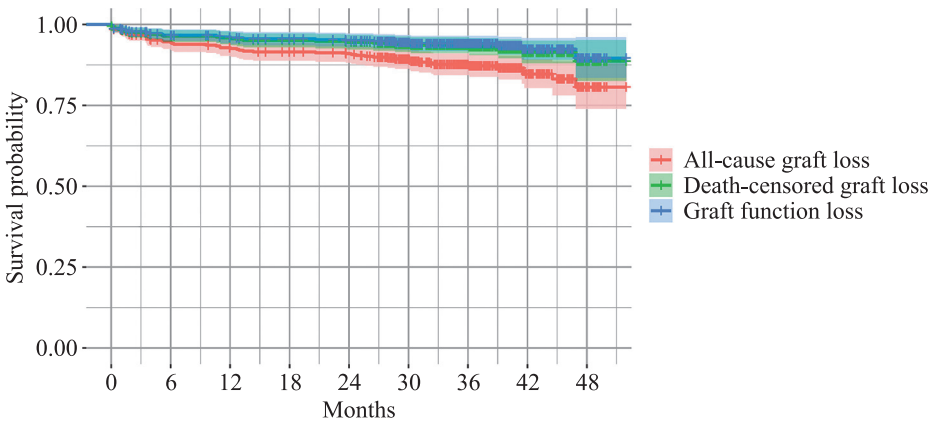

Fig. 4. Renal transplant survival. Survival rates and 95% confidence intervals (CI) are presented. Transplant loss for any reason: events included death of the recipient with a functioning transplant, retrieval of a functioning transplant for the purpose of discontinuing immunosuppressive therapy, or loss of transplant function. Death-censored graft loss: events included retrieval of a functioning graft for the purpose of discontinuing immunosuppressive therapy or loss of graft function; death of the recipient with a functioning graft was considered a censoring event. Transplant loss of function: events included graft loss; death of the recipient with a functioning graft and retrieval of a functioning graft for the purpose of discontinuing immunosuppressive therapy were considered censoring events

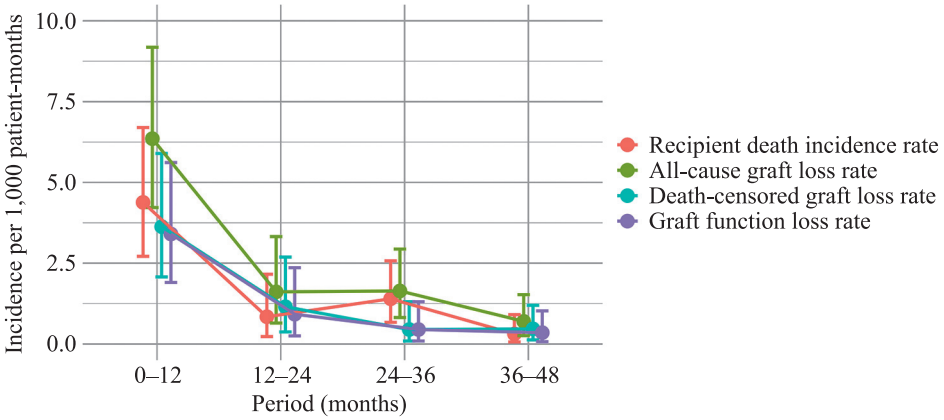

Fig. 5. Event intensity by follow-up period: recipient deaths, graft losses for any reason, death-censored graft losses, and graft function loss. Point estimates are shown with 95% confidence intervals (CI)

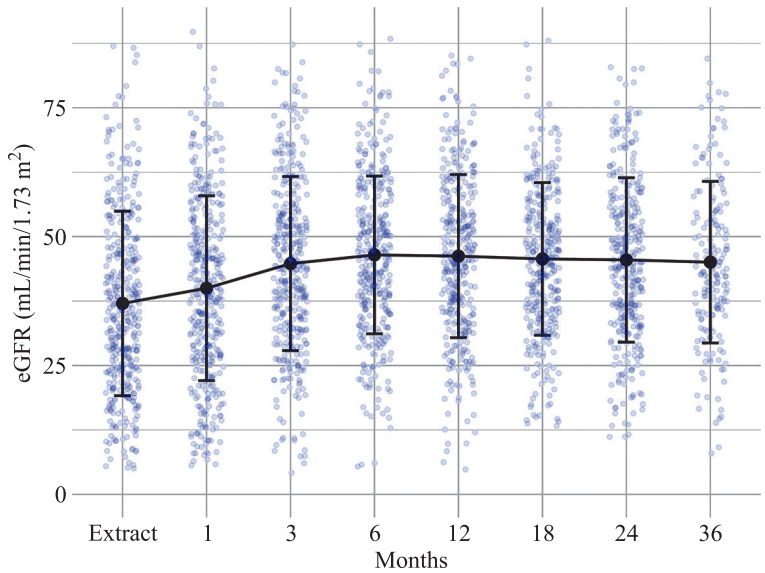

Fig. 6. Dynamics of estimated glomerular filtration rate (eGFR, CKD-EPI). Mean values with standard deviations and individual data points are presented

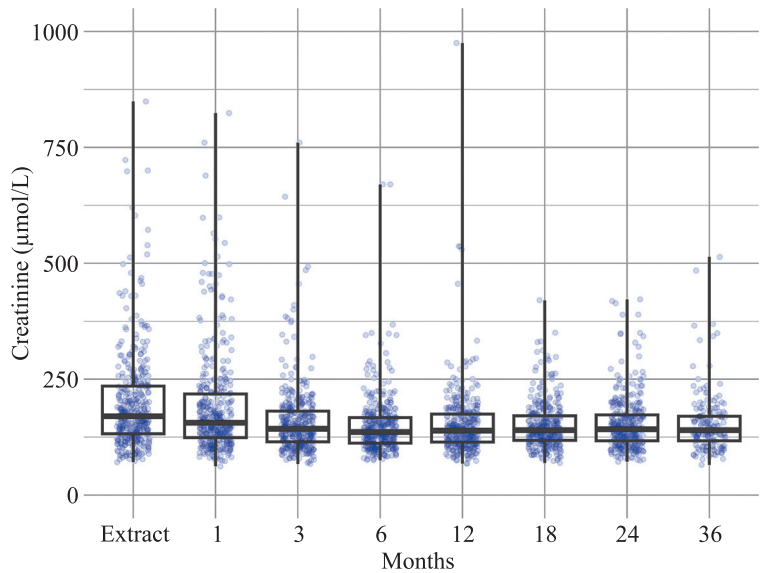

Fig. 7. Serum creatinine dynamics. Medians, first and third quartile limits, and individual values are presented

DISCUSSION

At present, there is a clear and steady trend toward an aging donor pool. According to Eurotransplant, between 2015 and 2024, the proportion of deceased donors aged ≥65 years increased from 22.4% to 26.4% [11]. In Spain, between 2014 and 2023, the proportion of donors aged 45–59 years remained nearly unchanged (28.7–29.2%), while the proportion aged 60–69 years rose from 23.8% to 27.2%, and those aged 70–79 years from 21.2% to 25.1% [12]. Querard et al. conducted a systematic review and meta-analysis of 32 studies comparing survival outcomes of kidney recipients from standard-criteria donors (SCDs) and expanded-criteria donors (ECDs). The pooled 5-year patient survival rates were 86.4% for SCDs and 78.4% for ECDs recipients [4]. A significant difference was also noted between European and North American data: in Europe, the 5-year survival rates for SCD and ECD recipients were 90.3% and 85.3%, respectively, whereas in North America they were considerably lower – 83.6% and 73.4% [13].

In a French prospective study published in the British Medical Journal in 2015, the 7-year graft survival rate was 80% for kidneys from ECDs and 88% for those from SCDs, demonstrating a moderately reduced graft viability but underscoring the continued clinical value of expanding donor criteria in the context of organ shortages [14].

The data presented support the necessity and feasibility of broadening kidney donation criteria, provided that donor–recipient pairing is carefully selected, risk is appropriately stratified, and perioperative management is optimized. Such an approach helps reduce patient mortality by reducing dialysis time, even while acknowledging potential limitations in long-term graft survival.

In the present study, anthropometric and gender-age characteristics of donors and recipients were generally comparable. The slight difference in mean age is down to the fact that the minimum age of a donor meeting the expanded criteria is 50 years.

A high incidence of diabetes mellitus and systemic atherosclerosis was observed among donors in this category. It is well established that donor diabetes is associated with poorer transplant outcomes [15, 16]. Moreover, kidneys obtained from ECDs may be more vulnerable to ischemic injury during preservation [17, 18]. These factors emphasize the need for further research aimed at identifying optimal allocation strategies for such organs and enhancing preservation technologies, particularly considering recent advances in machine perfusion systems.

In our study, the proportion of donors requiring inotropic support therapy to maintain hemodynamic stability at the time of organ retrieval decreased, indirectly reflecting the efficacy of donor optimization protocols. Nevertheless, increased azotemia and reduced GFR were noted in some donors, likely attributable to hemodynamic instability, high-dose inotropic therapy (including adrenaline administration), and the use of radiopaque contrast agents during brain death diagnosis. Despite these factors, current evidence indicates that acute kidney injury in donors prior to organ procurement is not associated with impaired medium-term graft outcomes [19–21].

An alarming yet common finding among KT recipients – including the general recipient population – is the increased incidence of recurrent renal pathology within 3–4 years after transplantation, particularly focal segmental glomerulosclerosis [22, 23]. This trend, also observed in Russia, is likely attributable to the lack of etiological verification of CKD prior to transplantation, as indirectly suggested by the high proportion (41.6%) of cases diagnosed as “chronic glomerulonephritis”.

The highest incidence of both recipient mortality and graft loss occurs during the first postoperative year. Nevertheless, long-term kidney graft survival in this cohort can be considered satisfactory, remaining comparable to that observed among recipients in the general population [24], and those receiving kidneys from SCDs [25]. Renal function improved significantly within six months after transplantation and remained relatively stable thereafter.

Comparable outcomes were reported in another study [26], which noted a high prevalence of hypertension and diabetes and elevated pre-donation creatinine levels, yet long-term recipient survival remained on par with that of transplants from SCDs. However, several other studies [27, 28], have demonstrated poorer graft outcomes in transplants from ECDs compared to standard donors. However, recipient survival remains higher than in patients maintained on dialysis while awaiting transplantation [29].

This publication presents descriptive statistics as well as recipient and graft survival rates. A detailed analysis of factors influencing recipient and transplant survival will be provided in a subsequent publication.

STUDY LIMITATIONS

The main limitation of this study is its retrospective design. However, inclusion of all transplants performed from donors meeting the inclusion criteria enhances the objectivity and representativeness of the findings. In several instances, particularly when characterizing comorbid conditions, it was not possible to retrospectively verify specific diagnoses, and the analysis therefore relied on data extracted from medical records. The assessment of the recipients’ comorbid background remains the most debatable aspect of the study. Nevertheless, the criteria for inclusion on the waiting list and for kidney transplantation in the analyzed cohort are largely standardized, suggesting that patients with decompensated extrarenal diseases were not included.

When describing biopsy results, the study did not apply the Banff classification, but rather focused on the rejection profile (cellular, antibody-mediated, or mixed) in order to obtain a larger number of patients in each category.

CONCLUSION

Approximately one-third of recipients who received kidneys from ECDs and from brain-dead donors developed delayed graft function. With increasing time after transplantation, the incidence of recurrent renal pathology also tended to rise. Nevertheless, the favorable 3- and 4-year graft survival rates observed in this study support the clinical effectiveness and feasibility of using ECDs as a viable strategy to increase the number of kidney transplants.

The authors declare no conflict of interest.

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The article was submitted to the journal on 22.08.2025