



# Quality Assessment of Donor Kidneys and the Tendency of Kidney Acceptance: A Single-Center Experience

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## ABSTRACT

**Purpose.** The increasing age of donors and the increasing tendency of comorbidities requires an extension in acceptance criteria. In this review, the tendency for acceptance and refusal was analyzed by examining reasons for declining donor kidneys at the kidney transplantation center in Debrecen. This analysis aimed to assess the quality of donor kidneys and indicate why two-thirds of donated organs were refused.

**Method.** Our center in Debrecen received 535 kidney offers (based on exclusion criteria) between November 2016 and August 2019, which were retrospectively analyzed. Donor kidneys were evaluated using expanded criteria donor, kidney donor profile index (KDPI), and kidney donor risk index criteria systems.

**Results.** Thirty-five percent ( $n = 189$ ) of the kidneys offered to the center in Debrecen had been approved in advance, and later 63% ( $n = 119$ ) were transplanted. Using the KDPI system, 41% of donors had a KDPI above 85, of which 23% were accepted, while acceptance of kidneys with a KDPI of 0 to 35 was around 70%.

When examining causes of donor kidney refusal, 90% of the organs had donor quality problems, 13% had logistical cause (long cold ischemic time, large age difference between donor and recipient), and 10.5% had immunologic cause. In 13% of cases, the refusal of donor organs was due to the coexistence of several problems.

**Conclusion.** Our data showed that high-risk donor organs were being refused in our center; however, they are being transplanted at a higher rate in other Eurotransplant centers. The decision to refuse or accept donor organs depends on several factors, including expected waiting time, patient's clinical characteristics, and quality of life.

**T**HE incidence of end-stage renal disease is increasing worldwide, and the limited supply of donor organs has led to an increase in the number of patients waiting for kidney transplantation [1,2]. The increasing age of donors and tendency of comorbidities requires an extension in acceptance criteria. Expanded criteria donors (ECDs) are used more frequently in kidney transplantations to close the gap between the expanding need and limited availability of donor organs. Donor kidneys are considered to be ECD if donor age  $\geq 60$  years, or donor age is 50 to 59 years, with at least 2 of the following criteria: serum creatinine  $> 1.5$  mg/dL, death due to cerebrovascular accident, or history of hypertension [3].

Kidney donor risk index (KDRI) and kidney donor profile index (KDPI) are tools used in kidney donor evaluation [4].

KDRI is used to assess the relative risk of posttransplant kidney graft failure from a particular deceased donor compared with a reference donor. The higher the KDRI, the less ideal the donor is. KDPI provides a numerical measure of donor quality. The higher the KDPI, the shorter the expected graft survival. The KDPI is determined by calculating the KDRI first. The lower the KDRI and KDPI values, the higher the donor quality and expected graft longevity [5]. KDRI may also be a good indicator in deciding whether a patient should receive a single or dual kidney transplant. A retrospective cohort study carried out in the United States confirms that in cases with a KDRI higher

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than 2.2, dual kidney transplantation can improve graft survival [6]. The following are the characteristics of the reference donor (KDRI = 1): 40 years old, height 170 cm, weight  $\geq 80$  kg, the cause of death is not a cerebrovascular accident, serum creatinine 1 mg/dL, non-African American race, hepatitis C negative, nondiabetic, non-hypertensive, and negative donation after circulatory death status. The reference population used were all deceased donors in the United States with a kidney donated for transplantation in the prior calendar year [5].

## DATA COLLECTION AND METHODS

This retrospective analysis studied 535 kidney offers for the Department of Transplantation at the University of Debrecen in Hungary. Data of all kidney offers from adult deceased brain death donors were collected between November 1, 2016 and August 31, 2019. Kidney offers from a donor to more than 1 recipient were entered into the database once, except when both kidneys were accepted. Donation after circulatory death is not permitted in Hungary; therefore, no such offers were included in this study.

Donor kidneys were evaluated using ECD, KDPI, and KDRI criteria systems.

Anonymous donor data were collected from the Eurotransplant Network Information System, while electronic records of recipient clinical data were collected from the hospital's information system. Statistical analysis was performed using SPSS 20.0 software (IBM, New York, New York, USA).

Our analysis aimed to assess the quality of donor kidneys and indicate why two-thirds of donated organs were refused.

## RESULTS

In the observed period, 535 kidneys were offered to our center. The average age of donors was 57 years (standard deviation 13.18). Causes of brain death of donors were stroke (72%), trauma (17%), and other (11%). Sixty-four percent of donors had hypertension, and 20% had diabetes. The majority of the offers came from Hungary, but we had several offers from other Eurotransplant countries like Croatia and Germany. Sixty-one percent of offered kidneys were ECD, and 36% were standard criteria donor (SCD) (in 15 cases [3%] data for ECD criteria were incomplete). Forty-one percent of donors had a KDPI above 85, 47% had a KDPI between 35 and 85, and 12% had a KDPI lower than 35. Donors with a KDPI above 85 were all ECDs, whereas there were no ECDs in donors with a KDPI under 35. Half of the donors with a KDPI between 35 and 85 were ECD.

Thirty-five percent ( $n = 189$ ) of the kidneys offered to our center had been approved in advance, and later 63% ( $n = 119$ ) were transplanted. Causes of brain death of accepted donors

**Table 1. Donor Quality Parameters**

	Accepted Donors ( $n = 189$ )	Declined Donors ( $n = 346$ )	<i>P</i>
Age (y)	51 (SD 12.6)	60 (SD 12.4)	.001
Serum creatinine mg/dL	0.87 (SD 0.33)	1.24 (SD 0.88)	.001
BMI ( $\text{kg}/\text{m}^2$ )	26.56 (SD 4.56)	27.75 (SD 4.84)	.005
Sex (male/female)	100/89 (53%/47%)	199/147 (57%/43%)	.305
KDPI	62 (SD 27.7)	78 (SD 21.6)	.001
KDRI	1.22 (SD 0.38)	1.56 (SD 0.52)	.001

BMI, body mass index; KDPI, kidney donor profile index; KDRI, kidney donor risk index; SD, standard deviation.

were stroke (61%), trauma (23%), and other (16%), while causes of brain death of declined donors were stroke (77%), trauma (14%), and other (9%). The average age, serum creatinine, and body mass index of refused donors were significantly higher than those of accepted donors; on the other hand, there was not a significant difference in sex (Table 1). Twenty-five percent of offers from ECDs were accepted, while acceptance of offers from SCDs was 50% ( $P < .05$ ). In other words, kidneys from ECD donors were being refused more often than SCD donor kidneys. Using the KDPI system, 41% of donors had a KDPI above 85, of which 23% were accepted, while acceptance of kidneys with a KDPI of 0 to 35 was around 70%. Acceptance of kidneys with a KDPI between 35 and 85 was 37%. Kidneys with a higher KDPI were declined significantly more often. Refused kidney KDPI and KDRI values were much higher than accepted kidney KDPI and KDRI values ( $P < .05$ ) (Table 1).

In our center, kidneys with a KDPI between 35 and 85 and  $> 85$  were declined regularly, while these kidneys were accepted in other Eurotransplant centers. Of donor kidneys offered to our center, the majority that were transplanted in other Eurotransplant centers had a KDPI between 36 and 85 (Table 2). Kidneys that were transplanted in our center had a significantly lower KDPI and KDRI than kidneys that were transplanted in other Eurotransplant centers (Table 3).

When examining the causes of donor kidney refusal, 90% of the organs had donor quality problems, 13% had logistical cause, including long cold ischemic time (CIT) and a large age difference between donor and recipient, and 10.5% had an immunologic cause. In 13% of cases, the refusal of donor organs was due to the coexistence of several problems. The most common causes for kidney refusal, in terms of donor quality, were proteinuria, anatomy problems (like severe atherosclerosis), urinary infection or elevated serum C-reactive protein level, and elevated serum creatinine level. In 48% of these

**Table 2. KDPI of Kidneys Offered to our Center and Actual Place of Transplantation**

	KDPI < 25	KDPI 25-35	KDPI 35-85	KDPI > 85
Discarded kidneys ( $n = 149$ )	0 (0%)	6 (4%)	41 (27.5%)	102 (68.4%)
Kidneys transplanted in other ET centers ( $n = 267$ )	6 (2.2%)	19 (7.1%)	152 (56.9%)	90 (33.7%)
Kidneys transplanted in our center ( $n = 119$ )	10 (8.4%)	25 (21%)	58 (48.7%)	26 (21.8%)

ET, Eurotransplant; KDPI, kidney donor profile index.

**Table 3. KDRI, KDPI Values (Mean), and Actual Place of Transplantation**

		n	Mean	SD	P
KDRI	Transplanted kidneys in our center	267	71.4	23.4	< .001
	Transplanted kidneys in other ET centers	119	58	27.7	
KDPI	Transplanted kidneys in our center	267	1.38	0.44	< .001
	Transplanted kidneys in other ET centers	119	1.15	0.34	

ET, Eurotransplant; KDPI, kidney donor profile index; KDRI, kidney donor risk index; SD, standard deviation.

**Table 4. Graft Functions of Transplanted Kidneys (After Kidney Transplantation in Our Center) Based on KDPI**

	KDPI < 25	KDPI 25-35	KDPI 35-85	KDPI > 85
Mean eGFR at 3 mo (n = 114)	66	67	52	44
Mean eGFR at 6 mo (n = 108)	70	70	54	41
Mean eGFR at 1 y (n = 88)	68	67	55	47

eGFR, estimated glomerular filtration rate; KDPI, kidney donor profile index.

cases, the refusal of donor organs was due to the coexistence of several problems.

Sixty-three percent (n = 119) of accepted kidneys were transplanted. In 22 cases, transplantation failed because of the recipient being unsuitable, and in 21 cases there was an anatomy problem. Additional causes of transplantation failure were positive crossmatch (n = 12), withdrawn backup offer (n = 6), and new, worse laboratory results of the donor (n = 9).

The mean estimated glomerular filtration rate levels at 3 months, 6 months, and 1 year after transplantation were significantly lower in recipients with ECD kidneys ( $P < .05$ ). The same could be observed when looking at a higher KDPI. Mean estimated glomerular filtration rate levels were, again, significantly lower in recipients with a higher KDPI (Table 4).

## DISCUSSION

Even though a high percentage of kidneys offered to our center fell into the extended criteria donor category and had a higher KDPI, these high-risk kidneys were mainly declined.

ECD kidneys and kidneys with a high KDPI were not the best choices for all recipients, due to their shorter estimated functioning. A practitioner's experience is a key factor in accepting or declining organs of a deceased donor. A delicate balance needs to be reached between estimating the immediate benefit of transplantation and the potential for future higher-quality offers [7]. The decision to wait for future offers or immediately transplant depends on several factors, including the expected waiting time at the transplant center, the patient's clinical characteristics, the possibility of live donation, the quality of life, and support from the Eurotransplant Senior Program (ESP).

ESP is known for its acceptable outcomes, as it uses ECD kidneys from donors over the age of 65 for recipients over 65 years [8]. Kidneys should be transplanted within the Eurotransplant region with the shortest possible CIT to reduce ischemic damage [9]. ECD kidney transplantation and prolonged CIT carry increased risk of delayed graft function (DGF) that is associated with inferior graft survival, so ESP tries to minimize CIT to avoid DGF and rejection [10].

Decisions about kidney transplantation of older recipients are often very complex. Multimorbidity of older recipients makes it challenging to decide who would benefit from kidney transplantation. Donor quality has significant interactions with recipient characteristics as well. KDRI might prove helpful in ESP kidney transplantation to forecast clinical outcomes. Also, this system aims to achieve a good primary organ function by shortening CIT. The short-term results of ESP have been encouraging [11].

Our data shows that high-risk donor kidneys were being refused in our center; however, they were being transplanted at a higher rate in other Eurotransplant centers. Husain et al [12] also showed that while organ or donor quality was the primary reason for refusing offers, these missed opportunities for a transplant still occur, despite evidence of receiving even a marginal-quality kidney that provides survival and quality of living advantages over being on the waiting list. To change clinician and patient behavior, making the consequences of declining offers more evident to all parties is necessary. However, only a small number of declined offers were attributed to patient status [12].

There is no option to do biopsy outside working hours in the majority of transplant centers, including ours. Having this would greatly improve evaluating the chances of transplanting kidneys of high risk.

A retrospective analysis carried out in Italy showed that even though recipients who received an ECD graft were older and presented a higher rate of DGF, the posttransplant graft loss did not differ between ECD and SCD groups. Therefore, ECDs seemed to be important in handling the chronic organ shortage, without impairing post-deceased donor kidney transplant results [13]. It is also important to consider that, due to the increase in life expectancy, the number of patients older than 60 years waiting for kidney transplantation is continuously growing. Another study showed that these patients experienced a significant reduction in mortality if they received ECD kidneys rather than staying on dialysis [14]. Ojo et al [15] also showed that on average, ECD transplanted patients lived 5 years longer than recipients of the same characteristics, but who remained on the waiting list and continued dialysis. In conclusion, it is more

convenient to accept an organ from a marginal donor than continuing dialysis therapy [13,15].

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