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Current status of kidney transplantation in Japan in 2015: the data of the Kidney Transplant Registry Committee, Japanese Society for Clinical Renal Transplantation and the Japan Society for Transplantation

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Abstract

The first deceased and living donor kidney transplants were performed in 1956 and 1964 in Japan, respectively. Larger numbers of transplants were performed after the introduction of cyclosporine in 1983. After that, the number has gradually and steadily increased and 1661 transplants were performed in 2015. In addition, the outcomes have improved year by year. The indications for transplantation have also expanded in various aspects, such as recipient and donor age, primary diseases, ABO incompatible and highly sensitized cases, and preemptive transplant.

We here report the current status of kidney transplantation in Japan. The number of transplants, detail transplant characteristics in the past decade, and outcomes are described.

Keywords: Kidney transplantation, Japan

Introduction

The first deceased and living donor kidney transplants were performed in 1956 and 1964 in Japan, respectively. The number of transplants gradually increased year by year. Larger numbers of transplants were performed after the introduction of cyclosporine in 1983. The first ABO incompatible transplant, which is now widely performed in Japan, was done in 1989. Afterward, as tacrolimus and mycophenolate mofetil became available, the number of transplants moreover increased and reached more than 1000 in 2006. The number has steadily increased in the 2000s.

We report the current status of kidney transplantation in Japan. The number of transplants performed in Japan from 2001, detail transplant characteristics from 2007, and outcomes are described. This report is based on the data of annual progress report from the Japanese Renal Transplant Registry from 2007 to 2015 published in Japanese Journal "Ishoku" [1–14]. All individual data were collected from the kidney transplant centers in Japan.

Total kidney transplants and transplant centers

In 2001, a total of 705 transplants, including 554 from living donors and 151 from deceased donors, were performed. The number gradually increased and reached 1000 in 2006 and 1500 in 2011. Afterward, approximately 1600 transplants were done every year, and 1661 transplants were performed in 2015, which was the largest number so far. While the number of living donor transplants has increased, that of deceased donor transplants has not changed since 2001 (Fig. 1). Living donor transplants accounted for 83 to 90% of all transplants in the past decade, and the rate of living donor transplants has been increasing.

A total of 120 to 140 centers have performed kidney transplants since 2001. About 40% of the centers performed only 1 to 4 cases a year in 2015. About 20 centers have routinely performed more than 20 cases a year (Fig. 2).

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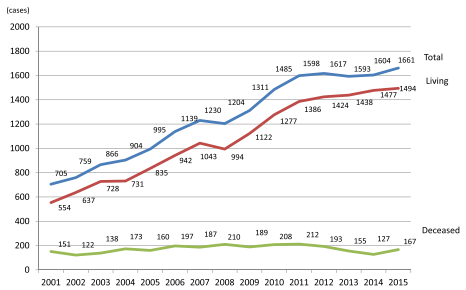

Fig. 1 Total kidney transplants

Transplant characteristics

A) Reoccurrence of transplantation (Fig. 3)

Approximately 95% of living donor transplants and 90% of deceased donor transplants were the first time transplants. The rates of the 2nd and more than 3rd transplants were about 3 to 4% in living donor and 6 to 10% in deceased donor cases, respectively. However, the rate of re-transplants decreased to 2.6% in deceased donor cases in 2015.

B) Age (Figs. 4 and 5)

Mean age of living donor transplants increased year by year, such as 42.8 years in 2007 and 47.0 years in 2 015. On the other hand, mean age of deceased donor transplants was unchanged, such as 47.0 years in 2001 and 48.0 in 2015 (Fig. 4).

The number of transplants by age (10-year intervals) is shown in Fig. 5. In living donor transplants, the number aged 40 to 49 and 60 to 69 years has rapidly increased since 2007. In addition, the number aged 70 to 79 years increased in these recent 3 years. In deceased donor transplants, the number aged 50 to 59, 40 to 49, and 60 to 69 years was large and these transplants occupied about 80% of all.

C) Sex (Fig. 6)

In both living donor and deceased donor transplants, 60 to 65% of transplants were male over the past decade. The rate of males has gradually decreased in deceased donor transplants since 2012.

D) Primary disease (Fig. 7)

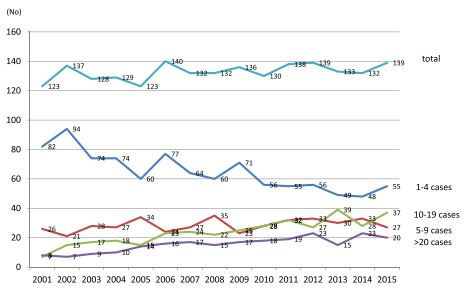

Fig. 2 Kidney transplant centers

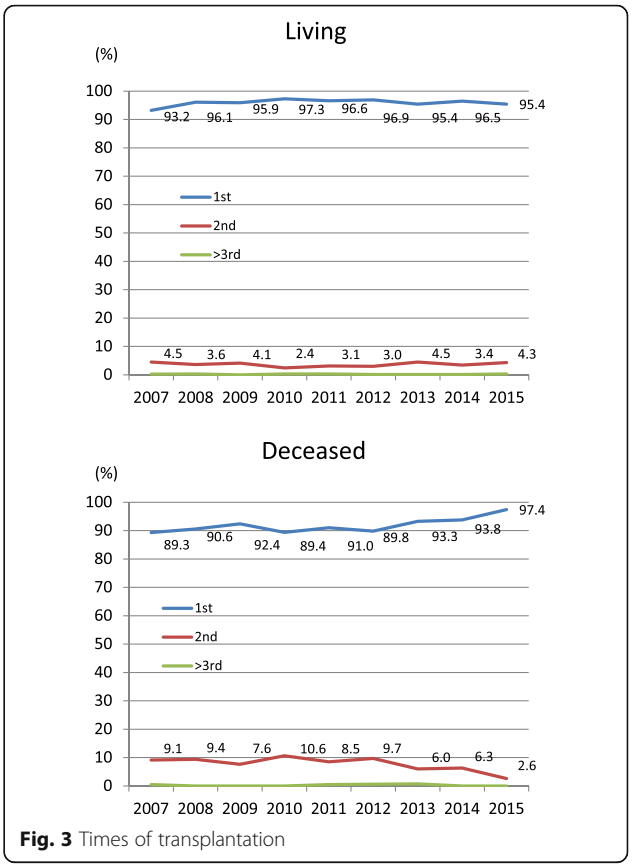

Fig. 3 Times of transplantation

In 2007, glomerulonephritis was a primary diagnosis for about 60% of transplants, diabetes for 17%, and polycystic kidney diseases for 9%. The number of diabetes as a primary disease has increased afterward, and 24% of transplants were diabetes in 2015. The rate of glomerulonephritis was about 46% in 2015.

E) Dialysis therapy before transplantation (Figs. 8, 9, 10, 11, and 12)

Figure 8 demonstrates the rates of preemptive transplants and transplants after dialysis therapy. The proportion of preemptive and temporary

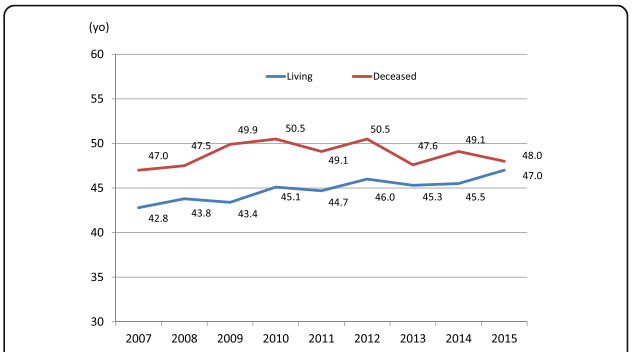

Fig. 4 Mean age of kidney transplants

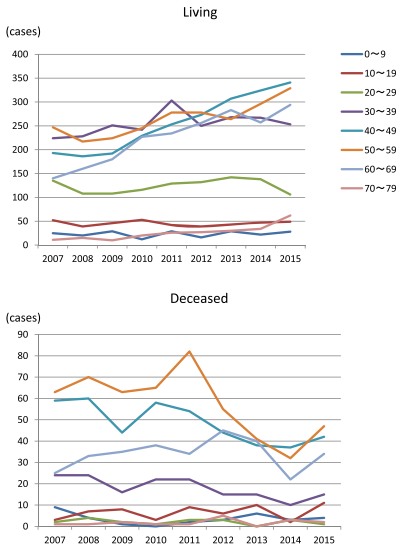

Fig. 5 Kidney transplants from living and deceased donors, by age (# cases)

dialysis transplants has increased year by year and was approximately 34% in 2015. Mean dialysis periods prior to transplantation in living and deceased donor transplants with chronic dialysis therapy are shown in Fig. 9. The periods were 3 to 4 years in living donor transplants and 14 to 17 years in deceased donor transplants in the past decade. There was a big difference between living and deceased donor transplants during the dialysis

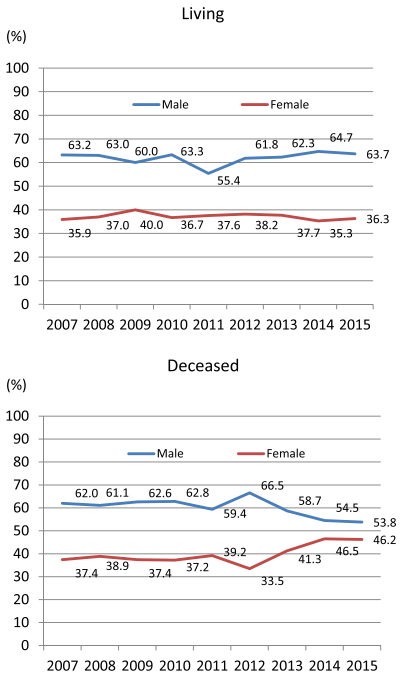

Fig. 6 Kidney transplants, by sex (%)

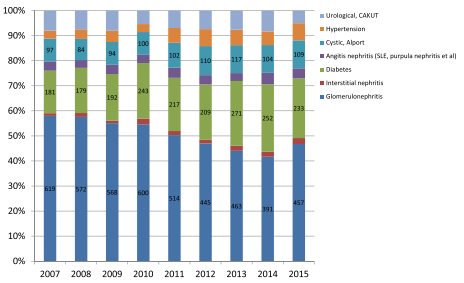

Fig. 7 Kidney transplants, by primary diseases (%)

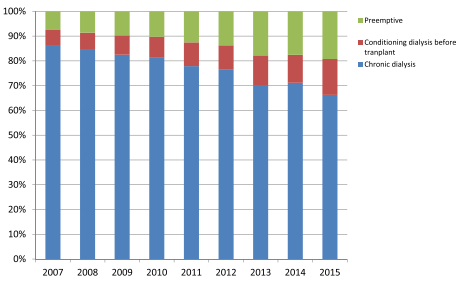

Fig. 8 Dialysis therapy prior to transplantation

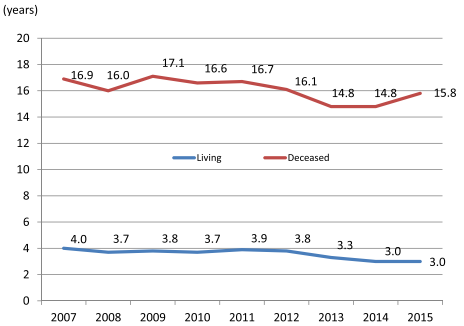

Fig. 9 Mean dialysis periods prior to transplantation

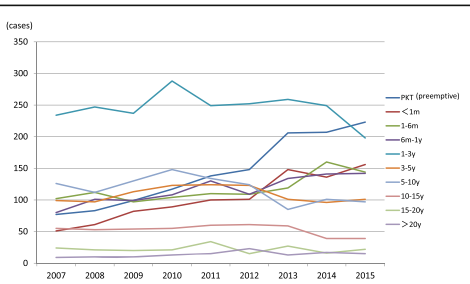

Fig. 10 Living donor transplants, by dialysis periods (# cases)

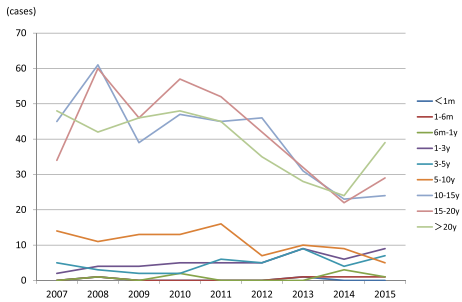

Fig. 11 Deceased donor transplants, by dialysis periods (# cases)

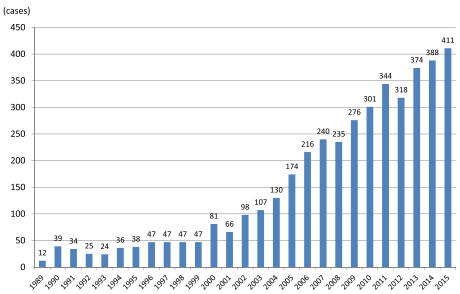

Fig. 13 ABO incompatible kidney transplants (# cases)

period. As the length of the waiting time is a major factor for candidate selection for deceased donor transplant in Japan, the patient with a longer period of dialysis therapy is frequently selected as the candidate.

Figures 10 and 11 show the number of transplants by dialysis period in living and deceased donor transplants, respectively. In living donor transplants, the number of preemptive transplants has rapidly increased and is the biggest, followed by those of 1 to 3 years, within 1 month (temporary dialysis), 1 to 6 months, and 6 months to 1 year dialysis therapy in 2015. On the other hand, the number of transplants with more than 20 years dialysis therapy is the biggest, followed by 15 to 20 years and 10 to 15 years dialysis therapy in deceased donor transplants. Regarding the modality of dialysis therapy, about 85% was hemodialysis and 10% was peritoneal dialysis in the past decade (Fig. 12).

F) ABO blood type compatibility (Figs. 13 and 14)
The first ABO incompatible living transplant was performed in 1989 in Japan. The number has increased, especially since 2002 and continues to increase year by year. In 2015, 411 ABO incompatible living transplants were performed, which was 32.7% of living donor transplants. No ABO incompatible deceased donor transplant has been performed in the past decade.

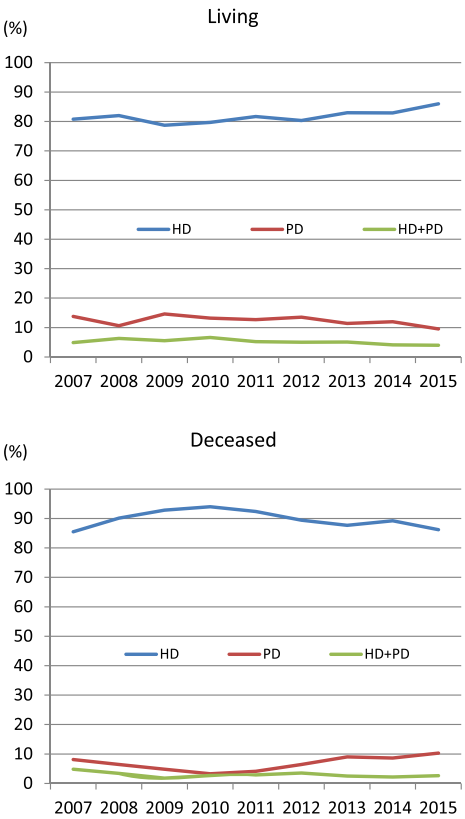

Fig. 12 Modality of dialysis therapy prior to transplantation

Kidney donor

In the past decade, 83 to 90% of kidney donors were living and the rate of living donor has been increasing. Mean age of living donors gradually increased and that of deceased donors decreased in these 3 years (Fig. 15). The number of living donors aged 60 to 69 and 70 to 79 years has increased in the past decade. Most deceased donors were 40 to 69 years old (Fig. 16). The rate of male was about 40% in living donors, while 60% in deceased donors (Fig. 17).

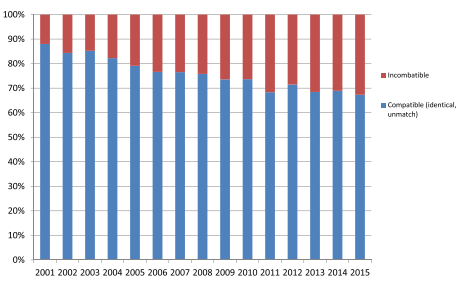

Fig. 14 Living donor transplants, by ABO compatibility (%)

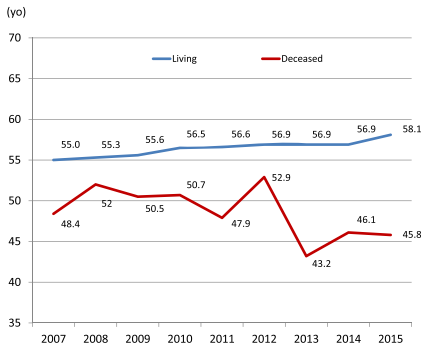

Fig. 15 Mean age of kidney donors

Outcomes

The patient and graft survivals analyzed at the time of May 2016 are shown in Figs. 18 and 19 and Table 1. The rates were analyzed using Kaplan-Meier method, stratified by the year of transplantation, such as 1956 to 1982, 1983 to 2000, 2001 to 2009, and 2010 to 2014.

A) Patient survival
The patient survival rates in both living and deceased donor transplants have improved since 1983 when cyclosporine became available. The rate has increased in order of the time of transplantation. For living and deceased donor transplants performed in 2010 to 2014, the rates were 99.1 and 97.8% in 1 year and 97.2 and 93.4% in 5 years, respectively (Fig. 18, Table 1).

B) Graft survival
The graft survival rates have also improved remarkably in both living and deceased donor transplants in order of the time of transplantation.

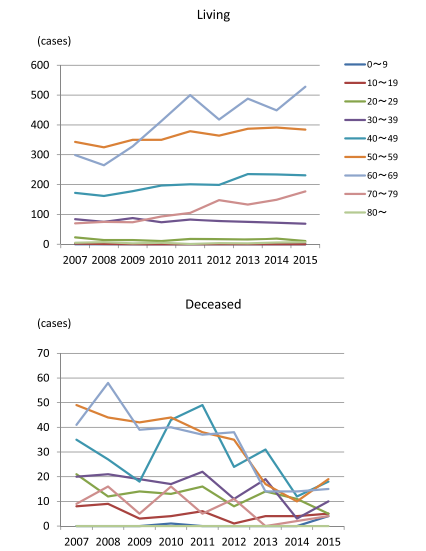

Fig. 16 Living and deceased kidney donors, by age (# cases)

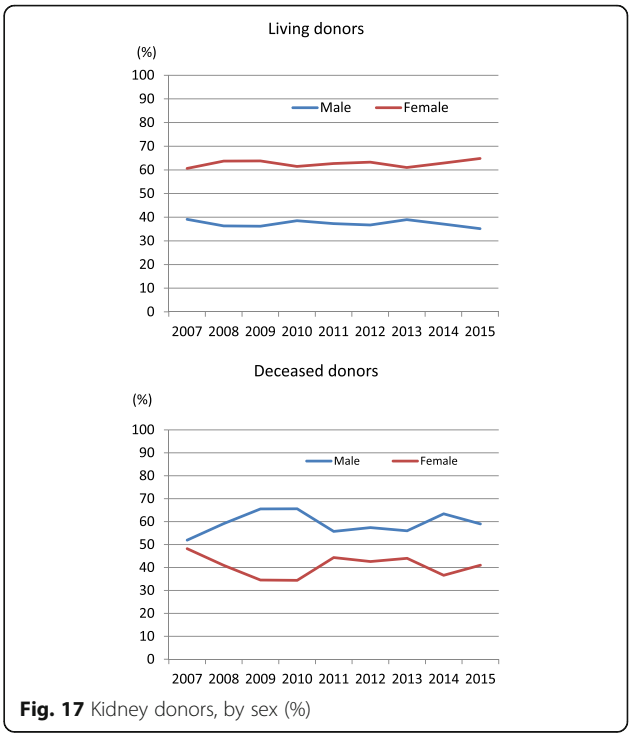

Fig. 17 Kidney donors, by sex (%)

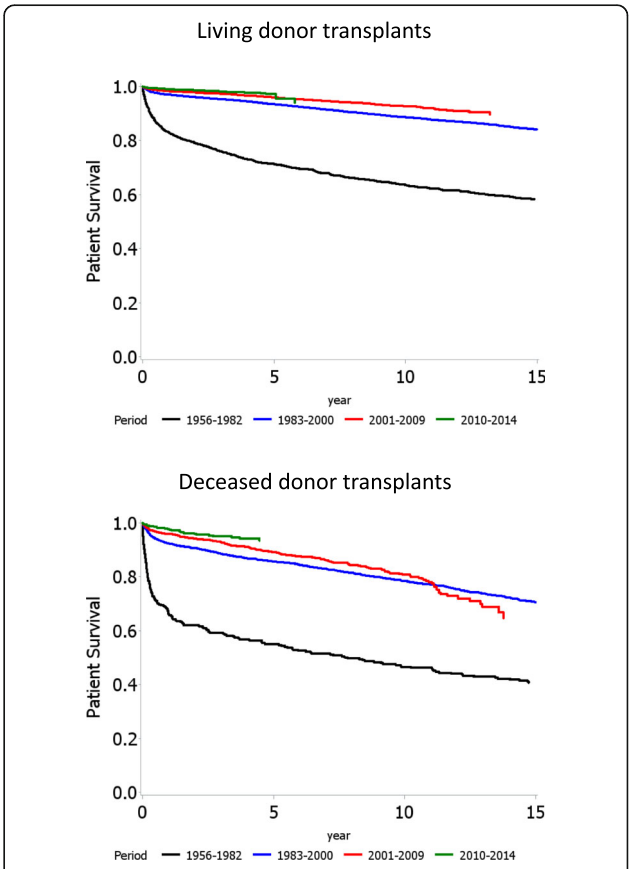

Fig. 18 Patient survival

Table 1 Patient and graft survivals

	# analyzed	1 year	5 years	10 years	15 years
Patient survival					
Living					
1956~1982	1478	83.1 [1.0]	71.2 [1.2]	63.6 [1.3]	58.3 [1.3]
1983~2000	7365	97.0 [0.2]	93.4 [0.3]	88.6 [0.4]	84.1 [0.5]
2001~2009	6820	98.3 [0.2]	96.0 [0.2]	92.7 [0.4]	–
2010~2014	5156	99.1 [0.1]	97.2 [0.4]	–	–
Deceased					
1956~1982	322	66.4 [2.7]	55.0 [2.9]	46.6 [2.9]	40.7 [2.9]
1983~2000	2796	92.4 [0.5]	85.6 [0.7]	78.5 [0.8]	70.6 [0.9]
2001~2009	1323	95.9 [0.5]	89.2 [0.9]	80.8 [1.4]	–
2010~2014	673	97.8 [0.6]	93.4 [1.4]	–	–
Graft survival					
Living					
1956~1982	1230	73.6 [1.3]	53.9 [1.4]	40.2 [1.4]	32.3 [1.3]
1983~2000	5486	92.8 [0.3]	81.8 [0.5]	69.1 [0.6]	60.2 [0.7]
2001~2009	6141	97.5 [0.2]	93.6 [0.3]	87.0 [0.6]	–
2010~2014	4780	98.7 [0.2]	94.6 [0.6]	–	–
Deceased					
1956~1982	283	45.4 [3.0]	27.0 [2.6]	16.2 [2.2]	10.8 [1.9]
1983~2000	2253	81.4 [0.8]	64.4 [1.0]	51.4 [1.1]	41.8 [1.1]
2001~2009	1151	92.4 [0.8]	83.4 [1.1]	71.1 [1.8]	–
2010~2014	617	96.4 [0.7]	87.5 [2.0]	–	–

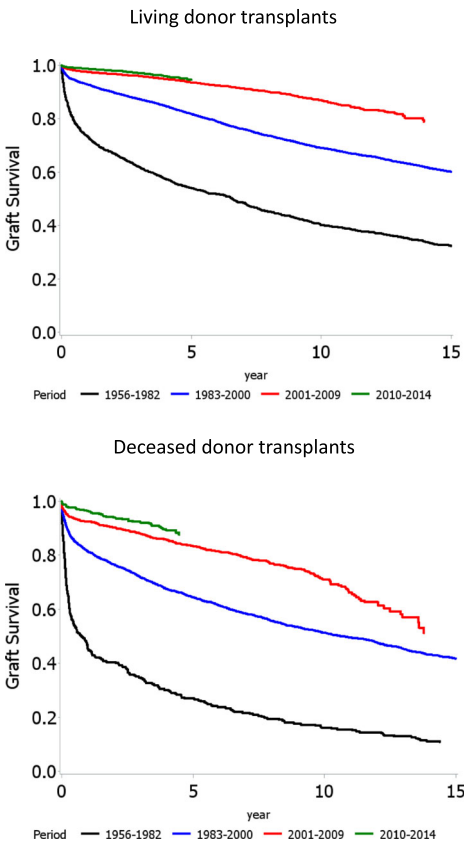

Fig. 19 Graft survival

The rates for living donor transplants performed in 2001 to 2009 were 97.5% in 1 year, 93.6% in 5 years, and 87.0% in 10 years. Those for deceased donor transplants were 92.4% in 1 year, 83.4% in 5 years, and 71.1% in 10 years. The rates improved furthermore in transplants performed in 2010 to 2014. The rate for living ones was higher than that for deceased ones in all stratifications (Fig. 19, Table 1).

Summary and conclusion

The number of kidney transplants has increased gradually and steadily in Japan. In addition, the outcomes have improved year by year. The indications for kidney transplantation have also expanded in various aspects, such as recipient and donor age, primary diseases, ABO incompatible and highly sensitized cases, and preemptive transplant. Therefore, kidney transplantation is now an ideal treatment modality in patients with end-stage kidney disease who have living kidney donors in Japan. However, though the number of candidates on the kidney transplant waiting list is nearly 13,000, that of deceased donors is very small and only 167 deceased donors kidney transplants are performed in 2015. Effort to increase deceased donor kidney donations primarily continues to be needed for development of kidney transplantation in Japan.

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Please contact the author for data requests.

Authors' contributions
Authors who are the members of the kidney transplant registry committee carried out the analyses of the data and approved the manuscript.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
All registered data were approved by each transplant center.

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