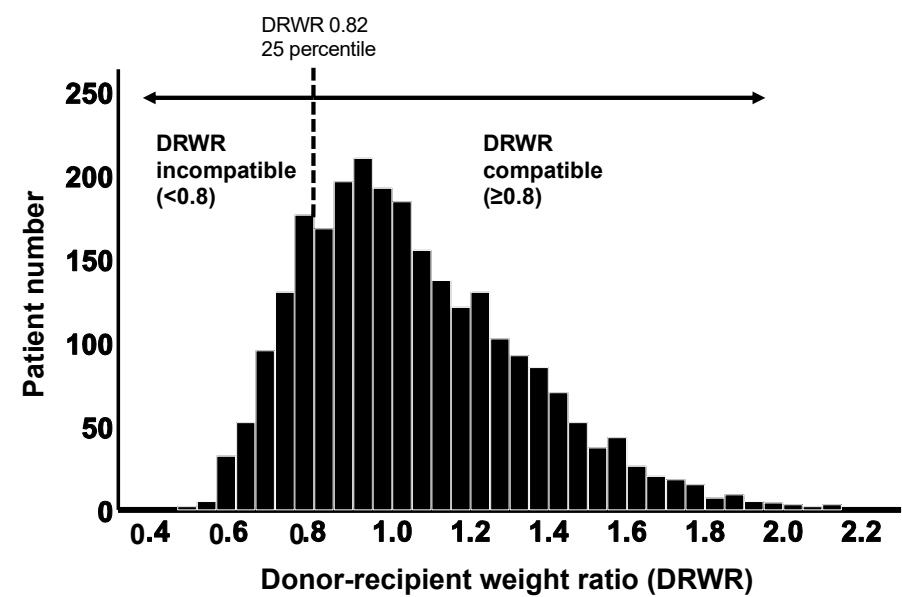**Figure S1. Distribution of donor-recipient weight ratio**

DRWR, dono-recipient weight ratio

Table S1. Details of ABOi LDKT (for available data only)

Variables	Available data	ABOi LDKT (n= 643)
Recipient blood type O	n=643	267 (41.5)
ABO titer, baseline		
IgM	n=249	32 (IQR 8-64)
IgG	n=175	32 (IQR 8-128)
High titer (≥ 256)		
ABO titer, at transplantation		
IgM	n=160	2 (IQR 1-4)
IgG	n=120	8 (IQR 2-16)
Rituximab use	n=306	290 (94.8)
Number of plasmapheresis	n=306	3.4±2.6
Intravenous immunoglobulin use	n=306	98 (32.0)

LDKT, living donor kidney transplantation

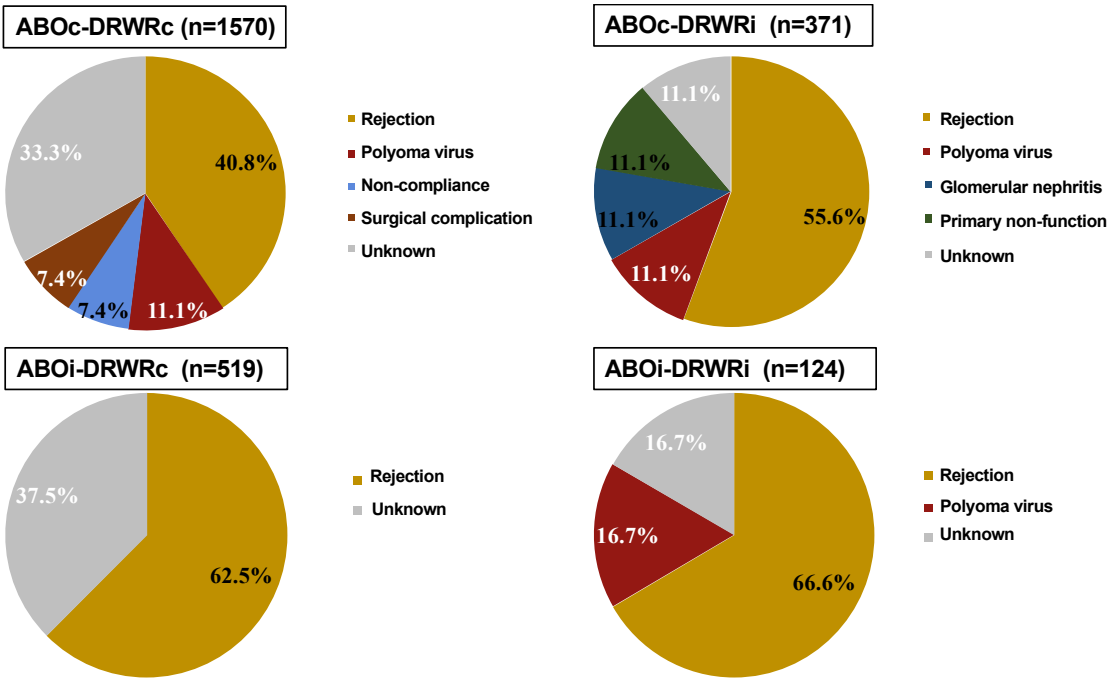**Table S2. Full results of one-way ANOVA with post hoc analyses for comparison eGFR at each time point**

eGFR at discharge		*P* value
ABOc-DRWRc (n=1570)	ABOc-DRWRi	<0.001
75.4±21.9	ABOi-DRWRc	0.999
	ABOi-DRWRi	<0.001
ABOc-DRWRi (n=371)	ABOc-DRWRc	<0.001
59.1±15.6	ABOi-DRWRc	<0.001
	ABOi-DRWRi	0.999
ABOi-DRWRc (n=519)	ABOc-DRWRc	0.999
75.2±23.2	ABOc-DRWRi	<0.001
	ABOi-DRWRi	<0.001
ABOi-DRWRi (n=124)	ABOc-DRWRc	<0.001
57.8±16.5	ABOc-DRWRi	0.999
	ABOi-DRWRc	<0.001
eGFR at 6 months		
ABOc-DRWRc (n=1542)	ABOc-DRWRi	<0.001
64.3±17.5	ABOi-DRWRc	0.168
	ABOi-DRWRi	<0.001
ABOc-DRWRi (n=360)	ABOc-DRWRc	<0.001
57.1±14.7	ABOi-DRWRc	<0.001
	ABOi-DRWRi	0.547
ABOi-DRWRc (n=513)	ABOc-DRWRc	0.168
62.4±17.0	ABOc-DRWRi	<0.001
	ABOi-DRWRi	<0.001
ABOi-DRWRi (n=119)	ABOc-DRWRc	<0.001
54.1±16.9	ABOc-DRWRi	0.547
	ABOi-DRWRc	<0.001
eGFR at 1 year		
ABOc-DRWRc (n=1435)	ABOc-DRWRi	<0.001
65.4±18.2	ABOi-DRWRc	0.135
	ABOi-DRWRi	<0.001
ABOc-DRWRi (n=333)	ABOc-DRWRc	<0.001
58.0±16.2	ABOi-DRWRc	<0.001
	ABOi-DRWRi	<0.546
ABOi-DRWRc (n=471)	ABOc-DRWRc	0.135
63.2±18.7	ABOc-DRWRi	<0.001
	ABOi-DRWRi	<0.001
ABOi-DRWRi (n=111)	ABOc-DRWRc	<0.001
54.6±18.3	ABOc-DRWRi	0.546
	ABOi-DRWRc	<0.001
eGFR at 2 year		
ABOc-DRWRc (n=1017)	ABOc-DRWRi	<0.001
65.0±19.6	ABOi-DRWRc	0.444

	ABOi-DRWRi	<0.001
ABOc-DRWRi (n=237) 57.8±18.4	ABOc-DRWRc	<0.001
	ABOi-DRWRc	0.017
	ABOi-DRWRi	0.999
ABOi-DRWRc (n=325) 62.8±19.6	ABOc-DRWRc	0.444
	ABOc-DRWRi	0.017
	ABOi-DRWRi	0.003
ABOi-DRWRi (n=81) 54.4±20.8	ABOc-DRWRc	<0.001
	ABOc-DRWRi	0.999
	ABOi-DRWRc	0.003

DRWR, donor-recipient weight ratio

Post hoc analyses were performed with Bonferroni method.
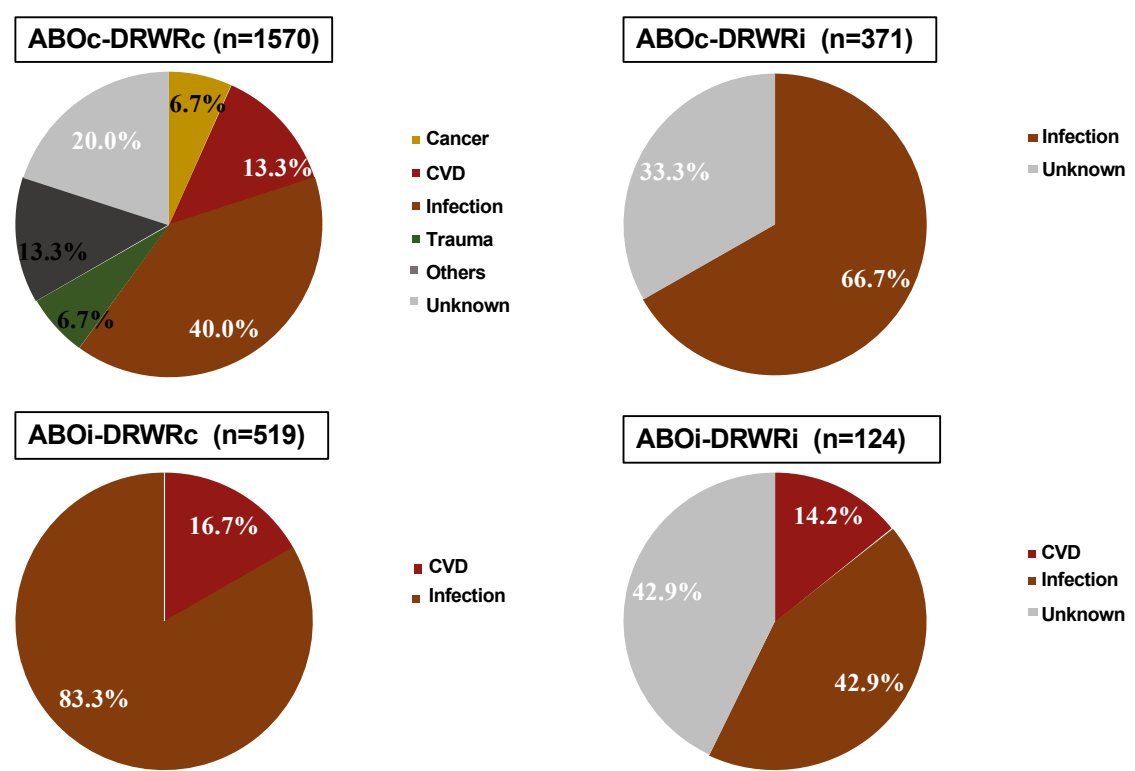
Figure S2. Causes of graft failure in each group

ABOc-DRWRc (n=1570)

- Rejection — 40.8%
- Polyoma virus — 11.1%
- Non-compliance — 7.4%
- Surgical complication — 7.4%
- Unknown — 33.3%

ABOc-DRWRi (n=371)

- Rejection — 55.6%
- Polyoma virus — 11.1%
- Glomerular nephritis — 11.1%
- Primary non-function — 11.1%
- Unknown — 11.1%

ABOi-DRWRc (n=519)

- Rejection — 62.5%
- Unknown — 37.5%

ABOi-DRWRi (n=124)

- Rejection — 66.6%
- Polyoma virus — 16.7%
- Unknown — 16.7%

Table S3. Cox regression analysis for death-censored graft survival

Variables	Cox regression with competing risk analysis			
	Univariate		Multivariate	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Age, per 1 year	0.98 (0.96-1.01)	0.079	0.97 (0.95-0.99)	0.026
Sex, male	1.37 (0.76-2.49)	0.294		
BMI per 1 kg/m^2	1.06 (0.98-1.13)	0.141		
Dialysis duration, month	1.00 (0.99-1.01)	0.361		
Retransplantation	0.32 (0.04-2.33)	0.261		
Diabetes mellitus	1.54 (0.87-2.70)	0.137		
Hypertension	0.58 (0.27-1.24)	0.162		
Cardiovascular disease	0.66 (0.21-2.12)	0.484		
Donor age	1.02 (1.00-1.05)	0.072	1.02 (0.99-1.05)	0.109
Donor sex, male	0.61 (0.34-1.11)	0.103		
Donor BMI	0.99 (0.90-1.08)	0.787		
Unrelated donor	1.33 (0.76-2.31)	0.318		
Number of HLA mismatches (for A/B/DR)	1.25 (1.02-1.52)	0.028	1.29 (1.04-1.60)	0.021
XM-DSA+	1.07 (0.33-3.45)	0.906		
Induction agent				
IL-2 receptor antibody	Reference			
Anti-thymocyte globulin	1.15 (0.49-2.70)	0.750		
Group				
ABOc DRWRc	Reference		Reference	
ABOc DRWRi	1.46 (0.69-3.10)	0.327	1.32 (0.62-2.83)	0.469
ABOi DRWRc	0.90 (0.41-1.98)	0.791	0.82 (0.37-1.81)	0.624
ABOi DRWRi	2.94 (1.21-7.12)	0.017	2.73 (1.11-6.70)	0.028
ABOi vs. ABOc	1.18 (0.64-2.19)	0.601	1.10 (0.59-2.04)	0.770
DRWRi vs. DRWRc	1.87 (1.02-3.43)	0.042	1.75 (0.95-3.23)	0.074

BMI, body mass index; DRWR, donor-recipient weight ratio; DSA, donor specific antibody;

HLA, human leukocyte antigen; IL, interleukin; XM, crossmatch

Figure S3. Causes of death in each group

ABOc-DRWRc (n=1570)

6.7%
13.3%
20.0%
13.3%
6.7%
40.0%

- Cancer
- CVD
- Infection
- Trauma
- Others
- Unknown

ABOc-DRWRi (n=371)

33.3%
66.7%

- Infection
- Unknown

ABOi-DRWRc (n=519)

16.7%
83.3%

- CVD
- Infection

ABOi-DRWRi (n=124)

14.2%
42.9%
42.9%

- CVD
- Infection
- Unknown

CVD, cardiovascular disease

Table S4. Cox regression analysis for patient survival

| Variables | Cox regression with competing risk analysis | | | |
| | Univariate | | Multivariate | |
	HR (95% CI)	p-value	HR (95% CI)	p-value
Age	1.05 (1.01-1.08)	0.008		
Sex, male	2.19 (0.95-5.09)	0.067		
BMI	1.07 (0.98-1.17)	0.159		
Dialysis duration	1.01 (1.00-1.01)	0.093		
Retransplantation	1.09 (0.26-4.57)	0.907		
Diabetes mellitus	1.88 (0.93-3.81)	0.081		
Hypertension	3.36 (0.46-24.61)	0.234		
Cardiovascular disease	3.55 (1.59-7.95)	0.002	3.06 (1.35-6.91)	0.007
Donor age	1.01 (0.98-1.05)	0.418		
Donor sex, male	0.92 (0.45-1.87)	0.817		
Donor BMI	0.97 (0.86-1.08)	0.564		
Unrelated donor	4.16 (1.79-9.67)	0.001	3.32 (1.39-7.97)	0.007
Number of HLA mismatches (for A/B/DR)	1.55 (1.18-2.03)	0.002		
XM-DSA+	3.24 (1.24-8.44)	0.016	1.43 (1.04-1.98)	0.029
Induction agent				
IL-2 receptor antibody	Reference			
Anti-thymocyte globulin	2.01 (0.82-4.90)	0.125		
Group				
ABOc DRWRc	Reference		Reference	
ABOc DRWRi	0.86 (0.25-2.97)	0.813	0.67 (0.19-2.35)	0.533
ABOi DRWRc	1.21 (0.47-3.12)	0.693	0.93 (0.35-2.42)	0.875
ABOi DRWRi	6.02 (2.46-14.77)	<0.001	3.55 (1.39-9.04)	0.008
ABOi vs. ABOc	2.18 (1.07-4.45)	0.032	1.65 (0.79-3.42)	0.181
DRWRi vs. DRWRc	2.05 (0.96-4.34)	0.063	1.64 (0.75-3.59)	0.214

Multivariable Cox model for patient survival was established by stepwise regression for establishing optimal model with limited number of death event (n=30). CVD, unrelated donor and XM-DSA+ were finally included in the model.

BMI, body mass index; DRWR, donor-recipient weight ratio; DSA, donor specific antibody; HLA, human leukocyte antigen; IL, interleukin; XM, crossmatch

;

Table S5. Cox regression analysis for BPAR

Variables	Cox regression with competing risk analysis			
	Univariate		Multivariate	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Age	0.99 (0.98-0.99)	0.001	0.98 (0.97-0.99)	<0.001
Sex, male	1.47 (1.22-1.77)	<0.001	1.59 (1.29-1.96)	<0.001
BMI	0.99 (0.98-1.02)	0.819		
Dialysis duration	0.99 (0.99-1.01)	0.179		
Retransplantation	0.53 (0.33-0.85)	0.008	0.56 (0.65-0.90)	0.016
Diabetes mellitus	0.91 (0.76-1.10)	0.336		
Hypertension	0.90 (0.69-1.18)	0.439		
Cardiovascular disease	0.72 (0.52-1.01)	0.055	0.73 (0.52-1.03)	0.073
Donor age	1.02 (1.01-1.03)	<0.001	1.02 (1.01-1.03)	<0.001
Donor sex, male	0.78 (0.65-0.93)	0.005	0.99 (0.82-1.21)	0.971
Donor BMI	1.01 (1.00-1.01)	0.083	1.01 (0.99-1.04)	0.083
Unrelated donor	1.37 (1.16-1.63)	<0.001	1.12 (0.89-1.40)	0.349
Number of HLA mismatches (for A/B/DR)	1.16 (1.09-1.23)	<0.001	1.14 (1.06-1.23)	0.001
XM-DSA+	1.15 (1.03-1.27)	0.010	1.21 (1.09-1.35)	<0.001
Induction agent				
IL-2 receptor antibody	Reference			
Anti-thymocyte globulin	1.44 (1.13-1.83)	0.003	1.29 (0.97-1.68)	0.063
Group				
ABOc DRWRc	Reference			
ABOc DRWRi	1.29 (1.02-1.64)	0.037	1.02 (0.79-1.32)	0.879
ABOi DRWRc	1.23 (0.99-1.52)	0.060	1.11 (0.89-1.38)	0.355
ABOi DRWRi	1.66 (1.17-2.34)	0.004	1.27 (0.88-1.82)	0.203
ABOi vs. ABOc	1.24 (1.03-1.50)	0.024	1.14 (0.94-1.38)	0.190
DRWRi vs. DRWRc	1.31 (1.07-1.60)	0.009	1.05 (0.84-1.31)	0.661

BMI, body mass index; DRWR, donor-recipient weight ratio; DSA, donor specific antibody;

HLA, human leukocyte antigen; IL, interleukin; XM, crossmatch

Table S6. Cox regression analysis for pneumonia

Variables	Cox regression with competing risk analysis			
	Univariate		Multivariate	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Age	1.03 (1.01-1.04)	0.001	1.02 (1.01-1.04)	0.006
Sex, male	1.63 (1.12-2.38)	0.010	1.43 (0.96-2.14)	0.080
BMI	0.99 (0.95-1.03)	0.546		
Dialysis duration	1.00 (0.99-1.01)	0.706		
Retransplantation	0.88 (0.41-1.87)	0.732		
Diabetes mellitus	0.99 (0.69-1.44)	0.979		
Hypertension	1.25 (0.67-2.32)	0.479		
Cardiovascular disease	1.69 (1.04-2.75)	0.034	1.29 (0.78-2.13)	0.330
Donor age	1.02 (1.01-1.04)	0.003	1.02 (1.01-1.04)	0.006
Donor sex, male	0.83 (0.59-1.18)	0.304		
Donor BMI	0.98 (0.92-1.03)	0.386		
Unrelated donor	1.50 (1.07-2.11)	0.020	0.90 (0.61-1.33)	0.604
Number of HLA mismatches (for A/B/DR)	1.07 (0.95-1.20)	0.282		
XM-DSA+	0.97 (0.75-1.25)	0.804		
Induction agent				
IL-2 receptor antibody	Reference			
Anti-thymocyte globulin	0.99 (0.57-1.72)	0.964		
Group				
ABOc DRWRc	Reference			
ABOc DRWRi	1.34 (0.80-2.25)	0.262	1.15 (0.67-1.97)	0.605
ABOi DRWRc	1.91 (1.27-2.86)	0.002	1.87 (1.24-2.82)	0.003
ABOi DRWRi	3.53 (2.04-6.12)	<0.001	2.94 (1.64-5.57)	<0.001
ABOi vs. ABOc	2.08 (1.47-2.93)	<0.001	2.02 (1.42-2.87)	<0.001
DRWRi vs. DRWRc	1.53 (1.04-2.25)	0.030	1.28 (0.85-1.94)	0.235

BMI, body mass index; DRWR, donor-recipient weight ratio; DSA, donor specific antibody;

HLA, human leukocyte antigen; IL, interleukin; XM, crossmatch