Clinical and Pathological importance of donor/recipient body weight mismatch after kidney transplantation

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【*Background and Aim*】

In recent years, increasing attention has been paid to non-immunological factors, such as donor age, body mass index (BMI), and the donor/recipient body weight ratio (D/R BWR). Previous studies showed that donor/recipient body weight mismatch affects long-term graft survival and graft function after renal transplantation. The postulated mechanism is glomerular enlargement or glomerular sclerosis due to glomerular hyperfiltration related to increased metabolic demand. The relationship between the D/R BWR and the annual changes in pathological parameters such as the glomerular volume (GV) after kidney transplantation is not clear. However, there might be some pathological changes with donor/recipient body weight mismatch. We investigated the clinical and pathological importance of metabolic parameters such as the D/R BWR, graft weight, and BMI after kidney transplantation.

【*Methods*】

The study enrolled 23 patients with stable kidney function without an episode of rejection or any complication that resulted in a functional decrease of the graft from 2005 to 2012. We measured GV using the Weibel-Gomez method and GD using 0- and 1-hour biopsy specimens (baseline controls) and 1-year biopsy specimens as follows: $GV = (GA)^{3/2} \times \beta / d$ and GD = nonsclerotic glomerular number/renal cortical area. The clinical and pathological characteristics of mismatch patients (D/RBWR≦0.9) were compared to those of non-mismatch patients (D/RBWR＞0.9). We also performed multivariate linear regression analysis using recipient glomerular filtration rate at 1 year after transplantation and proteinuria as the dependent variable to determine independent factors associated with better graft function.

【*Result*】

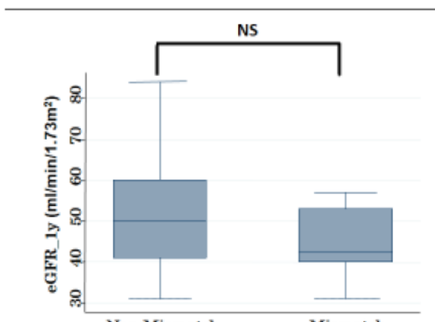
The donor and recipient characteristics at kidney transplantation are summarized in Table 1. Mismatch patients are likely to have a lower eGFR and a significantly higher proteinuria than non-mismatch patients 1 year after kidney transplantation (Table 2). Although the GD did not change, the GV of patients in the mismatch group was significantly increased 1 year after kidney transplantation. On the other hand, the ci+ct score was significantly higher in the mismatch group (Table 3). BMI and D/R BWR were independent predictors of eGFR at 1 year, while no metabolic parameters were independent predictors of proteinuria at 1 year (Table 4). The D/R BWR was significantly correlated with ΔGV ($P < 0.05$, $r_s = -0.436$) and the ci+ct score ($P < 0.05$, $r_s = 0.256$) (Table 5).

Table 1. Donor and recipient characteristics at kidney transplantation

Variables	Mismatch (n=10)	Non-mismatch (n=13)	P
Donor age (y)	61 (54-62)	57 (51-64)	NS
Donor male (n, %)	3 (30)	7 (53.9)	NS
Recipient age (y)	36 (32-46)	33 (29-36)	NS
Recipient male (n, %)	10 (100)	5 (38.5)	0.002
Body Mass Index (kg/m²)	21.8 (20.0-22.1)	18.6 (18.1-22.7)	NS
Body Surface Area (m²)	1.78±0.13	1.56±0.16	0.002
Graft weight (g)	140 (132-160)	180 (140-218)	NS
eGFR (ml/min/1.73m²)	42 (33-55)	49 (43-58)	NS
Proteinuria (mg/day)	215.1±79.8	83.6±64.5	0.0003

Table 2 . Clinical variables of 1 year after kidney transplantation

Variables	Mismatch (n=10)	Non-mismatch (n=13)	P
eGFR-1yr (ml/min/1.73m²)	43 (40-53)	50 (41-60)	NS
Proteinuria-1yr (g/day)	102.9±72.0	47.4±51.8	0.04



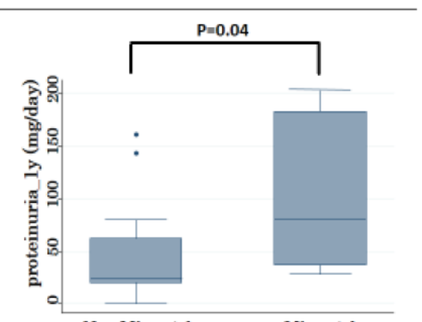
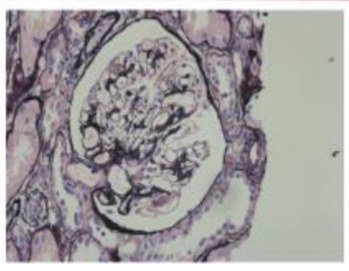


Table 3. Comparison of pathological parameters

Variables	Mismatch (n=10)	Non-mismatch (n=13)	P
Glomerular sclerosis (%)	0 (0-14)	0 (0-9)	NS
Glomerular volume (×10⁶ μm³)	2.4±1.0	2.5±0.7	NS
Glomerular density (/mm²)	2.5±0.8	2.1±0.6	NS
GS-1yr (%)	9.4 (0-13)	6.3 (0-11)	NS
GV-1yr (×10⁶μm³)	3.4±1.0	3.0±1.2	NS
GD-1yr (/mm²)	2.0±1.1	2.0±0.7	NS
ci+ct score-1yr	3.0±1.0	1.7±1.1	0.009
⊿GV=GV-1yr−GV (×10⁵ μm³)	10.6±4.6	5.5±7.1	0.049



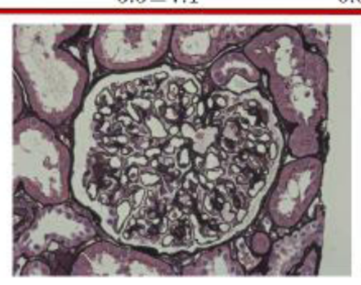
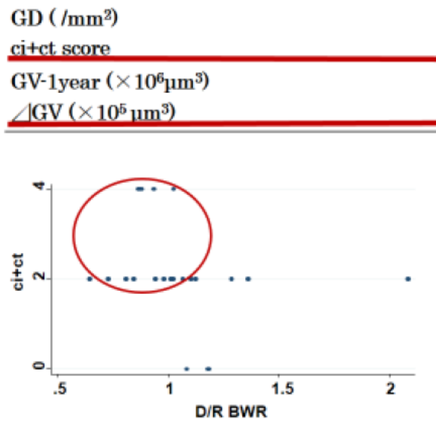


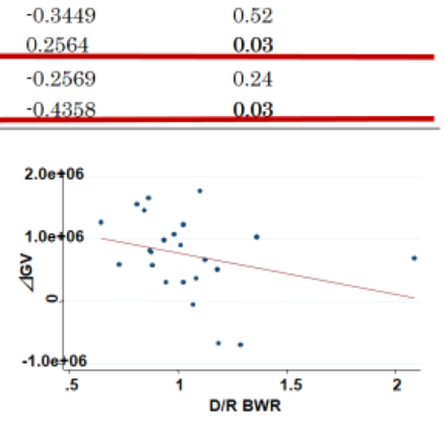
Table 4. Multivariable linear regression analysis showing independent variables associated with recipient **eGFR and proteinuria at 1 year**

	eGFR at 1 year		Proteinuria at 1 year	
Variables	Coefficient	P value	Coefficient	P value
Donor age	-0.34	NS	1.82	NS
Donor male	-1.45	NS	-6.67	NS
Recipient age	-0.07	NS	2.14	NS
Recipient male	8.17	NS	21.9	NS
BMI	-2.24	0.037	6.26	NS
BSA	8.15	NS	130.4	NS
D/R BWR	32.5	0.028	92.9	NS
Graft weight	0.004	NS	-0.38	NS

Table 5. Pathological variables associated with D/R BWR

Variables	<rs	P value
Glomerular sclerosis (%)	-0.0591	0.79
GD (/mm²)	-0.3449	0.52
ci+ct score	0.2564	0.03
GV-1year (×10⁶μm³)	-0.2569	0.24
⊿GV (×10⁵ μm³)	-0.4358	0.03





【*Discussion*】

A previous study showed that glomerular enlargement is associated with long-term graft survival. Furthermore, it is well known that hyperfiltration induces glomerular enlargement and consequently leads to secondary focal segmental glomerular sclerosis (FSGS). We showed that donor/recipient body weight mismatch is associated with glomerular enlargement and IF/TA. These results suggest that this pathological change should be considered as an important predictor of graft survival. Additional follow-up is needed to determine the long-term effect of these pathological changes on graft function.

【*Conclusion*】

D/R BWR mismatch is one of the most important metabolic factors affecting graft function after kidney transplantation. Excessive glomerular enlargement caused by glomerular hyperfiltration due to the mismatch might be associated with graft function.

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N) Renal Transplantation. N1) Transplantation basic science and immune-tolerance of allogenic and xenogenic transplants.
Yamakawa Takafumi
DOI: 10.3252/pso.eu.51era.2014
Poster presented at: 51 ERA-EDTA CONGRESS AMSTERDAM 2014
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