

A study to evaluate the effect of ratio of donor kidney weight to recipient body weight on renal graft function

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Abstract

Aim and Objectives: To study the effect of the ratio of donor kidney weight (dkw) to recipient body weight (rbw) on short and long term graft function in live donor kidney transplant patients.

Materials and Methods: It was a prospective study of 79 live donor kidney transplant recipients. Patients were divided into three groups depending on the ratio of dkw in grams to rbw in kilograms. Serum creatinine in milligrams percent on the day of surgery, 7th day, 1 month, 6 months, 1 year, and 3 years after the surgery was recorded and their means compared.

Results: The comparison showed that the decrease in mean creatinine level was more in group three patients as compared with group 2 and one patients at 7 days (1.04,1.44 and 1.59 in group 3,2 and 1 respectively) and 30 days (1.12,1.36 and 1.45 in group 3,2 and 1 respectively), showing that higher dkw/rbw ratio is beneficial with respect to the early graft function. However this decrease was not statistically significant (*P* value –0.256 and 0.358 respectively on 7th and 30th day). Furthermore long-term function was not different among these three groups.

Conclusion: The ratio of dkw to rbw does not have a significant effect on long-term graft function inspite of an early improvement in the function with increased dkw to rbw ratio.

Key Words: Donor kidney weight, graft function, recipient body weight

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Received: 28.12.2012, Accepted: 29.05.2013

INTRODUCTION

The effect of nephron reduction has long been described in animal models as well as in humans^[1] and is thought to be a potential non immunologic risk factor for chronic graft dysfunction after kidney transplantation.^[2] After transplant the remaining glomeruli in the graft kidney undergo “adaptive hyper-filtration” which ultimately leads to glomerulosclerosis

and progressive decrease in graft function.^[3] We conducted this study in an attempt to establish a relationship between the ratio of dkw and rbw in live donor kidney transplant patients.

MATERIALS AND METHODS

It was a prospective study of 79 live donor kidney transplant recipients from may 2008 to september 2011, conducted at Institute of Renal Sciences, Sir Ganga Ram Hospital, New Delhi. Patients were divided in three groups depending on the ratio of dkw in grams to rbw in kilograms. Group 1; dkw/rbw <2, group 2; 2-3, and group 3; >3. Serum creatinine in milligrams percent on the day of surgery, 7th day, 1 month, 6 months, 1 year, and 3 years after the surgery was recorded and their means compared [Table I]. Patients with acute tubular necrosis, sepsis, drug toxicity and graft rejection were excluded (total excluded 11). Data was collected prospectively

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/0974-7796.130644

in a meticulous way from patients and hospital information system in accordance with the hospital ethical committee requirements. Donor parameters which were recorded included age, gender and serum creatinine (mg/dl) and recipient parameters included age, weight after dialysis, gender, baseline serum creatinine level (mg/dl) comorbidities, and basic disease which led to end stage renal disease (ESRD). During the surgery all donors were operated by the same team and kidney weighed after defatting (preparing) the graft kidney, by an electronic weighing gadget kept in the dedicated operation theater. All patients were followed with mean follow up period of 14.5 months (range 1 to 39 months). A Kruskal-Wallis test was conducted after which pair wise comparison was carried out using the Mann-Whitney U test.

RESULTS

The mean serum creatinine value in mg/dl at 7 days, 1 month, 6 months, 1 year and 3 years respectively was compared among the three groups. The comparison showed that the decrease in mean creatinine level was more rapid in group 3 patients as compared with group 2 and one patients at 7 days (1.04, 1.44 and 1.59 in group 3, 2 and 1 respectively) and 30 days (1.12, 1.36 and 1.45 in group 3, 2 and 1 respectively), showing that higher dkw/rbw ratio is beneficial with respect to the early graft function. However this decrease was not statistically significant (P value-0.256 and 0.358 respectively on 7th and 30th day). On further follow-up no significant difference in the decrease in creatinine in the three groups was seen at 1 month, 6 months, 12 months and 36 months [Table 1 and Figure 1].

DISCUSSION

The deleterious effect of nephron reduction on graft function has been known since long and is thought to be due to “adaptive hyper-filtration” injury of the remaining glomeruli which ultimately leads to glomerulosclerosis.^[3] Individuals who have undergone nephrectomy have been shown to develop high blood pressure (BP) and proteinuria decades after the nephrectomy which is in accordance with this hypothesis, and same is the case when a kidney is transplanted into a patient with ESRD.^[4,5] Moreover, superimposed immunologic and non-immunologic events further decrease the initial

nephron mass of a transplant and serve only to exacerbate the consequences of hyper-filtration related to its single kidney. Low donor weight (i.e. low nephron mass) as compared with recipient weight has been associated with decreased graft function. The number of nephrons transplanted (directly related to the kidney weight) have an impact on the outcome of the graft following transplant, and it is quite logical to state that more the number of nephrons transplanted better will be the outcome of graft function.^[6] The impact of matching the kidney weight (which correlates with both glomerular volume and nephron number)^[7] to the rbw has been studied only in relatively small cohorts of patients and only in living donors,^[8,9] where the graft does not have the same accumulating injuries as those from deceased donors. Giral et al.,^[10] in a study on dkw and rbw incompatibility, assessed the long-term consequences of the ratio of the weight of donor kidney to the weight of the recipient (dkw/rbw ratio) in a multicenter cohort of 1189 patients observed that the graft glomerular filtration rate increased by a mean of 5.74 ml/min between the third and sixth post transplantation months among patients with a low dkw/rbw ratio (2.3 g/kg) which remained stable between 6 months and 7 years but then decreased at a mean rate of 3.17 ml/min per year (P = 0.0001). In addition, low dkw/rbw ratios conferred greater risk for proteinuria, need of more antihypertensive drugs, and segmental or global glomerulosclerosis. Moreover, a dkw/rbw of ≤2.3 g/kg was associated with a 55% increased risk for transplant failure by

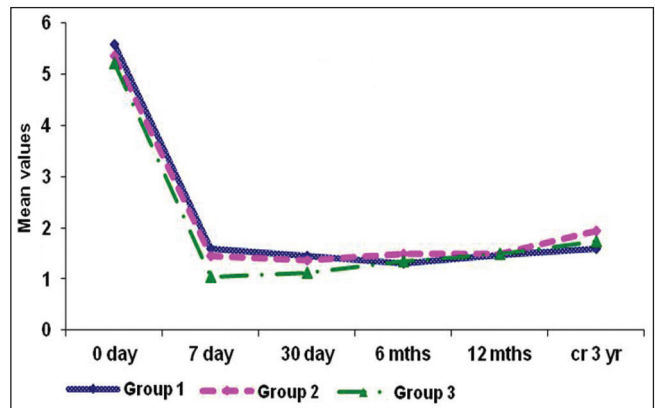


Figure 1: Line diagram showing a trend of fall in serum creatinine in the three groups

Table 1: Distribution of creatinine among the groups with comparison

Sr. creat	Group 1 (n = 21)		Group 2 (n = 46)		Group 3 (n = 12)		P value	P value		
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	Range		1 versus 2	1 versus 3	2 versus 3
Day 0	5.58±1.87	(2.3-9.8)	5.36±1.66	3.0-8.7	5.22±1.19	(3.7-7.6)	0.814	0.881	0.838	0.968
Day 7	1.59±0.67	(0.8-3.3)	1.44±1.10	0.8-5.7	1.04±0.27	(0.7-1.5)	0.256	0.845	0.265	0.400
Day 30	1.45±0.48	(0.8-3.1)	1.36±0.76	0.6-5.7	1.12±0.34	(0.8-1.8)	0.358	0.87	0.365	0.515
6 M	1.30±0.29	(1.0-2.3)	1.49±0.82	(0.1-4.9)	1.35±0.17	(1.2-1.6)	0.665	0.677	0.991	0.937
12 M	1.47±0.40	(1.1-2.33)	1.48±0.22	(1.13-1.8)	1.48±0.19	(1.28-1.65)	0.996	0.996	1.000	0.999
36 M	1.59±0.39	(1.3-2.4)	1.95±1.34	(1.1-6.2)	1.73±0.35	(1.4-2.1)	0.737	0.742	0.98	0.947

Sr: Serum, Creat: Reatinine

2 years of follow-up. They concluded that incompatibility between graft and recipient weight is an independent predictor of long-term graft survival, suggesting that avoiding kidney and recipient weight incompatibility may improve late clinical outcome after kidney transplantation. In another study on 82 living donor kidney transplant patients, Kim *et al.*^[9] concluded that recipients with a low renal mass or mismatching kidney size have higher chances of chronic graft nephropathy and those with higher dkw/rbw ratio have better graft function. Saxena *et al.*^[11] in a study on donor kidney volume to rbw ratio concluded that a low ratio is associated with significantly worse graft function. Kim *et al.*^[12] investigated the impacts of dkw/rbw ratios on the graft function including acute rejection and donor's age in 259 live-donor renal recipients. Renal function showed a positive correlation with the dkw/rbw ratio, but an inverse correlation with the rejection episodes and donor's age. Nicholson *et al.*^[13] in a study on transplant kidney size to recipient weight ratio showed that it was an important determinant of long-term renal allograft function in their study. They concluded that extreme mismatching between allograft and recipient size should be avoided where possible, but the findings presented require confirmation in larger studies before clear recommendations can be made about size matching and kidney allocation. Other study which showed a positive correlation between high dkw/rbw ratio and graft function is by Spatenka *et al.*^[14]

However there are studies which did not show a positive correlation between dkw/rbw ratio and graft function. Vianello *et al.*^[15] in a study "importance of donor/rbw ratio as a cause of kidney graft loss in the short to medium term", on 112 cadaver renal transplant patients, concluded that the dkw/rbw ratio has no major effects on kidney graft function and survival in the short to medium term, which is in accordance with our study.

CONCLUSION

The ratio of dkw to rbw in live donor kidney transplant patients does not have a significant effect on long term graft function inspite of an early improvement in the function with increased dkw to rbw ratio. However randomized trials and longer follow-up need to be undertaken before a recommendation can be made.

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How to cite this article: Dar TI, Tyagi V, Pahwa M, Chada S, Jauhari H, Sharma N. A study to evaluate the effect of ratio of donor kidney weight to recipient body weight on renal graft function. *Urol Ann* 2014;6:139-41.

Source of Support: Nil, **Conflict of Interest:** None.