Serum albumin levels at one year after kidney transplantation to predict long-term outcomes

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Background

Hypoalbuminemia is associated with an increased risk of mortality in patients with end-stage renal disease. In renal transplants, however, there have been limited data on the relationship between initial serum albumin levels and final recipient prognoses. We hypothesized that even a low normal serum albumin level may affect long-term outcomes after kidney transplantation (KT).

Methods

Among 693 patients who received allograft kidneys between 1990 and 2009, recipients without delayed graft function and with maintenance follow-up > 1 year were included in this retrospective analysis. Three patients were also excluded whose serum albumin level at one year after KT was not in the normal range (3.6 – 5.5 g/dL). Based on the 1-year serum albumin after KT, a total of 404 patients were divided into two groups: high normal ≥ 4.6 g/dL (n = 209) and low normal < 4.6 g/dL (n = 195). Kaplan-Meier analysis was used to compare cumulative survivals between the groups, and the association between parameters and patient outcomes were evaluated by Cox regression analysis.

Results

Table 1. Basal characteristics at one year after kidney transplantation

Variables	High normal serum albumin (4.6 - 5.5 g/dL) (n = 209)	Low normal serum albumin (3.6 - 4.5 g/dL) (n = 195)	*P*
Age (years)	36.0 ± 10.1	42.9 ± 10.0	<0.01
Male	141 (67)	112 (57)	<0.05
Dialysis vintage (months)	27.3 ± 31.0	40.6 ± 46.9	<0.01
Diabetes mellitus*	56 (27)	42 (22)	NS
Body mass index (kg/m^2)	22.3 ± 3.9	21.9 ± 2.4	NS
SBP (mmHg)	122.2 ± 13.7	123.0 ± 14.5	NS
DBP (mmHg)	80.0 ± 10.1	79.7 ± 11.2	NS
Triglyceride (mg/dL)	162.8 ± 94.3	163.0 ± 82.0	NS
HDL-cholesterol (mg/dL)	55.7 ± 15.1	55.9 ± 14.1	NS
LDL-cholesterol (mg/dL)	113.8 ± 30.7	111.6 ± 31.4	NS
Hemoglobin (mg/dL)	13.2 ± 2.2	12.5 ± 2.0	<0.01
Ca x P (mg^2/dL^2)	36.0 ± 6.2	34.6 ± 5.3	<0.05
Uric acid (mg/dL)	7.1 ± 2.0	6.8 ± 1.8	NS
Albumin (g/dL)	4.8 ± 0.2	4.3 ± 0.2	<0.01
Blood urea nitrogen (mg/dL)	23.0 ± 7.3	23.6 ± 7.9	NS
Creatinine (mg/dL)	1.55± 0.8	1.52 ± 1.6	NS
eGFR (mL·min^{-1}·1.73m^{-2})†	57.2 ± 16.2	57.1 ± 16.7	NS
Proteinruia‡	22 (10)	21 (11)	NS
Acute rejection	36 (17)	24 (12)	NS
First KT	195 (93)	182 (93)	NS
Medication			
Cyclosporin A	187 (81)	168 (76)	NS
Mycophenolate mofetil	70 (30)	87 (45)	<0.05
Steroid	209 (100)	195 (100)	NS
Diuretics	43 (21)	55 (28)	NS
ACEI or ARB	95 (45)	48 (25)	<0.01
Statin	35 (17)	42 (21)	NS

* Diabetic mellitus (DM) diagnosed before kidney transplantation + post transplantation DM during 1 year post-transplant
† eGFR was calculated using CKD-EPI equation.
‡ Proteinuria was defined as 1+ on dipstick test.
NS, not significant; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL, high density lipoprotein; LDL, low density lipoprotein; Ca, calcium; P, phosphate; eGFR, estimated glomerular fitration rate; KT, kidney transplantation; ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker.

Figure. Kaplan-Meier analyses for the long-term outcomes in two groups based on the serum albumin level (high normal, 4.6 - 5.5 g/dL versus low normal, 3.6 - 4.5 g/dL) at one year after KT.

(A) Cumulative graft survival (*P* < 0.001 by log rank test)
(B) Cumulative patient survival (*P* < 0.001 by log rank test)
(C) Cumulative CV event-free survival (*P* < 0.001 by log rank test)
KT, kidney transplantation; CV, cardiovascular.

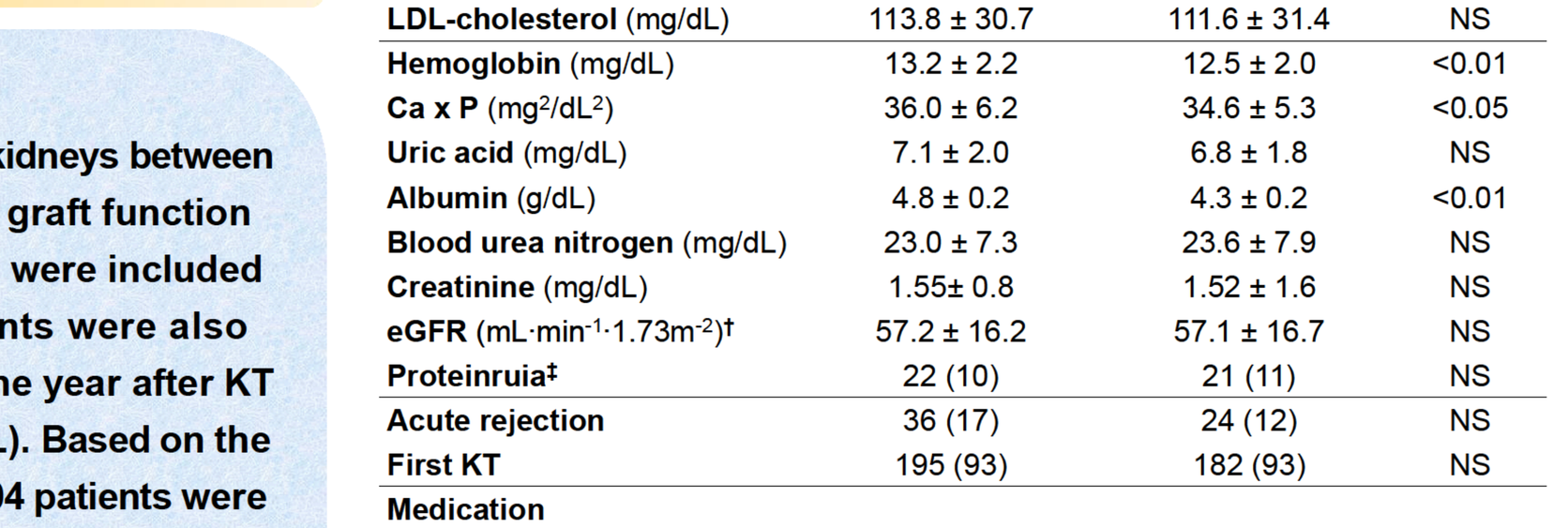

Table 2. Results of Cox proportional hazard model for graft loss, patient death, and cardiovascular event

	Graft loss		Patient death		Cardiovascular event	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
Covariate	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**
Age	0.996 (0.976-1.016)		1.069 (1.020-1.120)		1.044 (1.015-1.075)	1.038 (1.005-1.073)
Body mass index	0.971 (0.824-1.143)		1.104 (0.886-1.375)		1.115 (0.943-1.318)	
Dialysis vintage	1.003 (0.996-1.009)		1.013 (1.002-1.023)		1.005 (0.996-1.014)	
Acute rejection	1.744 (1.142-2.664)		1.502 (0.612-3.685)		1.261 (0.649-2.453)	
Diabetes mellitus*	1.110 (0.686-1.796)		2.184 (0.905-5.273)		1.484 (0.812-2.714)	
eGFR	0.971 (0.958-0.985)	0.972 (0.957-0.986)	0.967 (0.939-0.996)		1.005 (0.988-1.023)	
Creatinine	1.185 (1.047-1.341)		1.197 (0.931-1.538)		0.891 (0.494-1.607)	
Albumin	**0.464 (0.228-0.943)**	**0.414 (0.200-0.856)**	**0.123 (0.027-0.564)**	**0.097 (0.019-0.484)**	**0.151 (0.055-0.413)**	**0.228 (0.074-0.702)**
Proteinuria†	2.726 (1.655-4.490)	2.561 (1.535-4.272)	3.692 (1.324-10.299)	4.5373 (1.597-12.866)	2.721 (1.349-5.490)	3.105 (1.478-6.523)
ACEI or ARB use	0.775 (0.507-1.184)		0.401 (0.151-1.066)		0.784 (0.434-1.415)	

*Diabetes mellitus (DM) diagnosed before kidney transplantation + post transplantation DM during 1 year post-transplant
†Proteinuria was defined as 1+ on dipstick test.
HR, hazard ratio; CI , confidence intervals; eGFR, estimated glomerular filtration rate; Ca , calcium; P , phosphate

Conclusion

Even within the normal range, a relatively low level of serum albumin may predict poor graft, patient survival, and cardiovascular event-free survival. We cannot stress too much the importance of the initial recipient care after KT, probably focusing on improving nutrition and relieving inflammation.

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