Association Between Low Anti-spike Antibody Levels After the Third Dose of SARS-CoV-2 Vaccination and Hospitalization due to Symptomatic Breakthrough Infection in Kidney Transplant Recipients

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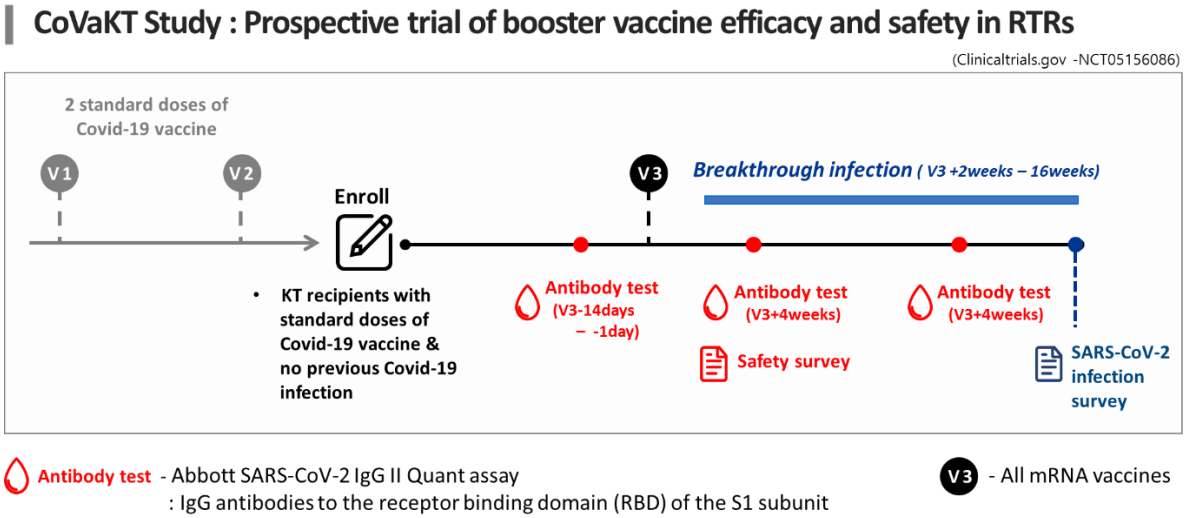
Supplemental Data Table S1. Factors associated with a negative antibody response after booster mRNA vaccination in a multivariable logistic model

Baseline characteristics	Model 1*			Model 2†		
	HR	95%CI	*P*	HR	95%CI	*P*
Age	0.95	0.91, 1.00	0.04			
Male sex	0.22	0.06, 0.80	0.02			
Body mass index, kg/m^2				0.90	0.81, 1.01	0.07
Time since transplantation, yrs	0.89	0.80, 0.98	0.02	0.91	0.85, 0.98	0.01
Antimetabolite use						
None	Ref			Ref		
Mizoribine	0	0, NA	> 0.9	0	0, NA	> 0.9
MPA or MMF ≤ 500 mg/day	2.30	0.24, 21.87	0.47	5.98	1.06, 33.76	0.04
MPA or MMF > 500 mg/day	8.12	0.94, 69.83	0.06	19.01	3.49, 103.46	< 0.01
Hb				0.70	0.54, 0.91	0.01
MDRD eGFR	0.95	0.92, 0.99	0.01	0.96	0.93, 0.98	< 0.01
Tacrolimus trough level	1.10	1.00, 1.23	0.06	1.16	1.01, 1.33	0.03
Type of primary vaccination						
mRNA/mRNA vaccine				Ref		
ChAdOX1-S/ChAdOX1-S				3.34	1.38, 8.06	0.01
ChAdOX1-S/BNT162b2				1.10	0.45, 2.68	0.84
Pre-third dose anti-RBD IgG seronegativity	158.56	58.12, 659.59	< 0.01			

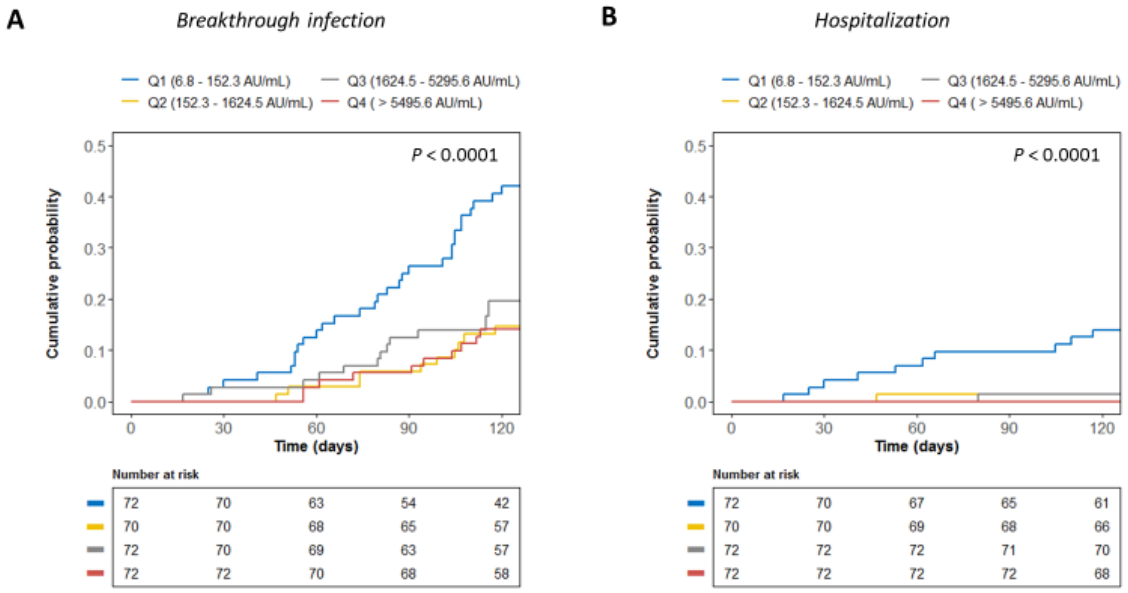
*Multivariable logistic regression model 1 included sex, age, and factors with $P \leq 0.2$ in univariate tests (i.e., body mass index, time since transplantation, three or more types of immunosuppression medication, antimetabolite use, Hb, MDRD eGFR, tacrolimus trough level, and pre-third dose anti-RBD IgG seronegativity).

†Model 2 included the type of primary vaccination instead of pre-third dose anti-RBD IgG seronegativity because these two variables showed collinearity.

Abbreviations: NA, not available; MDRD, modification of diet in renal disease; MPA, mycophenolic acid; MMF, mycophenolate mofetil; eGFR, estimated glomerular filtration rate; RBD, receptor-binding domain; Ref, reference



Supplemental Data Figure S1. Scheme of the study.



Supplemental Data Figure S2. Cumulative risk of symptomatic breakthrough infection or hospitalization in the four subgroups according to post-third vaccination anti-RBD IgG level quartiles. When the patients were grouped into four groups according to the quartile values of anti-spike IgG levels after the third vaccination (Q1, 6.8 – 152.3; Q2, 152.3 – 1,624.5; Q3, 1,624.5 – 5,495.6; Q4, > 5,495.6 AU/mL), the risk of symptomatic breakthrough infection did not differ among the Q2, Q3, and Q4 groups ($P < 0.0001$). When the patients were grouped into four groups according to the quartile values of anti-spike IgG levels after the third vaccination (Q1, 6.8 – 152.3; Q2, 152.3 – 1,624.5; Q3, 1,624.5 – 5,495.6; Q4, > 5,495.6 AU/mL), the risk of symptomatic breakthrough infection requiring hospitalization did not differ among the Q2, Q3, and Q4 groups ($P < 0.0001$).

Abbreviation: RBD, receptor-binding domain.