

Table S1. Inclusion and exclusion criteria.

Inclusion criteria	
1.	Eligible for COVID-19 vaccination as described by the instructions of the manufacturer
2.	Age of 18 years or older
3.	Capable of understanding purpose and risks of the study, given written informed consent
4.	Either A. CKD stages 4/5, with an eGFR <30 ml/min/1.73m² by CKD-EPI B. Hemodialysis or peritoneal dialysis C. Kidney transplant recipient at least 6 weeks after transplantation D. Partner, sibling or household member of participating patient
Exclusion criteria	
1.	History of severe adverse reaction associated with a vaccine and/or severe allergic reaction (eg, anaphylaxis) to any component of the study intervention(s)
2.	Multiorgan transplant recipients
3.	Previous or active COVID-19 disease
4.	Active (hematological) malignancy
5.	Inherited immune deficiency
6.	Infection with human immunodeficiency virus (HIV)
7.	Bleeding diathesis or condition associated with prolonged bleeding that would, in the opinion of the investigator, contraindicate intramuscular injection
8.	Additional criteria - For patients with CKD stages 4/5, on dialysis and controls: Maintenance treatment with immunosuppressive therapy in the 6 months before inclusion, including cytotoxic agents or systemic corticosteroids - For kidney transplant recipients: Administration of alemtuzumab, ATG, or rituximab in the 3 months before inclusion - For controls: Severely impaired kidney function, eGFR < 45 ml/min/1.73m² by CKD-EPI

ATG, anti-thymocyte globulin; CKD, chronic kidney disease; CKD-EPI, Chronic Kidney Disease Epidemiology Collaboration; COVID-19, coronavirus disease 2019; eGFR, estimated glomerular filtration rate.

Table S2. Study visits and assessments.

	Visit				
	V1	V2	V2 + 1M (± 3 days)	V2 + 6M (± 14 days)	V2 + 12M (± 14 days)
Informed consent	x				
In- / exclusion criteria	x				
Medical history	x				
Concomitant medication	x				
Height / weight	x				
Vital signs ^a	x	x			
Hematology ^b	x	x	x	x	x
Biochemistry ^c	x	x	x	x	x
SARS-CoV-2 antibodies	x	x	x	x	x
Biobanking	x		x	x	x
Solicited adverse events	x	x			
COVID-19 questionnaire		x	x	x	x
SARS-CoV-2 vaccination	x	x			

^aVital signs: blood pressure, heart rate, and temperature.

^bHematology: hemoglobin (Hb), leucocytes with differentiation, and platelets.

^cBiochemistry: glucose, urea, creatinine, alanine aminotransferase (ALAT), potassium, albumin, and C-reactive protein (CRP).

COVID-19, coronavirus disease 2019; M, months; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; V, visit.

Table S3. Solicited adverse events per group after first vaccination.

	First vaccination						
	Control (N = 191)	CKD G4/5 (N = 161)	<i>P</i> ^a	Dialysis (N = 151)	<i>P</i> ^a	KTR (N = 287)	<i>P</i> ^a
Any systemic symptom, n (%)	115 (60.2)	116 (71.6)	0.02	92 (57.9)	0.66	195 (67.7)	0.09
Arthralgia	20 (10.5)	39 (24.2)	0.001	33 (21.8)	0.004	63 (21.9)	0.001
- Mild	17 (8.9)	30 (18.6)		27 (17.9)		48 (16.7)	
- Moderate	3 (1.6)	6 (3.7)		4 (2.7)		12 (4.2)	
- Severe	0	3 (1.9)		2 (1.3)		3 (1.1)	
Fatigue	65 (34.0)	74 (46.2)	0.02	59 (39.3)	0.31	132 (46.0)	0.01
- Mild	59 (30.9)	51 (31.9)		40 (26.7)		95 (33.1)	
- Moderate	5 (2.6)	18 (11.3)		15 (10.0)		32 (11.2)	
- Severe	1 (0.5)	5 (3.1)		4 (2.7)		5 (1.7)	
Fever	1 (0.5)	6 (3.7)	0.03	3 (2.0)	0.21	7 (2.4)	0.11
- Mild	0	6 (3.7)		2 (1.3)		6 (2.1)	
- Moderate	1 (0.5)	0		1 (0.7)		0	
- Severe	0	0		0		1 (0.4)	
Chills	19 (9.9)	36 (22.4)	0.001	25 (16.6)	0.07	56 (19.5)	0.005
- Mild	18 (9.4)	29 (18.0)		23 (15.2)		45 (15.7)	
- Moderate	1 (0.5)	7 (4.4)		1 (0.7)		9 (3.1)	
- Severe	0	0		1 (0.7)		2 (0.7)	
Headache	48 (25.1)	41 (25.5)	0.94	32 (21.2)	0.39	85 (29.6)	0.28
- Mild	41 (21.5)	35 (21.7)		26 (17.2)		65 (22.7)	
- Moderate	6 (3.1)	5 (3.1)		6 (4.0)		15 (5.2)	
- Severe	1 (0.5)	1 (0.6)		0		5 (1.7)	
Myalgia	65 (34.0)	68 (42.5)	0.10	57 (37.7)	0.48	122 (42.5)	0.06
- Mild	54 (28.3)	54 (33.8)		46 (30.5)		102 (35.5)	
- Moderate	9 (4.7)	11 (6.9)		10 (6.6)		18 (6.3)	
- Severe	2 (1.0)	3 (1.9)		1 (0.7)		2 (0.7)	
Nausea	21 (11.0)	20 (12.5)	0.66	10 (6.6)	0.16	38 (13.3)	0.46
- Mild	20 (10.5)	16 (10.0)		8 (5.3)		32 (11.2)	
- Moderate	1 (0.5)	3 (1.9)		1 (0.7)		6 (2.1)	
- Severe	0	1 (0.6)		1 (0.7)		0	
Any local symptom, n (%)	155 (81.1)	130 (80.2)	0.83	120 (75.5)	0.20	259 (89.9)	0.01
Erythema	33 (17.3)	19 (11.9)	0.16	14 (9.3)	0.03	30 (10.5)	0.03
- Mild	29 (15.2)	17 (10.6)		12 (8.0)		27 (9.4)	
- Moderate	4 (2.1)	2 (1.3)		2 (1.3)		2 (0.7)	
- Severe	0	0		0		1 (0.4)	
Induration	30 (15.7)	28 (17.5)	0.65	23 (15.3)	0.92	57 (19.9)	0.24
- Mild	24 (12.6)	25 (15.6)		20 (13.3)		48 (16.8)	
- Moderate	6 (3.1)	3 (1.9)		3 (2.0)		7 (2.5)	
- Severe	0	0		0		2 (0.7)	
Pain at injection side	152 (79.6)	126 (78.7)	0.85	118 (78.1)	0.75	259 (90.6)	0.001
- Mild	131 (68.6)	106 (66.3)		98 (64.9)		231 (80.8)	
- Moderate	20 (10.5)	18 (11.3)		20 (13.3)		27 (9.4)	
- Severe	1 (0.5)	2 (1.3)		0		1 (0.4)	

Variables are given as number and percentage. *P*-values were calculated using chi-squared test.

^a*P*-values are given for the comparison between patient groups and controls.

CKD, chronic kidney disease; KTR, kidney transplant recipient; N, number.

Table S4. Solicited adverse events per group after second vaccination.

	Second vaccination						
	Control (N = 188)	CKD G4/5 (N = 158)	<i>P</i> ^a	Dialysis (N = 135)	<i>P</i> ^a	KTR (N = 282)	<i>P</i> ^a
Any systemic symptom, n (%)	162 (84.8)	128 (79.0)	0.16	105 (66.0)	<0.001	196 (68.1)	<0.001
Arthralgia	68 (36.2)	59 (37.3)	0.82	44 (32.6)	0.50	67 (23.8)	0.004
- Mild	39 (20.7)	31 (19.6)		27 (20.0)		47 (16.7)	
- Moderate	25 (13.3)	20 (12.7)		14 (10.4)		17 (6.0)	
- Severe	4 (2.1)	8 (5.1)		3 (2.2)		3 (1.1)	
Fatigue	126 (67.0)	101 (63.9)	0.55	78 (58.2)	0.11	152 (53.9)	0.005
- Mild	65 (34.6)	43 (27.2)		43 (32.1)		91 (32.6)	
- Moderate	44 (23.4)	43 (27.2)		26 (19.4)		45 (16.0)	
- Severe	17 (9.0)	15 (9.5)		9 (6.7)		15 (5.3)	
Fever	51 (27.1)	40 (25.3)	0.70	28 (20.7)	0.19	18 (6.4)	<0.001
- Mild	31 (16.5)	28 (17.7)		16 (11.9)		12 (4.3)	
- Moderate	15 (8.0)	6 (3.8)		5 (3.7)		3 (1.1)	
- Severe	5 (2.7)	6 (3.8)		7 (5.2)		3 (1.1)	
Chills	89 (47.1)	81 (51.3)	0.44	56 (41.5)	0.32	72 (25.5)	<0.001
- Mild	48 (25.4)	36 (22.8)		31 (23.0)		56 (19.9)	
- Moderate	31 (16.4)	36 (22.8)		17 (12.6)		12 (4.3)	
- Severe	10 (5.3)	9 (5.7)		8 (5.9)		4 (1.4)	
Headache	106 (56.4)	68 (43.0)	0.01	46 (34.1)	<0.001	114 (40.4)	0.001
- Mild	74 (39.4)	41 (26.0)		27 (20.0)		100 (35.5)	
- Moderate	24 (12.8)	21 (13.3)		13 (9.6)		9 (3.2)	
- Severe	8 (4.3)	6 (3.8)		6 (4.4)		5 (1.8)	
Myalgia	113 (59.8)	92 (58.3)	0.77	71 (52.6)	0.20	117 (41.5)	<0.001
- Mild	65 (34.5)	52 (32.9)		46 (34.1)		82 (29.1)	
- Moderate	39 (20.6)	33 (20.9)		18 (13.3)		30 (10.6)	
- Severe	9 (4.8)	7 (4.4)		7 (5.2)		5 (1.8)	
Nausea	50 (26.6)	56 (35.4)	0.07	34 (25.4)	0.80	54 (19.3)	0.06
- Mild	40 (21.3)	36 (22.8)		25 (18.7)		45 (16.1)	
- Moderate	7 (3.7)	18 (11.4)		7 (5.2)		8 (2.9)	
- Severe	3 (1.6)	2 (1.3)		2 (1.5)		1 (0.4)	
Any local symptom, n (%)	156 (81.7)	125 (77.2)	0.29	104 (65.4)	0.001	221 (76.7)	0.20
Erythema	49 (25.9)	35 (22.1)	0.41	27 (20.1)	0.23	36 (12.9)	<0.001
- Mild	27 (14.3)	29 (18.4)		22 (16.4)		31 (11.1)	
- Moderate	17 (9.0)	4 (2.5)		3 (2.2)		5 (1.8)	
- Severe	5 (2.7)	2 (1.3)		2 (1.5)		0	
Induration	56 (29.6)	41 (25.9)	0.45	38 (28.4)	0.80	59 (21.1)	0.03
- Mild	43 (22.8)	35 (22.2)		33 (24.6)		53 (18.9)	
- Moderate	10 (5.3)	4 (2.5)		4 (3.0)		6 (2.1)	
- Severe	3 (1.6)	2 (1.3)		1 (0.8)		0	
Pain at injection side	155 (82.0)	122 (77.2)	0.27	102 (76.1)	0.20	221 (78.9)	0.41
- Mild	117 (61.9)	83 (52.5)		73 (54.5)		188 (67.1)	
- Moderate	36 (19.0)	33 (20.9)		25 (18.7)		30 (10.7)	
- Severe	2 (1.1)	6 (3.8)		4 (3.0)		3 (1.1)	

Variables are given as number and percentage. P-values were calculated using Chi-squared test.

^aP-values are given for the comparison between patient groups and controls.

CKD, chronic kidney disease; KTR, kidney transplant recipient; N, number.

Figure S1. SARS-CoV-2 Spike S1-specific IgG antibody levels per study cohort at 28 days after first vaccination vs second vaccination. Depicted are box and whisker plots together with outliers, with the box representing median and interquartile range, whiskers representing the 95% CI. Dotted horizontal line indicates threshold for definition of responder; *P*-values to compare levels at vaccination 1 vs vaccination 2 were calculated using Wilcoxon signed rank test. BAU, binding antibody units; CKD, chronic kidney disease; IgG, immunoglobulin G; KTR, kidney transplant recipient; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

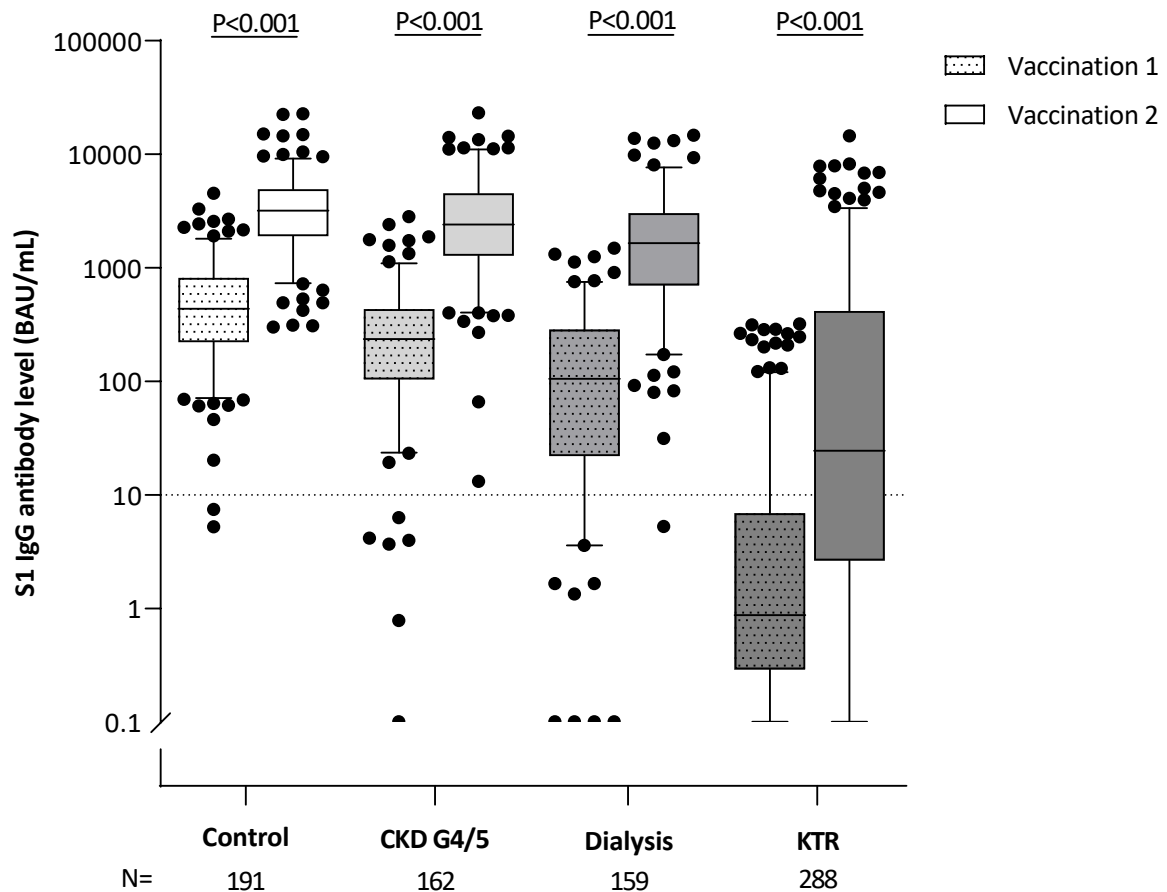


Figure S2. S1-specific IgG antibody level 28 days after vaccination 1 vs vaccination 2. Dotted horizontal and vertical lines indicate threshold for seroresponse; solid line represents the line of identity; R's and P-values were calculated using Spearman correlation (overall, $R = 0.86$; controls, $R = 0.54$; CKD G4/5, $R = 0.68$; dialysis, $R = 0.76$; transplant recipients, $R = 0.71$; all, $P < 0.001$). BAU, binding antibody units; CKD, chronic kidney disease; IgG, immunoglobulin G; KTR, kidney transplant recipient.

