

Magnetic Resonance Imaging for Evaluation of Interstitial Fibrosis in Kidney Allografts

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Supplementary Material

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TABLE S1. Morphologic lesions assessed in two independent pathologist evaluations - correlations with MRI parameters.

Morphologic parameters	Cortical T1 relaxation time		Δ ADC		Cortical T2 relaxation time	
	<i>rho</i>	<i>P</i>	<i>rho</i>	<i>P</i>	<i>rho</i>	<i>P</i>
Prospective evaluation (two nephrologists)^a						
Interstitial fibrosis (ci)	0.388	0.028	-0.475	0.007	0.063	0.73
% interstitial fibrosis	0.449	0.010	-0.490	0.005	0.152	0.41
Tubular atrophy (ct)	0.505	0.003	-0.414	0.021	0.176	0.34
Separate re-evaluation (independent pathologist)^a						
Interstitial fibrosis (ci)	0.482	0.005	-0.388	0.031	0.065	0.72
% interstitial fibrosis	0.493	0.004	-0.388	0.031	0.080	0.66
Tubular atrophy (ct)	0.484	0.005	-0.326	0.074	0.063	0.73

ADC, apparent diffusion coefficient; Δ ADC, cortico-medullary difference of ADC; MRI, magnetic resonance imaging; rho, correlation coefficient.
^aStudy biopsies were evaluated prospectively by two nephrologists blinded to MRI results (H.R., J.K.). For assessment of inter-observer variability, specimens were re-evaluated by a third independent pathologist (M.N.).

TABLE S2. Morphologic and MRI parameters in indication versus protocol biopsies.

Parameters, median (IQR)	All patients (N=32)	Type of biopsy		P value
		Indication biopsies (n=23)	Protocol biopsies (n=9)	
Histological parameters				
Interstitial fibrosis (ci)	2 (1-3)	2 (1-3)	2 (1-3)	0.62
%IF	40 (10-78)	40 (10-70)	40 (20-70)	0.65
IF/TA	2 (1-3)	2 (1-3)	2 (1-3)	0.62
MRI parameters				
T1 mapping				
Coronal T1 (ms)	1338 (1254-1467)	1377 (1243-1471)	1322 (1257-1339)	0.39
Axial T1 (ms)	1336 (1216-1511)	1354 (1236-1531)	1294 (1222-1369)	0.30
Cranial pole T1 (ms)	1334 (1224-1477)	1334 (1211-1484)	1340 (1288-1365)	0.94
Medullary T1 (ms)	1617 (1501-1733)	1595 (1481-1724)	1631 (1561-1783)	0.26
Δ T1	253 (180-349)	215 (163-302)	286 (247-543)	0.12
Diffusion-weighted imaging				
Cortical ADC (mm ² /s)	1.7 (1.6-1.8)	1.6 (1.6-1.8)	1.8 (1.5-1.9)	0.55
Medullary ADC (mm ² /s)	1.7 (1.6-1.8)	1.7 (1.6-1.8)	1.8 (1.6-1.8)	0.95
Δ ADC	-0.03 (-0.08-0.03)	-0.05 (-0.1-0.3)	-0.03 (-0.07-0.06)	0.44
T2 mapping				
Cortical T2 (ms)	88.8 (69.9-97.1)	92.0 (72.8-97.5)	72.0 (68.0-89.0)	0.25
Coronal T2 (ms)	89.8 (74.0-100.0)	92.1 (75.2-101.3)	75.1 (73.2-85.9)	0.15
Axial T2 (ms)	89.6 (65.2-97.0)	92.5 (66.9-97.1)	69.0 (64.4-93.4)	0.34

ADC, apparent diffusion coefficient; Δ ADC: cortico-medullary difference of ADC; IF, interstitial fibrosis; IF/TA, interstitial fibrosis and tubular atrophy; IQR, interquartile range; MRI, magnetic resonance imaging.

TABLE S3. MRI parameters in relation to interstitial fibrosis – Sub-analysis of patients without ABMR or TCMR

MRI parameters, median (IQR)	All patients without rejection (N=25)	Degree of IF (Banff ci score)		P value
		ci 0 or 1 (n=10)	ci 2 or 3 (n=15)	
T1 mapping				
Cortical T1 (ms)	1323 (1216-1453)	1258 (1197-1320)	1441 (1287-1496)	0.010
Coronal T1 (ms)	1336 (1230-1458)	1243 (1203-1329)	1437 (1283-1471)	0.010
Axial T1 (ms)	1294 (1194-1436)	1236 (1185-1293)	1426 (1262-1527)	0.012
Cranial pole T1 (ms)	1294 (1197-1463)	1218 (1188-1276)	1458 (1297-1488)	0.004
Medullary T1 (ms)	1609 (1490-1733)	1531 (1461-1634)	1709 (1543-1787)	0.14
Δ T1	-274 (-403 to -182)	-289 (-374 to -254)	-249 (-476 to -176)	0.53
Diffusion-weighted imaging				
Cortical ADC (mm ² /s)	1.7 (1.6-1.8)	1.7 (1.6-1.9)	1.6 (1.6-1.8)	0.43
Medullary ADC (mm ² /s)	1.7 (1.6-1.8)	1.7 (1.6-1.8)	1.8 (1.7-1.8)	0.34
Δ ADC	-0.02 (-0.08-0.03)	0.03 (-0.003-0.06)	-0.06 (-0.13 to -0.02)	0.005
T2 mapping				
Cortical T2 (ms)	76 (69.5-94.5)	81.8 (70.5-93.8)	76.0 (68.8-93.8)	0.89
Coronal T2 (ms)	79.8 (73.6-97.9)	82.0 (73.8-94.5)	79.8 (73.6-99.6)	0.76
Axial T2 (ms)	75.3 (65.1-95.0)	81.8 (66.4-96.2)	75.3 (65.1-95.0)	0.64

ADC, apparent diffusion coefficient; Δ ADC, cortico-medullary difference of ADCs; IF, interstitial fibrosis; IQR, interquartile range; MRI, magnetic resonance imaging.

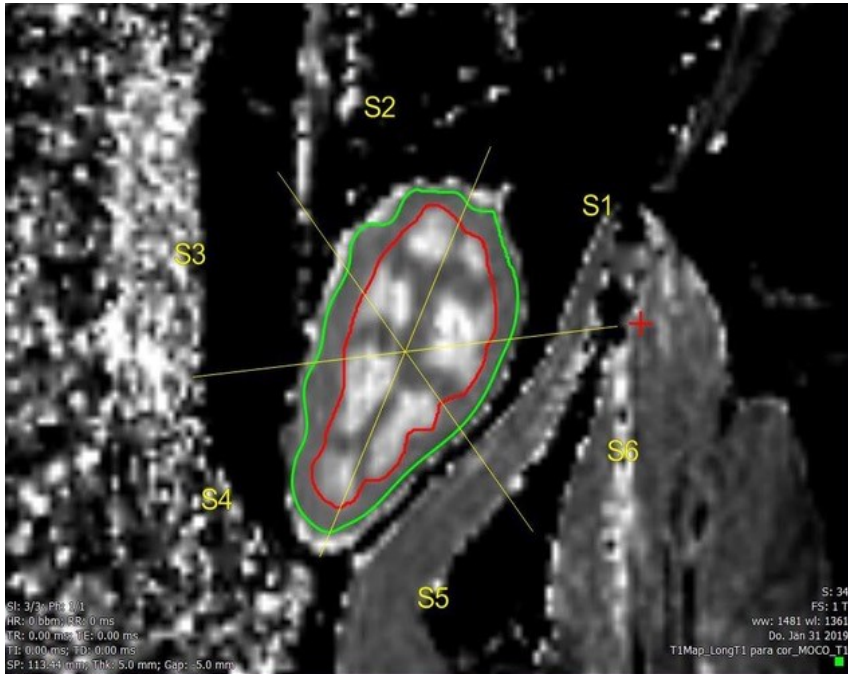
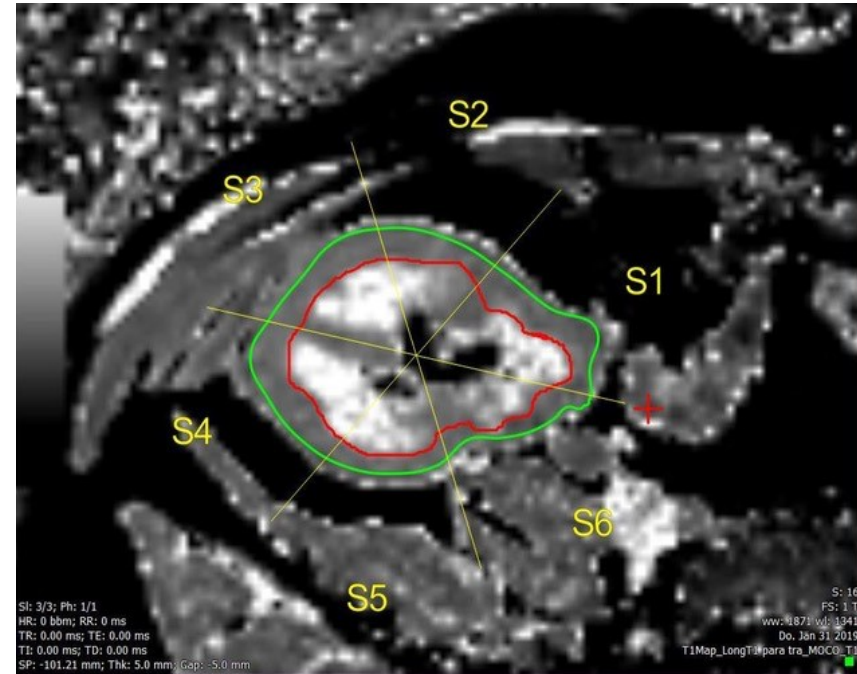
A**B**

Figure S1. Representative example of T1-weighted MRI of a kidney allograft in coronal and axial slices. MRI scans are shown for a representative study subject with low grade interstitial renal allograft fibrosis on histology (ci0). Representative coronal (A) and axial slices (B) are shown. Green and red lines indicate the outer and inner margins of the renal cortex, respectively. Each slice was divided in 6 segments (S1-S6). T1 relaxation time was measured for each of the segments.