

Acquisition recommendations: DWI

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Motivation

- Standardization is an important milestone in the validation of diffusion-weighted imaging (DWI) as renal MR-biomarker => technical recommendations on 3 variants of renal DWI techniques (monoexponential DWI, IVIM and DTI) and associated MRI biomarkers
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Methods

Literature review (until November 2018)

- Extraction of reported DWI biomarkers from 194 prior renal DWI studies (monoexponential DWI = 113 studies, DTI = 40 studies, IVIM = 41 studies)
 - Computing of Pearson correlations between diffusion biomarkers and protocol parameters
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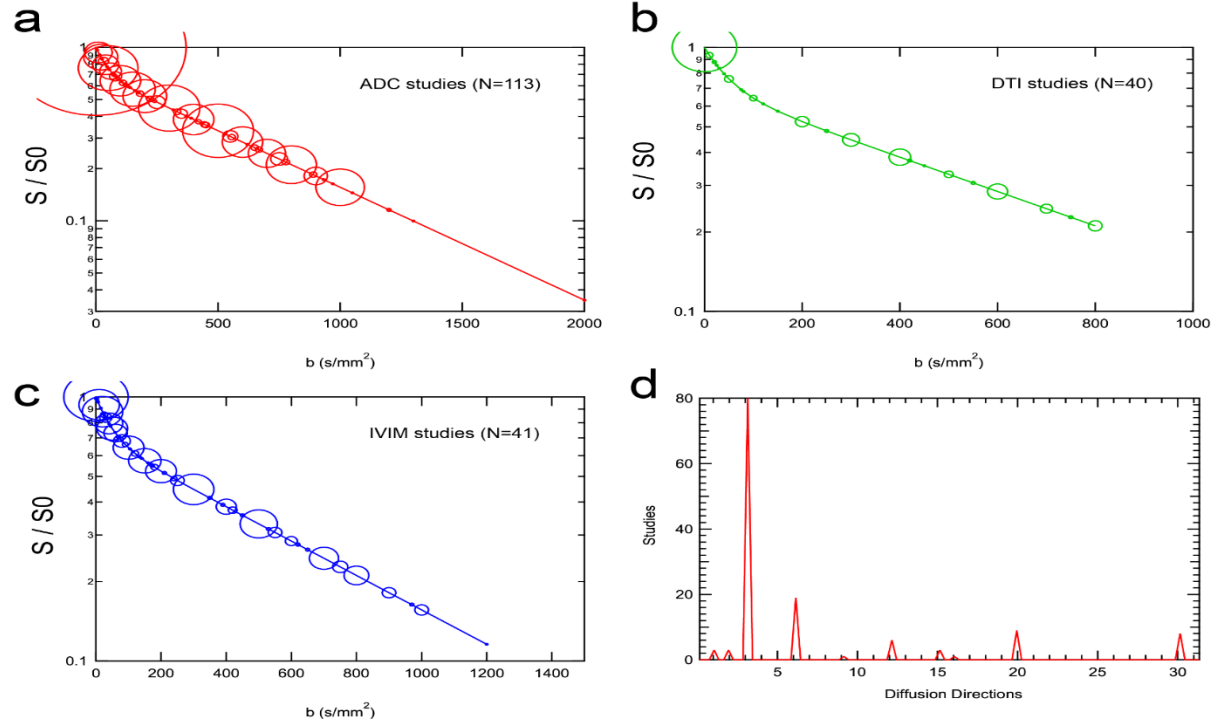
Methods

Survey process

- Surveys regarding acquisition procedure (preparation, acquisition, processing and reporting of renal DWI) were designed based on the literature review (87 questions)
 - Survey data were collected via Delphi consensus process (2 rounds of survey, 21 respondents), (consensus: $\geq 75\%$ agreement, preference: between 60% and 75%)
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Results

Literature




















Results

Survey



- 87 questions in total: 23 reached consensus agreement
18 reached consensus disagreement
16 same topics as the “parent” consensus questions
17 preferences
No consensus for 13 topics
 - Unsolved questions: diet before scan, slice thickness, TR, number of signal averages, breathing mode, separate vs. combined protocols for monoexponential DWI, DTI and IVIM studies, diffusion gradient waveform, number and highest b-value employed, number of diffusion directions for DTI, aspects of ROI prescriptions
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Recommendation

bold = consensus view of the expert panel
 = consensus ($\geq 75\%$)
 = preference preference ($\geq 60\%$)

Protocol option	Recommendation	Weight
Preparation	Normal hydration	
Field strength	1.5 T or 3.0 T	
Sequence	Single shot EPI	
Orientation	Oblique coronal	
Matrix	>128	
In-plane resolution	2-3 mm	
Slice thickness	>4 mm	
Coverage	Full kidney	
Parallel imaging factor	2	
Fat suppression	SPAIR	
TR (s)	4	
TE (ms)	Min (< 100)	
Averages	3	
Breathing mode	Respiratory gated (or free breathing with post-hoc motion correction)	
Cardiac gating	no	

Recommendation

bold = consensus view of the expert panel
 = consensus (>=75%)
 = preference preference (>=60%)

Protocol option	Recommendation			Weight
Diffusion gradients	Monopolar			
	ADC	IVIM	DTI	
# b-values	4	>6	>2	
Suggested b-values	0,100,200,800	0,30,70,100,200,400,800	0,200,800	
# directions	3	3	12 or more	
Time (min)	2	3.8	5	
Distortion correction	Recommended			
Registration	Recommended, unilateral if possible			
Image quality control	Recommended			
ROI placement	b=0 image			
Cortical ROI	1 stripe / slice ;> 3 slices			
Medullary ROI	3 samples / slice ;> 3 slices			
Reporting	Cortex and Medulla			
Metric statistics reporting	Mean, Median, Standard deviation, ROI size			
Diffusion units	10⁻³ mm² / s			
Map format	Colormap, fused with anatomy if possible			

Conclusion

- Recommendations should be taken into account when starting new studies in the field of renal DWI or reviewing submitted work in this area
 - Recommendations are intended to be updated when new evidence from ongoing or future studies is made available
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Thank you very much for your attention!

