Standard Operating Procedure: MRI Acquisition for ADPKD

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1. Scope

This document applies to all personnel responsible for ADPKD MR imaging. In order to obtain high quality **renal** and **hepatic** MRI imaging the following SOP has been developed. It is critical that this guideline is followed. Subjects having contraindications to or interference with MRI assessments will be excluded from participation (ferromagnetic metal prostheses, aneurysm clips, severe claustrophobia, large abdominal/back tattoos, subjects too large to fit safely in the magnet, etc.). Please refer to the protocol for more details regarding the scheduled visits.

2. Objective

This Standard Operating Procedure (SOP) aims to harmonize the procedure for ADPKD volumetry.

3. Requirements

- Regularly scheduled imaging for this purpose should be acquired in strict adherence to this SOP.
- Breath-holding instructions shall be given to the subject prior to imaging. It is critical to emphasize the importance of remaining motionless during the MRI scan particularly during the T1 sequence.
- Ensure that respiratory gating is used particularly during the T1 sequence if subjects cannot hold the breath adequately.
- Use your scanner's built-in software to reduce motion artifact if it is available.

For inquiries regarding these guidelines, please contact: Andreas Serra, info@adpkd.ch

4. Process

4.1 MRI QUALIFICATION

- Whole-body scanner operating at 1.5 Tesla or greater
- Commercially available phased array or torso coil
- Digital data transfer in DICOM format
- Digital images archived in an “uncompressed” format.

4.2 Preparation

Care should be taken to perform the examination for each subject at each MRI acquisition visit

- For all imaging sequences requested below, the subject will lie supine (on his/her back) on the magnet bed, head first, with arms either at his/her side or over the shoulders. Every effort should be made to assure the patient’s body is straight within the scanner.
- A phased-array surface or torso coil should be positioned with its center over the inferior costal margin, estimated as the upper margin of the kidney, inclusive of any cysts originating from the upper margin of the kidney covering the entire liver.
- When total liver and kidney volume are too large for one scan, than two separate scans have to be performed: 1 for total kidney volume and 1 for total liver volume.
- Breath-holding instructions shall be given to the subject prior to imaging. It is critical to emphasize the importance of remaining motionless during the MRI scan particularly during the T1 sequence.
- Every effort should be made to have a radiologist familiar with the requirements for this study review all images prior to the patient leaving the MRI suite in case it is advisable to repeat the images.

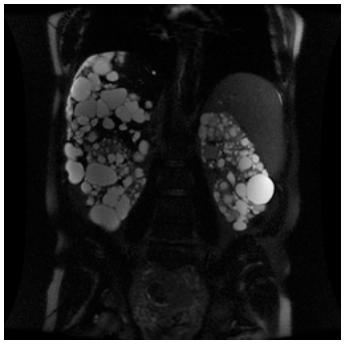
4.3 Localizers

Sites may prescribe their standard localizer (scout) parameters to locate the scan range of the liver and both kidneys inclusive any cysts in their entirety.

4.4 T2 single shot fast/turbo spin echo

Fat saturation and breath holding must be applied.

Parameters	Siemens	GE	Philips	Toshiba
Sequence	HASTE	SSFSE	SSTSE	FASE +6.5
Orientation	Coronal	Coronal	Coronal	Coronal
Slice thickness (mm)	4	4	4	4
Gap/spacing (mm)	0	0	0	0
FOV (cm)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)
Matrix	256x256	256x256	256x256	256x256
TE (ms)	≈ 100	≈ 190	≈ 70	≈ 78
TR (ms)	Infinite	≈ 1400 ms, max	≈ 1900 ms, max	≈ 1500 ms



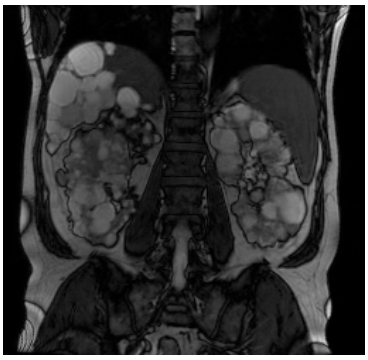
- Ensure one overlapping image (4 mm) between consecutive series when more than one series is required to cover both kidneys inclusive of any cysts in their entirety.
- Use the same position and package (#slices, FOV) as sequence FISP or FIESTA spoiled gradient echo. (#4.6)
- When the package cannot be scanned within a reasonably time or acceptable quality, it’s allowed to make 2 contiguous packages.

4.5 FISP or FIESTA 3D spoiled gradient echo

This will consist of a volumetric interpolated fast multislice spoiled gradient echo sequence. No fat saturation

should be used. **Note:** If your MRI center cannot perform this sequence, please provide a T2 single shot fast/turbo spin echo without fat saturation instead. To acquire this sequence, please follow the parameters above without fat sat.

Parameters	Siemens	GE	Philips	Toshiba
Sequence	TrueFISP in 3D	Fiesta in 3D	Balanced FFE in 3D	FFE3D2.6 ssfp200k
Orientation	Coronal	Coronal	Coronal	Coronal
Slice thickness (mm)	4	4	4	4
Gap/spacing (mm)	0	0	0	0
FOV (cm)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)
Matrix	256x256	256x256	256x256	256x256
TE (ms)	≈ 2	≈ 2	≈ 2	≈ 2.6
TR (ms)	≈ 7	≈ 7	≈ 7	≈ 5.2
Flip Angle (degrees)	40-50	40-50	40-50	40-50



- The kidneys and liver, including all cysts, have to be within the package.
- At front and back of the scan has to be at least 1 slice without liver, kidney and/or cyst.
- Backfolding in liver, kidney or cysts is not allowed. When needed the FOV maybe increased. IMPORTANT: use the same FOV for the follow-up visit of the patient involved.
- When the package cannot be scanned within a reasonably time or acceptable quality, it's allowed to make 2 contiguous packages.

4.6 T1-3D spoiled gradient echo

Parameters	Siemens	GE	Philips	Toshiba
Sequence	Turbo Flash 3D	Fast SPGR 3D	TFE 3D	FFE3D1.9 quick
Orientation	Coronal	Coronal	Coronal	Coronal
Slicethickness (mm)	4	4	4	4
Gap/spacing (mm)	0	0	0	0
FOV (cm)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)	30-35 (avoid wrap-around)
Matrix	256x256	256x256	256x256	256x256
TE (ms)	≈ 2	≈ 2	≈ 2	≈ 2
TR (ms)	≈ 4	≈ 4	≈ 4	≈ 4
Flip Angle (degrees)	≤15	≤15	≤15	≤15

- Use the same position and package (#slices, FOV) as sequence .
- When the package can not be scanned within a reasonably time or acceptable quality, it's allowed to make 2 contiguous packages.