



Clinical Protocol

## Renal Arteries

1. Aorta: Long images of aorta with measurements (prox, mid, and dist).
2. Common Iliac Arteries: Image right and left common iliac arteries in long and transverse with single trans (largest) diameter measurement.
3. IVC: Long image.
  - Include AP measurement if over 3.75 cm.
  - If IVC filter or catheter seen, localize with respect to hepatic/renal veins.
4. Bladder: Image long and trans.
  - Measure wall if thickened.
  - Demonstrate ureteral jets if hydronephrosis seen in either kidney or if suspected ureteral stone.
  - If requested, pre- and post-void residual volumes.
5. Kidneys: Long images (medial, mid, lateral) and trans images (upper, mid, lower) of both kidneys.
  - Record max measurement (long and trans) of kidneys.
  - Image comparison to adjacent liver/spleen.
  - Single color Doppler image of kidneys.
  - If absence of kidney, image renal fossa.
  - If hydronephrosis seen, also show ureteral jets.
  - If stones present, measure largest dimension of largest stone.
6. Prostate: Image and measure, if seen.
7. Spectral waveform to measure peak systolic velocity in aorta at level of renal arteries.
8. Assess and image entire extra-renal renal arteries in long axis using color/power Doppler. Record limitations of visualization.
9. Angle corrected\* spectral Doppler waveforms with peak systolic blood flow velocities and resistive index of all renal arteries prox (origin), mid, and dist. If significant stenosis, Doppler spectrum should be recorded within stenosis and distal to each stenosis.
10. Search for accessory renal arteries with evaluation as above. If renal artery (main or accessory) comes off iliac artery, calculate ratio to iliac artery velocity.
11. Spectral waveforms with acceleration times should be recorded from segmental arteries at upper, mid, and lower kidney – near hilum, at level of interlobar and segmental arteries (NOT at arcuate arteries). Lowest angle of insonation should be used (usually < 20 degrees).
12. Evaluate renal veins for patency.

\* For angle correction:

Angle  $\theta$  is Doppler angle between direction of flowing blood in vessel and applied Doppler ultrasound signal. Should not exceed 60 degrees. (The lower the angle, the better.) Angle  $\theta$  should not be preset!

INDICATIONS	DATE/TIME	
	SONOGRAPHER	

AORTA PSV (cm/s)	Right Renal Vein Patent?	Left Renal Vein Patent?
	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

RIGHT			Renal Artery (RA) PSV and Resistive Index (RI)	LEFT		
EXTRARENAL	PSV (cm/s)	RI		EXTRARENAL	PSV (cm/s)	RI
Prox				Prox		
Mid				Mid		
Dist			Dist			

RA PSV / Aortic PSV = R/A Ratio _____ / _____ = _____	<b>R/A Ratio</b>	RA PSV / Aortic PSV = R/A Ratio _____ / _____ = _____
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INTRARENAL	AT (sec)	Acceleration Time (AT)	INTRARENAL	AT (sec)
Upper			Upper	
Mid			Mid	
Lower			Lower	

**Interpretation Criteria**  
 Normal R/A Ratio < 3.5. Abnormal R/A Ratio > 3.5 (indicates 60% or greater diameter reduction).  
 AT > 0.070 sec consistent with RAS. RI < 0.5 suggests RAS.  
 If unable to rely on aortic PSV due to aortic stenosis or other aortic pathology, RAS then indicated by RA PSV of 180-200 cm/s or greater.

**Findings/Limitations/Comments**

SONOGRAPHER CONFIRMATION: My signature confirms that instructions have been provided to the conscious patient regarding this exam, that US utilizes sound waves rather than ionizing radiation, and that coupling gel is used to improve the quality of the exam.	_____ Sonographer's Signature
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FMC    KMC    CMC    TMC    NHSC	Name / MR # / Label
KIC    MIC    PI    TI	
MFP    SFP    Other	

**US Renal Arteries Worksheet**