

RENAL TRANSPLANT & EN BLOC RENAL TRANSPLANT ULTRASOUND PROTOCOLS

URENTX – Evaluation of Renal TX with or without spectral doppler

URENTXBX – Renal Transplant with Biopsy

****For repeat exams within 7 days, limited 2D and color doppler examination for fluid collections or hydronephrosis is acceptable. Spectral doppler does not need to be repeated unless indicated, or previously abnormal.**

PATIENT PREP: No Prep

IMAGES TO OBTAIN

Kidney Transplant:

- Document and label its location in pelvis. (RLQ or LLQ)
- Measure sagittal kidney length
- Sagittal images of medial, mid and lateral sections
- Transverse images of upper, mid, and lower poles
- Document presence of stent is seen.

Assess for fluid collections:

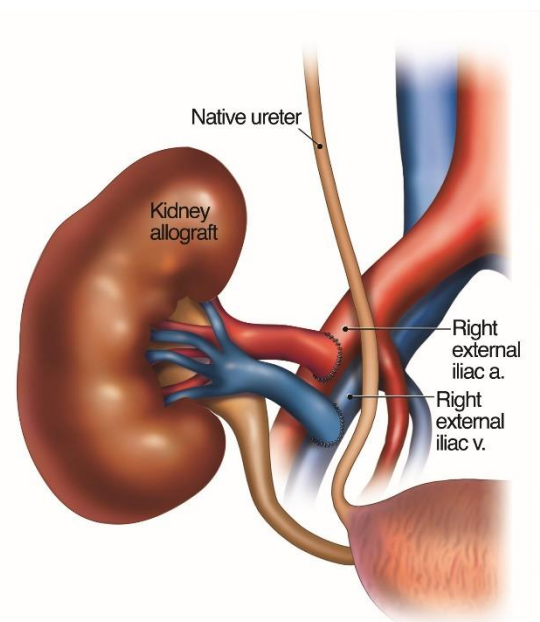
- Document any fluid collections with and without color doppler images.
- Include sagittal and transverse measurements of any collections seen.

Bladder and Ureter:

- Sagittal and transverse 2D images. Show stent if present
- Document and measure the ureter if seen. Show stent if seen within.

Color Doppler Images

- Color image of sagittal kidney to show perfusion throughout using MFI color doppler when available.
- Document proximal, mid and distal segments of the main renal artery with color doppler and determine number of arteries present.
- Document proximal, mid and distal segments of the main renal vein with color doppler and determine the number of veins present.

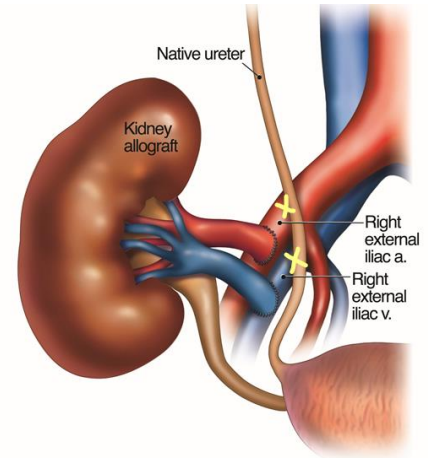


- Evaluate for arterial venous fistulas (AVF) in patients with hematuria or if a bruit is heard on exam. Renal biopsy is the most common cause of AVF, the inferior pole will be the most likely location of AVF caused by renal biopsy.
 - AVF will be seen as an area of aliasing on color doppler images that will persist with increased color doppler scale.
 - Measure size of area where aliasing is seen.
 - Use spectral doppler to sample the area. Waveforms will show turbulent flow with high velocity and a color thrill.
 - Pulsatility can be seen in renal veins when a AVF is present

PULSED WAVE/SPECTRAL DOPPLER:

External Iliac Vessels:

- Iliac artery velocity superior/proximal to anastomosis (see image).
- Iliac vein velocity superior to anastomosis (see image).



Intrarenal Arteries:

- Resistive Index (RI) of the Intrarenal arteries at the superior, mid and inferior poles.
 - Sample should be obtained from the distal segmental arteries within the cortex.
 - The normal range for the RI is 0.50 – 0.80.
 - Compare to previous exams to evaluate for changes in RI, arterial velocities, upstroke or waveform.

Main Renal Vein:

- Document velocities at the anastomosis. If more than one vein, include velocities for each.
 - Normal Peak velocity in MRV is < 100 cm/s. If velocity is increased, put patient in LLD or RLD position and reevaluate for change in velocity.
 - Evaluate any other areas of vein if aliasing is seen on color doppler or if flow in vein is turbulent.

Main Renal Artery:

- Document velocities at distal, mid and proximal artery with angle correction. The proximal velocity should be evaluated at the anastomosis. There is often more than one main renal artery, evaluate the velocity in each according to the type of anastomosis present. See types of graft anastomoses below for where to sample.
 - Peak velocity in MRA should be less than 200cm/s (angle corrected). If velocity is greater than 350 cm/s, put patient in LLD or RLD position and reevaluate for change in velocity.
 - Compare to previous exams to evaluate for changes in arterial velocities, upstroke or waveform.

- **TYPES OF KIDNEY GRAFT ANASTOMOSES:**

- **Single Artery:**

- Document: Proximal (at the anastomosis), Mid and Distal velocities

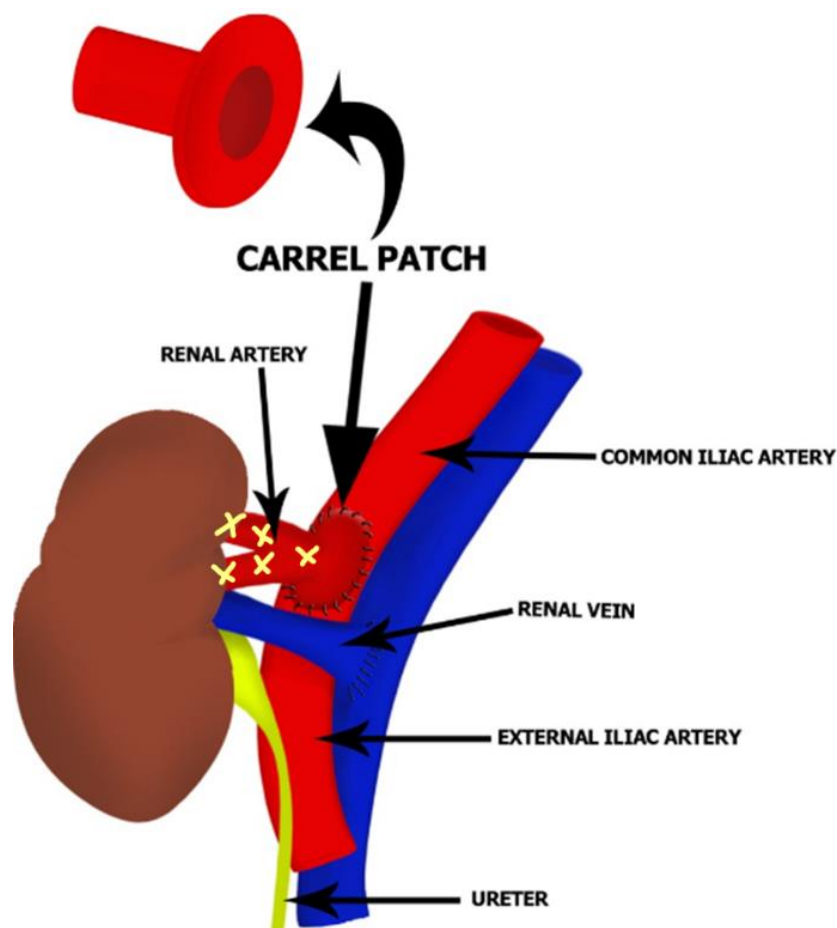
- **2 (or more) Arteries with Separate Anastomoses:**

- Document: Proximal (at the anastomosis), Mid and Distal velocities for each artery.
- Label with appropriate location, ie Superior MRA and Inferior MRA
- Be sure to compare prior velocities to the corresponding vessel.

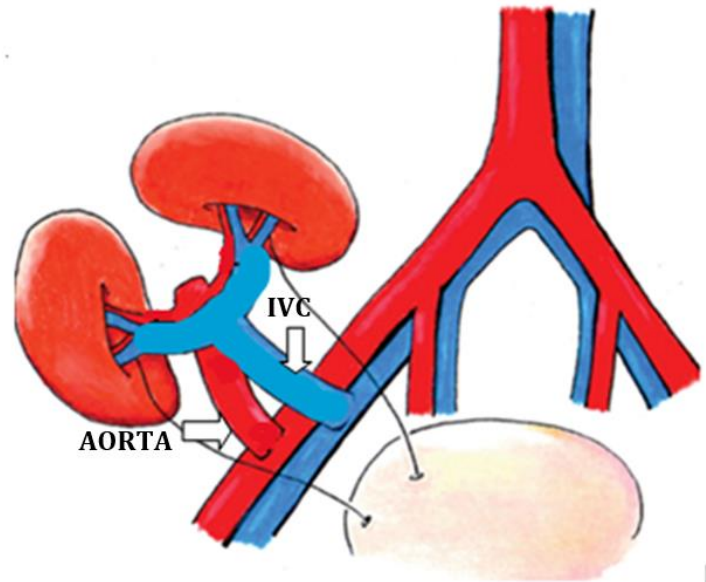
- **2 (or more) Arteries on a Carrel Patch:**

- Proximal artery at the COMMON anastomosis. Report the same velocity for both arteries. The proximal artery/anastomosis is the same for both arteries if on a Carrel Patch.
- Separate Mid and Distal velocities for each artery.

Illustration of Carrel Patch and sample locations:



EN BLOC RENAL TRANSPLANT PROTOCOL:



IMAGES TO ACQUIRE:

Medial and Lateral Kidney Transplants:

- Document each kidney and label its location in pelvis. (RLQ or LLQ and MEDIAL or LATERAL kidney.)
- Measure sagittal length of each kidney
- Sagittal images of medial, mid and lateral sections of each kidney
- Transverse images of upper, mid, and lower poles of each kidney
- Document presence of stent if seen.

Assess for fluid collections:

- Document any fluid collections with and without color doppler images.
- Include sagittal and transverse measurements of any collections seen.

Bladder and Ureter:

- Sagittal and transverse 2D images. Show stent if present
- Document and measure the ureter if seen. Show stent if seen within.

Color flow images:

- Color image of each sagittal kidney to show perfusion throughout.
- Document the donor Aorta at the anastomosis to the External Iliac Artery
- Document each Renal Artery with color doppler
- Document the donor IVC at the anastomosis to the External Iliac Vein
- Document each Renal Vein with color doppler
- Evaluate for arterial venous fistulas (AVF) in patients with hematuria or if a bruit is heard on exam. Renal biopsy is the most common cause of AVF, the inferior pole will be the most likely location of AVF caused by renal biopsy.
 - AVF will be seen as an area of aliasing on color doppler images that will persist with increased color doppler scale.
 - Measure size of area where aliasing is seen.
 - Use spectral doppler to sample the area. Waveforms will show turbulent flow with high velocity and a color thrill.
 - Pulsatility can be seen in renal veins when a AVF is present

Pulsed wave/Spectral Doppler:

External Iliac Vessels:

- Iliac artery velocity superior/proximal to anastomosis (see image on page 2)
- Iliac vein velocity superior to anastomosis (see image on page 2)

Intrarenal Arteries:

- Resistive Index (RI) of the Intrarenal arteries at the superior, mid and inferior poles of each kidney (medial and lateral).
 - Sample should be obtained from the distal segmental arteries within the cortex.
 - The normal range for the RI is 0.50 – 0.80.
 - Compare to previous exams to evaluate for changes in RI, arterial velocities, upstroke or waveform. Be sure to compare to corresponding kidney from prior exam.

Donor Arteries:

- **Proximal Aorta:** Velocity taken at the anastomosis to external iliac artery. Report the same velocity for both kidneys. The proximal artery/anastomosis is the same for both kidneys.
- **Mid Aorta:** Velocity taken just proximal to the bifurcation of the main renal arteries. Report this velocity for both kidneys. Since the mid artery sample should be sampled within the Aorta, it is the same for both kidneys.
- **Distal Renal Arteries:** Velocity taken at the hilum of each kidney
 - Peak velocity in MRAs and donor Aorta should be less than 200cm/s with appropriate angle correction. If velocity is high, put patient in LLD or RLD position and reevaluate for change in velocity.
 - Compare to previous exams to evaluate for changes in arterial velocities, upstroke or waveform.

Donor Veins:

- **IVC:** Velocity at anastomosis to external iliac vein. Report this velocity for both kidneys. The proximal artery/anastomosis is the same for both kidneys.
 - Normal Peak velocity in MRV and IVC is < 100 cm/s. If velocity is increased, put patient in LLD or RLD position and reevaluate for change in velocity.
 - Evaluate MRV of donor IVC in other areas if aliasing is seen on color doppler, or if flow in vein is turbulent.

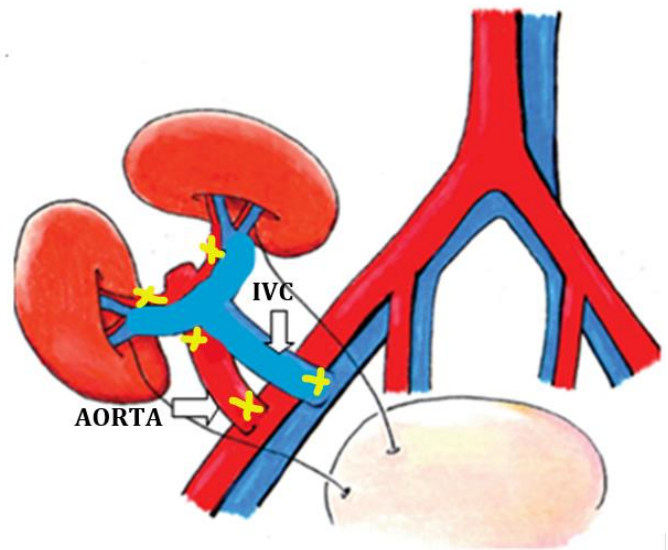
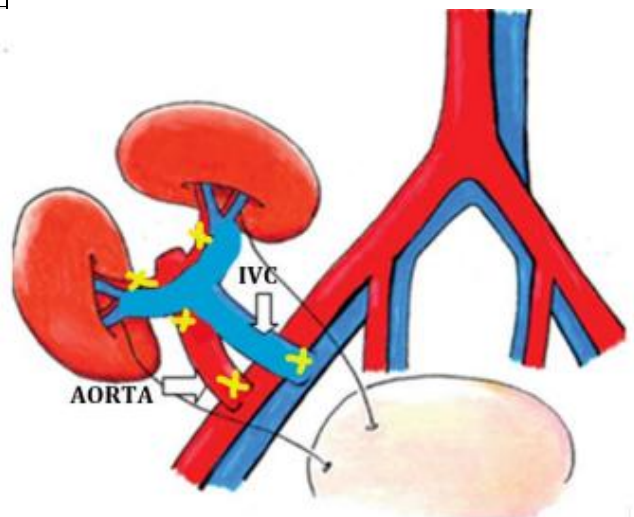


Illustration of En bloc sample locations:

EN BLOC RENAL TRANSPLANT IMAGE LIST

IMAGE	MODE	IMAGE	MODE
Lateral Kidney Sag Mid	2D	Lateral MRA length mapped with color	Color
Lateral Kidney Sag Mid w/ measurement	2D +	Lateral MRA Distal <i>velocity w angle correction</i>	Spectral cm/s
Lateral Kidney Sag w/ color for perfusion	Color	Medial MRA length mapped with color	Color
Lateral Kidney Sag w/ MFI for perfusion	MFI	Medial MRA Distal <i>velocity w angle correction</i>	Spectral cm/s
Lateral Kidney Sag Med	2D	Donor Aorta & Anast mapped with color	Color
Lateral Kidney Sag Lat	2D	Donor Aorta Mid Vessel	Spectral cm/s
Lateral Kidney Trans Sup	2D	<i>velocity w angle correction</i>	
Lateral Kidney Trans Mid	2D	Donor Aorta Prox at EIA Anast	Spectral cm/s
Lateral Kidney Trans Inf	2D	<i>velocity w angle correction</i>	
<i>Eval for AVF if hematuria, bruit, pulsatile veins or recent biopsy</i>	Color	Repeat in LLD if artery >350cm/s	Spectral cm/s
		<i>Repeat Distal MRAs if multiple arteries to either kidney</i>	Spectral cm/s
Medial Kidney Sag Mid	2D		
Medial Kidney Sag Mid w/ measurement	2D +	Donor IVC at EIV Anast	Spectral cm/s
Medial Kidney Sag w/ color for perfusion	Color	<i>velocity w angle correction</i>	
Medial Kidney Sag w/ MFI for perfusion	MFI	Repeat in LLD if vein >100cm/s	Spectral cm/s
Medial Kidney Sag Med	2D	<i>MRV hilum or areas of aliasing if needed</i>	Spectral cm/s
Medial Kidney Sag Lat	2D		
Medial Kidney Trans Sup	2D	External Iliac Artery (superior to anastomosis) <i>velocity w angle correction</i>	Spectral cm/s
Medial Kidney Trans Mid	2D		
Medial Kidney Trans Inf	2D	External Iliac Vein (superior to anastomosis) <i>velocity w angle correction</i>	Spectral cm/s
<i>Eval for AVF if hematuria, bruit, pulsatile veins or recent biopsy</i>	Color		
		Stent - kidney end if present	2D
		Stent - bladder end if present	2D
Eval for fluid collections under new incisions and around transplants	2D/Color		
		Bladder Sag	2D
Medial Kidney Superior Arcuate Artery RI	Spectral RI	Bladder Trans	2D
Medial Kidney Mid Arcuate Artery RI	Spectral RI	<i>Bladder jet if hydro</i>	Color
Medial Kidney Inferior Arcuate Artery RI	Spectral RI	<i>Post void if hydro</i>	2D
Lateral Kidney Superior Arcuate Artery RI	Spectral RI		
Lateral Kidney Mid Arcuate Artery RI	Spectral RI		
Lateral Kidney Inferior Arcuate Artery RI	Spectral RI		



RENAL TRANSPLANT IMAGE LIST

IMAGE	MODE
Kidney Sag Mid	2D
Kidney Sag Mid w/ measurement	2D +
Kidney Sag w/ color for perfusion	Color
Kidney Sag w/ MFI for perfusion	MFI
Kidney Sag Med	2D
Kidney Sag Lat	2D
Kidney Trans Sup	2D
Kidney Trans Mid	2D
Kidney Trans Inf	2D
<i>Eval for AVF if hematuria, bruit, pulsatile veins, or recent biopsy</i>	Color
Eval for fluid collections under new incisions and around transplant	2D/Color
Superior Kidney Arcuate Artery RI	Spectral RI
Mid Kidney Arcuate Artery RI	Spectral RI
Inferior Kidney Arcuate Artery RI	Spectral RI
MRA length mapped	Color
MRA Distal <i>velocity w angle correction</i>	Spectral cm/s
MRA Mid <i>velocity w angle correction</i>	Spectral cm/s
MRA Prox/Anast <i>velocity w angle correction</i>	Spectral cm/s
Repeat in LLD if artery >350cm/s	Spectral cm/s
<i>Repeat if multiple arteries</i>	
MRV length mapped	Color
MRV Anast <i>velocity w angle correction</i>	Spectral cm/s
Repeat in LLD if vein >100cm/s	Spectral cm/s
<i>MRV hilum or areas of aliasing if needed</i>	<i>Spectral cm/s</i>
<i>Repeat if multiple veins</i>	
External Iliac Artery (superior to anastomosis) <i>velocity w angle correction</i>	Spectral cm/s
External Iliac Vein (superior to anastomosis) <i>velocity w angle correction</i>	Spectral cm/s
Stent -kidney end if present	2D
Stent -bladder end if present	2D
Bladder Sag	2D
Bladder Trans	2D
<i>Bladder jet if hydro</i>	<i>Color</i>
<i>Post void if hydro</i>	<i>2D</i>

