MARY WASHINGTON HEALTHCARE IMAGING SERVICES

DIALYSIS FISTULA & GRAFT CRITERIA

Normal flow characteristics:

1. Normal flow in a dialysis access graft is disorganized with PSV remaining fairly consistent throughout the graft.
2. Inflow artery has low resistance flow with spectral broadening & PSV 100-250cm/s.
3. AV access will typically have a thrill or vibration due to turbulent flow within the graft or vein.

Mature fistula ultrasound findings:

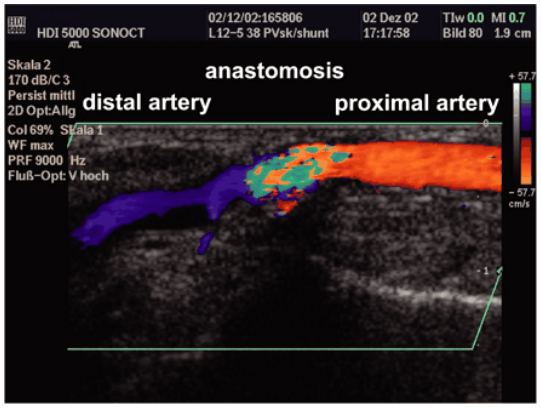
1. Diameter ≥4mm
2. Depth of no more than 5 mm from surface of the skin.

Suggested findings and values to help determine if access if failing:

1. Loss of thrill replaced with prominent pulsatility
2. Luminal diameter reduction >50% with the luminal diameter ≤2-3mm
3. Peak systolic flow velocity >400 cm/s
4. End diastolic velocity >250 cm/s
5. PSV ratio >3
6. Mid fistulae velocity of <150 cm/s (Note, velocities <150 cm/s may be normal in synthetic straight and loop interposition grafts.)
7. High resistant inflow artery Doppler waveform may indicate an outflow venous stenosis.
8. Inflow artery or outflow vein focal velocity increase with a doubling in the PSV.

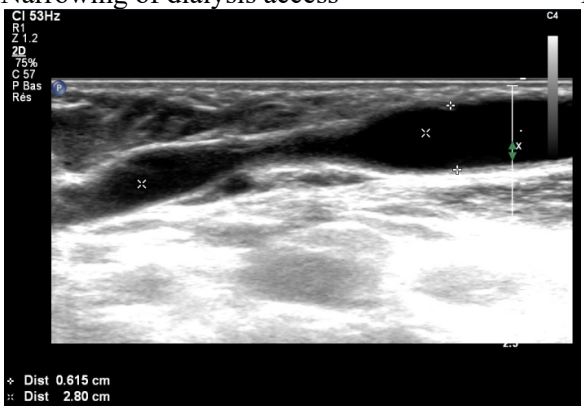
Steal phenonomen: Retrograde flow in the outflow radial artery of the mature fistula is present in 75-90% of patients, i.e. from the wrist to the fistula vein, effectively "stealing" blood from the ulnar artery via the palmer arch and can jeopardize adequate perfusion of the hand. Usually, the steal phenomenon is clinically silent and the patient remains asymptomatic. Steal syndrome is converted from a steal phenomenon when compensatory mechanisms to maintain peripheral arterial perfusion fails.

Retrograde flow can be demonstrated on duplex-see below. A steal may be diagnosed if PVR waveforms and/or digit pressures augment significantly during graft/fistula compression.

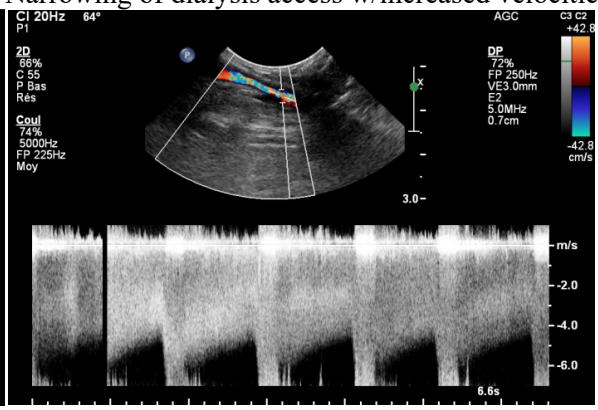


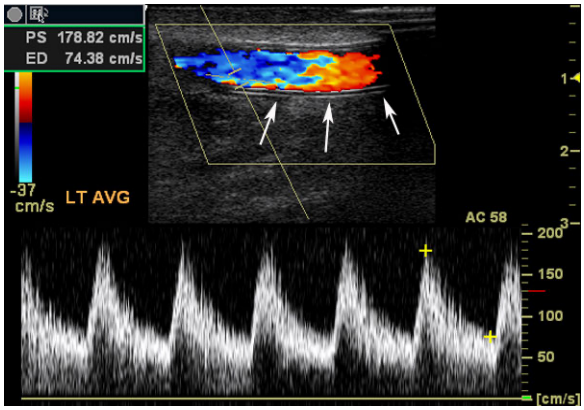
Retrograde inflow of blood into the access during diastole

Narrowing of dialysis access

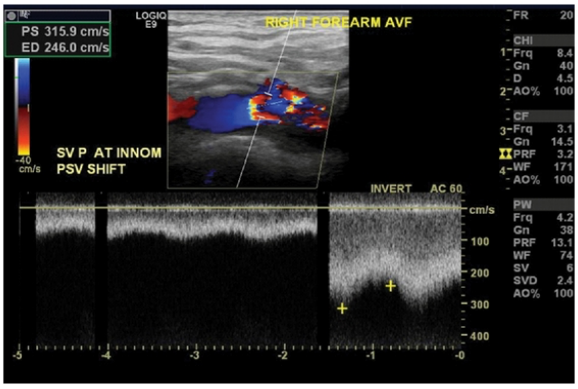


Narrowing of dialysis access w/increased velocities

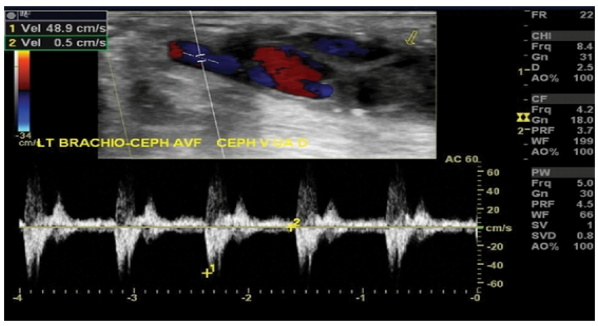




Patent dialysis access



Turbulence & velocity shift at confluence of subclavian & innominate veins indicate presence of outflow stenosis



Thrombosed brachiocephalic fistula. Waveforms with to & from flow indicative of no outflow.

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References:

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2) Utility of Duplex Ultrasound for Evaluation of Hemodialysis Access and Selection for Intervention of Non-Maturing Conduits. Dennis Bandyk, MD
3) Guidelines For Ultrasound Examination of Hemodialysis Access Grafts-Carol Miranda, RDCS, RDMS, RVT.
4) Ultrasound Assessment in the Maintenance and Planning of Hemodialysis Access Grafts and Fistulas, Carol Miranda, RVT, RDMS, Wilkes-Barre, PA