Hemodialysis Access Surveillance

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Postoperative AV Fistula Evaluation

- Failure of maturation
- Stenosis
- Perigraft mass/Fluid collection
- Graft and anastomotic pseudoaneurysms
- Central venous stenosis
- Ischemic steal syndrome

Postoperative examination protocol

- Evaluate arterial inflow
- Graft body
- Venous outflow
- Distal digital perfusion with and without fistula compression in patients with possible ischemic steal syndrome

Postoperative AVF Protocol

- Patient is supine
- 5 or 7 MHz transducer is used
- 60 degree angle
- Increase the velocity scale
Postoperative AVF Evaluation

- Proximal native artery (above AVF)
- Native artery below anastomosis
- Arterial anastomosis and graft body
- Mid graft PSF or PSV
- Distal venous anastomosis
- Outflow vein
- Central vein

Normal AV Graft Waveform

Normal Findings

- Pulsatile flow
- Low resistance waveform with high, forward diastolic flow
- High amplitude (systolic and diastolic)
- Spectral broadening
- Characteristics similar to stenotic ICA

Diagnostic Criteria for Stenosis

- Indirect:
  - Proximal arterial waveform analysis
  - Diastolic to systolic velocity ratio (Vd/Vs)
    - Normal > 0.4  Abnormal < 0.3
- Direct:
  - Peak systolic frequency (PSF)
  - PSF ratio
  - Volume flow
Threshold Criteria for AVF Stenosis

- Vd/Vs < 0.3
- PSF and PSF ratio (F)
  - autogenous AVF > 12 kHz
  - prosthetic AVF > 10 kHz or F > 3.5
  - efferent vein > 8 kHz
- Volume flow < 450 ml/min

Indirect tests

- When the waveform in the native artery proximal to the AVF origin reverts to a triphasic one or exhibits decreased diastolic forward flow, this reflects the development of AVF stenosis.
- Ratio of diastolic to systolic flow should be greater than 0.3.

Indirect test: Inflow arterial waveform

Inflow arterial waveform above origin of AVF should be low resistance. If high resistance waveform develops, AVF or outflow stenosis is suggested.
Indirect test: Vd/Vs

Normal AVF:
Vd/Vs > 0.4 indicating a low resistance outflow tract

Problems with routine AVF surveillance


- Is prophylactic correction of such lesions in the absence of fistula malfunction beneficial?

Proposed benefit of routine surveillance

- PTA for stenosis > 50%
- Duplex surveillance and elective revision resulted in a mean of 1223 days of access patency compared to 689 days in the thrombectomy and revision group (p=0.013)

Proposed benefit of routine surveillance

- PTA for stenosis > 50% in prosthetic grafts
- Stenosis identification with elective PTA had markedly improved patency compared to thrombolysis and revision/PTA (p<0.0001)
**Lack of surveillance benefit: A prospective randomized trial**

- 170 pts, 136 (80%) with PTFE grafts
- 65 stenoses >50% detected by surveillance, 64 confirmed by fistulography and randomized to observation versus PTA
- Surveillance by duplex every 2 months
- No difference in 6 and 12 month patency rates (80% confidence limit for >20% difference)

*Lumsden et al. JVS. 26:382-92, 1997.*

**AVG Graft Surveillance**

- AVG screening (Qa or DUS) increases stenosis detection but does not reduce graft thrombosis or prolong graft survival
- Whether DUS and pre-emptive angioplasty reduces graft survival is unknown (mixed results, Level I and II evidence)
  - Polkinghorne, Nephrology 2008; 13, S1-11


- Of 1,613 identified citations, 69 full articles were retrieved, and 12 randomized controlled trials comparing access screening
- No evidence that screening with blood flow measurements or Doppler ultrasound is of benefit to patients with grafts. Access blood flow screening may prevent access thrombosis in AV fistulas...
Surveillance of arteriovenous hemodialysis access: a systematic review and meta-analysis

UK Guidelines - 2011

- **Guideline 4.3 – Vascular access surveillance**
  - We suggest that systematic observation and advanced surveillance should be employed to predict and prevent access failure (2C)
    - Blood flow: AVG < 600 ml/min and AVF < 300 ml/min suggest at risk graft

http://www.renal.org/guidelines/modules/vascular-access-for-haemodialysis


- Our current approach to postoperative AV access imaging
  - Useful to evaluate failure of maturation: where is the lesion? Is it focal and potentially remediable?
  - Otherwise, we evaluate AVF’s only for problems: decreased thrill, bruit; high intragraft (>50 mm Hg) or venous pressure (> 150 mm Hg at 200ml/min) on dialysis
  - Recirculation > 15-20%
  - Interventional nephrologists with dedicated outpatient suites follow alternate algorithms
UREA REDUCTION RATE: TARGET 70%

- Normally functioning fistula
- Stenosis
- Post PTA

Graph showing urea reduction rate from Nov '05 to Mar '06 with target at 70%.