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Vascular Access Monitoring



Disclosures

None

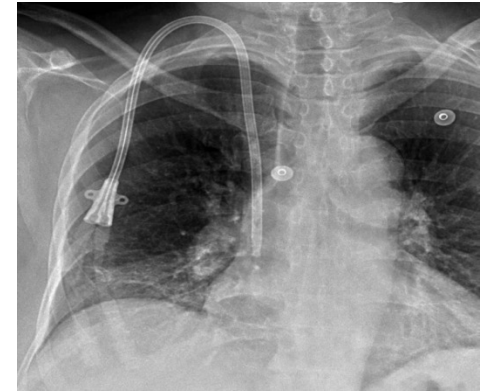
Objectives

Define	Monitoring Vs. surveillance of vascular access
Discuss	Symptoms and signs of vascular access dysfunction
Describe	Methods of vascular access monitoring



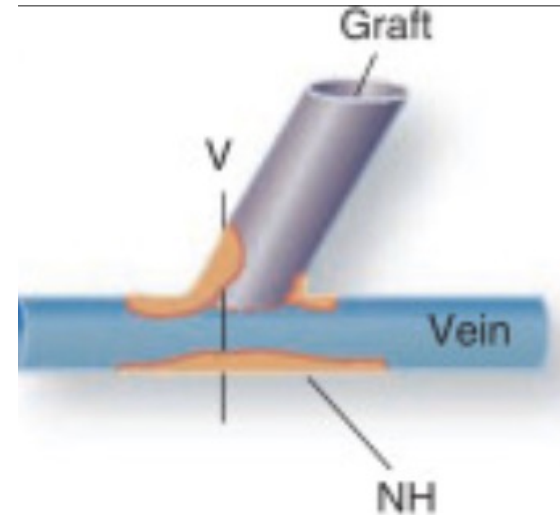
- AV fistula and AV graft are considered superior to catheter access

Ideal Vascular Access remains a Fantasy...



Common issues with vascular access

- **Primary failure due to poor maturation of AVF**
 - 25-60% failure rate
- **Neo-intimal hyperplasia causes stenosis in established access**
 - AVG: Mainly at the venous anastomosis
 - AVF: inflow and outflow



And The Result Is.....

- **Thrombosis as a result of stenosis**
 - AVG > AVF
 - Each thrombotic event reduces the survival of access



Guidelines

- KDOQI 2020 guideline 13.1, 13.2 and 13.e recommend regular physical examination of AVF and AVG, and training of nephrology trainees and practitioners in examination of dialysis access
- **Fistula First** Change Concept 9 suggests:
 - Monitoring and maintenance to ensure adequate access function
 - Post-operative physical evaluation of (new) AVFs in 4 weeks

Definitions

Monitoring refers to the examination and evaluation of the vascular access to detect physical signs that would suggest pathology

Surveillance involves periodic evaluation of access by special tests requiring special instruments that would suggest pathology, e.g.,

- Access flow
- Intra access pressure and resistance
- Doppler duplex ultrasound imaging

Monitoring and Surveillance- When and Why

- New AVF
 - Identify primary failure for intervention or revision
- Established AVF/AVG
 - Early detection of problem to prevent thrombosis, prolong patency and improve adequacy of dialysis treatment
 - Reduce catheter use
 - Improve quality of life for patient- and dialysis staff

AV Access Monitoring Begins With a Good History!

- Prior central venous catheters, pacemaker, AICD
- Swelling of arm, breast
- Prolonged bleeding, extravasation/infiltration
- Frequent clotting
- Difficulty with needle placement, pulling clots
- Presence of dilated collaterals, aneurysms



Initial Evaluation of AVF

- Should evaluate maturity and adequate flow at 4 weeks after creation
- Rule of 6' s for 'maturity'
 - 6mm diameter
 - 6mm or less in depth
 - 6cm straight segment for cannulation
 - 600ml/minute blood flow

Physical Examination

- An art- not always taught or learned enough
- Should be done before every use (at least weekly), starting with first use
- Look, listen and feel! (Inspection, palpation, auscultation)
- Effective:
 - Positive predictive value as high as 70-80% in multiple studies

Physical Examination: Key Components

- Identify site and type of access
- Look for
 - Extravasation
 - Evidence of infection
 - Aneurysms
- Listen for continuous vs. intermittent systolic bruit
 - High pitch bruit suggests stricture or stenosis



Poor Arterial Flow to *Distal Limb*



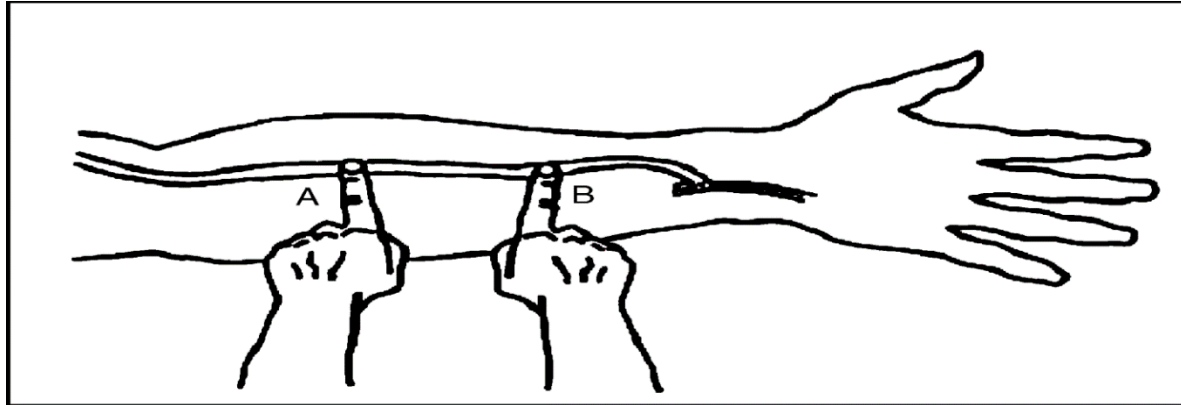
Ischemic Ulcers

Physical Examination- Key components

- Pulse
 - Hyperpulsation in AVF indicates stenosis
 - Hypopulsation in AVF may indicate inflow stenosis causing inadequate arterial filling
- Thrill
 - Palpable thrill in a graft at arterial, mid and venous end predicts flow >450ml/minute
 - A palpable thrill in axilla predicts flow >500ml/minute

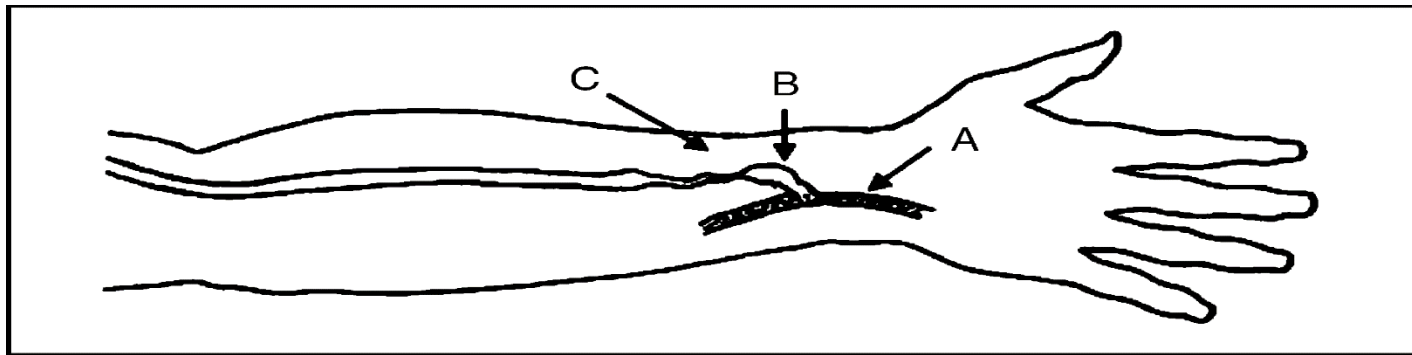
Examining AVF Inflow: Augmentation Test

- Feel pulse or thrill at anastomosis and its progression and strength
- Occlude the fistula at point A and feel at point B for increase in strength
- If poor augmentation, indicates poor inflow

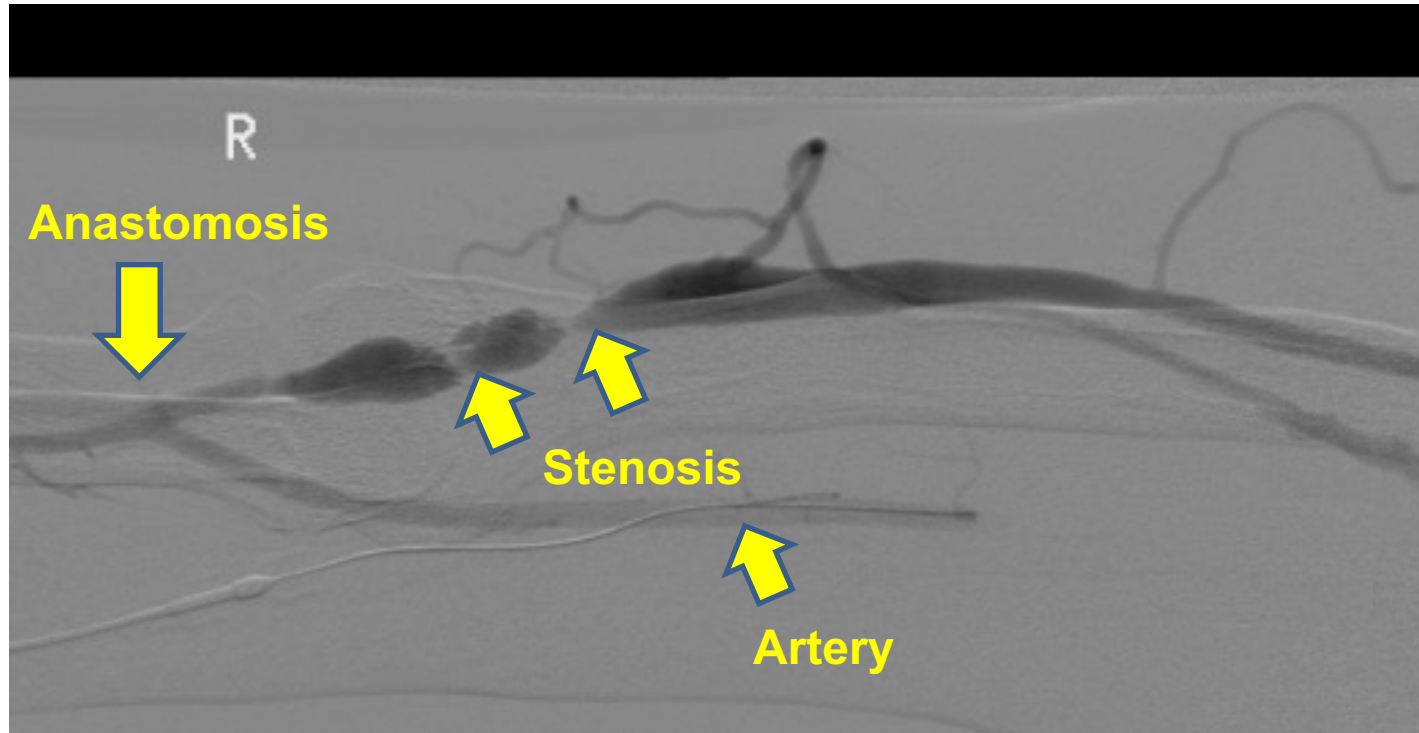


Examining for Juxta-Anastomotic Stenosis

- Excellent pulse at anastomosis (B) with dilated vein, but poor or no thrill
- Poor progression of pulse (C) and collapsible vein- indicative of JAS



Juxta-Anastomotic Stenosis



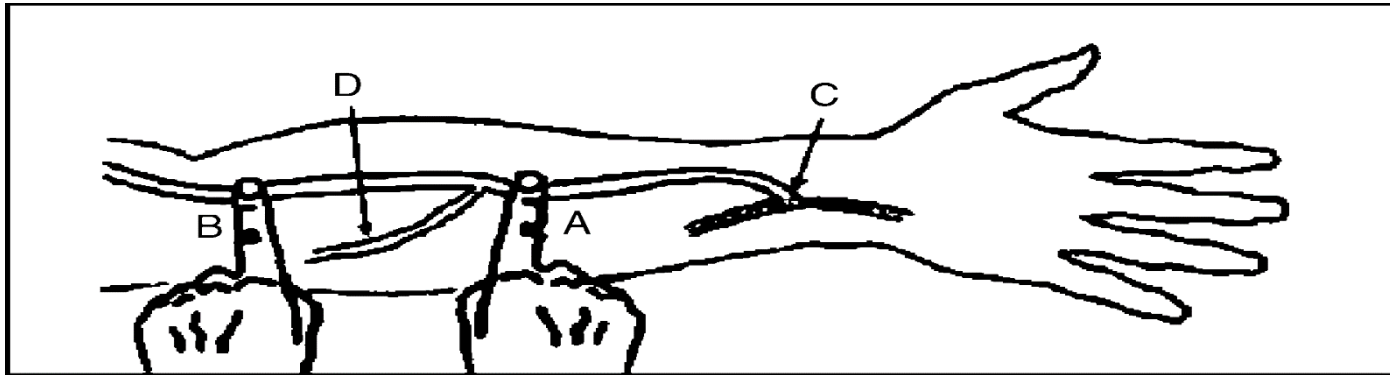
Examination for Venous Outflow Stenosis

- **Arm Elevation Test**
 - The AVF should be distended in dependent position
 - Upon raising the arm above the head, the fistula should collapse
 - Failure to collapse will indicate stenosis in outflow



Accessory Veins: Sequential Compression Test

- Occlude AVF as in augmentation test (A), should develop strong pulse
- Continue to move the hand further up on the vein (B)
- If there is an accessory vein, the pulse will disappear, and thrill will return



Other Methods of Clinical Monitoring

- Unexplained ↓ in dialysis delivery (Kt/V , URR)
- ↑ negative pre pump pressure \equiv poor inflow
- ↑ venous chamber pressure \equiv outflow obstruction
- Measurement of Recirculation
 - May be effective for AVF, not for AVG
 - Late in detecting stenosis
 - More expensive than physical examination

Efficacy and Benefits of monitoring

- Monitoring detects stenosis well- a high positive predictive value >70% in many studies
- More economical and compares quite favorably to surveillance with
 - Static Pressure monitoring (92%)
 - Flow monitoring (80% with ultrasound and 93% with dilution)

Potential Advantages of Monitoring

- Keeps AV access patent
- Avoids under-dialysis due to poor access flow
- Reduces missed treatments due to clotted access and maximize chair utilization
- Improves quality of life
- Easy and economical

When done by expert staff on a routine basis, monitoring itself may be sufficient to detect stenosis potentially making added surveillance redundant

Strategies to Salvage AV Access

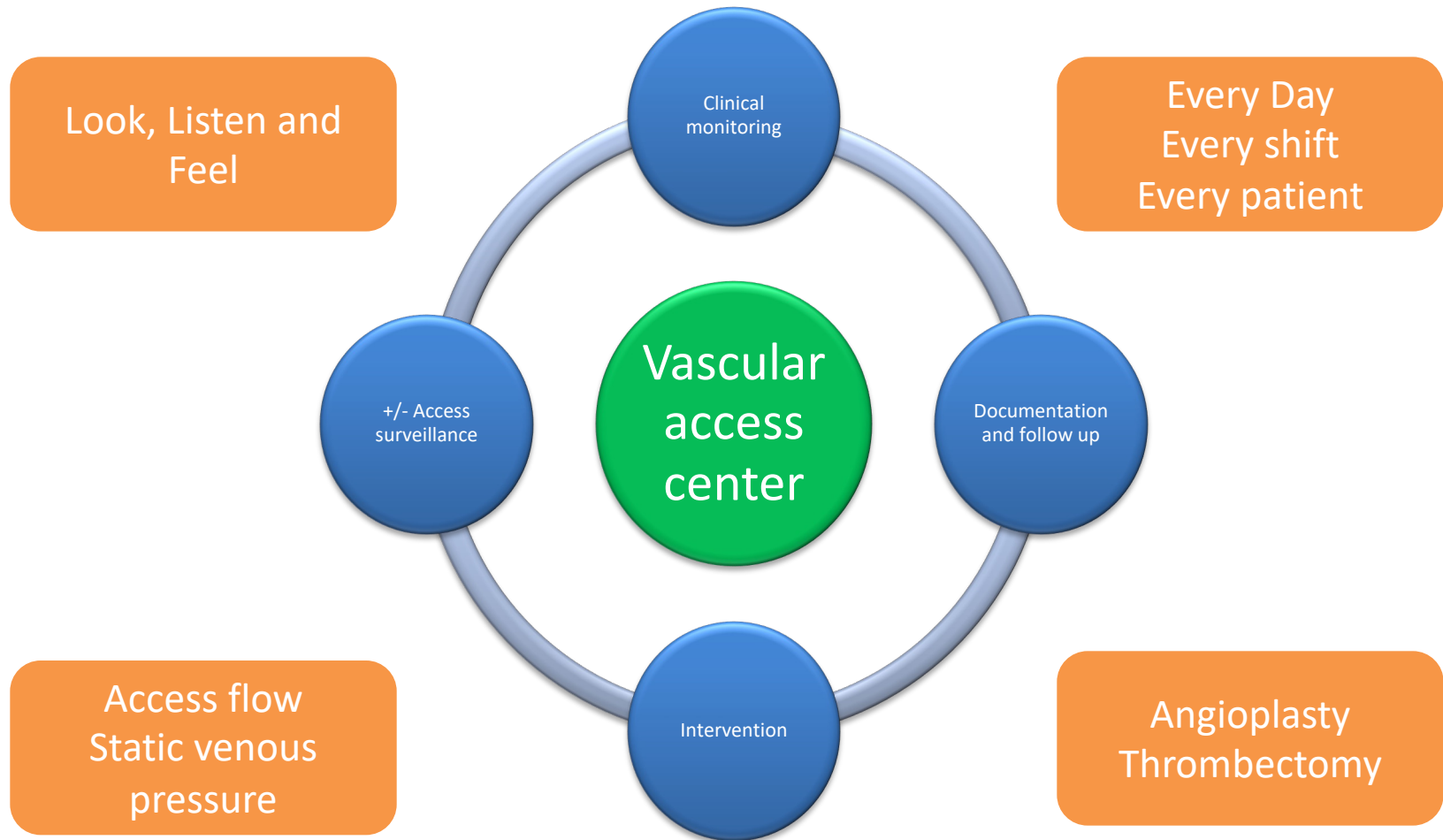
- Based on the evaluation, access can be investigated with angiography
 - Stenosis can be treated with angioplasty and stenting as needed
 - Accessory veins can be ligated
 - Surgical revision can be planned

Catheters can be avoided

Research Issues

- Definition of access dysfunction is not uniform
- Methods- Description of anatomical &/or functional end points is variable among studies
- Limited number of RCT's (often single center)
- Small sample size (many with < 200 subjects)
- Results from studies of AVG and AVF- often generalized
- Anatomical and functional/physiological successes can not be equated

What should a clinician do?



SUMMARY

AV accesses commonly become dysfunctional due to occurrence of stenosis

Clinical monitoring involves looking for evidence of access dysfunction and physical examination

Monitoring is able to provide early clues to the presence of stenosis

Monitoring alone is relatively inexpensive and accurate in experienced hands

Thank You



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