Vascular Access Update: What You Need To Know
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“Pull out, Betty! Pull out! ...You’ve hit an artery!”

KP Endovascular Symposium
Wyndham Garden Grove, CA
May 20, 2017

Important Developments in VA
- Endovascular fistula creation
- Inside-out method of catheter placement
- Cannulation advances
- Update of 2006 KDOQI Vascular Access guidelines have anticipated publication of Jan. 2018 and will emphasize patient centered life path goals over Fistula First. (Translation: Put in more grafts, especially in elderly patients, and even a few catheters.)

Endovascular Fistula Creation
TVA everlinQ endoAVF System

Presented by Dheeraj Rajan at ASDIN 2017
Rajan DK. J Vasc Interv Radiol 2015;26:484-490
FLEX study: (Pilot study)
- 97% initial success (32/33 pts)
- Mean maturation time 58 d (range 37-168)
- Cumulative patency at 6 months 96.2% (26/27 pts)
- 0.6 intervention/pt (0.1 in last 17 pts)
- 4 pts died from unrelated causes and 1 lost to FU

Figure 1. Vascular access of the proximal femoral and/or popliteal vessels by transbrachial approach of the thigh or access of either femoral and/or popliteal vessels by transbrachial approach of the thigh. Transarterial placement of grafts is used and distal to iliac vessels must be taken into consideration.

Figure 2. Angiogram after pAVF creation. Injection of contrast medium from the brachial artery sheath demonstrates rapid filling of the cephalic vein (white star). The pAVF (white arrow) is created between the ulnar artery (white arrowhead) and ulnar vein (black arrow).

Rajan DK. J Vasc Interv Radiol 2015;26:484-490
Multiple clinical studies support the endoAVF for hemodialysis

Endovascular AVF Creation: Ellipsys® Catheter from Avenu Medical

Thermal Resistance Anastomosis Device (TRAD)

- Single catheter
- Over-the-wire
- Venous access
- Ultrasound guided
- Lower power thermal energy

Automated, side-to-side anastomoses
Vessels in direct contact
No permanent implant
Tissue Fusion
“Outside-in” versus “Inside-out” Tunneled Catheter Placement

- Usual technique is “outside in.” Puncture skin and then vein and guide catheter into right atrium
- Direct puncture of axillosubclavian, jugular and brachiocephalic veins can usually be done with real-time ultrasound guidance. Sometimes a collateral vein can be used as a path to the SVC
- Direct puncture of the SVC with fluoroscopic guidance using wire manipulation or balloon catheter passed from the femoral vein as a target has an order of magnitude more risk.
- With “inside out,” wire comes from femoral or infra-diaphragmatic vein into the right atrium and exits occluded vein anteriorly to reach skin below or above clavicle on right or left side.

Elayi CS et al. Heart Rhythm 2011;8:851-857

Presented by John Gurley at CiDA 2016

DMT (www.dmtsharp.com)
Steelcore 18 wire 190 cm is from Abbott
BRK (not BRK 1) Transhepatic needle and arterial directional guide
Metabolic Energy

Relationship to Arteries
BRACHIOCEPHALIC, RIGHT SUBCLAVIAN, RIGHT CAROTID ARTERIES

- Arteries are always BEHIND veins
- Veins are always BEHIND bone
- Anterior needle path from head of clavicle is always safe

Central Veins and the Thoracic Cage
ALIGNMENT OF VEINS AND PROXIMITY TO BONES OF THE CHEST WALL

- Needle guide aimed at head of right clavicle
- Puncture with sharpened 0.018" needle-wire
- Needle with skin

More than 400 patients treated
No complications
No failures
No cases declined
- Axillary and subclavicular veins
- Axillary and subclavicular veins (defined)
- Axillary and subclavicular veins
- Axillary and subclavicular veins
- Axillary and subclavicular veins

This procedure can be repeated as many times as needed

Presented by John Gurley at CiDA 2016
Example 2. A: Venography showing bilateral total occlusion of the internal brachiocephalic veins. B: Chest radiograph showing a dual-chamber ICD that was implanted using IOCV A.

Presented by John Gurley at CiDA 2016

Elayi CS et al. Heart Rhythm 2011;8:831-837

Case Study 3: Access Crisis

**Failed Femoral Grafts and Need for Urgent Dialysis**

- Unable to re-establish any access
- Chronic SVC occlusion at RA
- Identify RA appendage (posterior)
- Intact SVC stump (anterior)
- Puncture to cavitate
- Successful TDC placement

Inside Out

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Early referral: Vessel mapping: Fistula creation: Maturation Cannulation

Modified from M.Allen

Cannulation Advances

**Barriers to AVF Use**

Early referral

Vessel mapping

Fistula creation

Maturation Cannulation

Needle tip location assessed with ultrasound:

- 30% against anterior wall
- 60% against posterior wall
- 10% in middle of lumen

Marticorena et al. CANNT Journal, March 2016

- Time to first cannulation: AVF 119 d; AVG 70 d
- Mean cannulation zone for AVF 13 cm
- Mean cannulation zone for AVG 23 cm
- Risk of mis-cannulation of AVF 2x that of AVG

Severe Infiltration

- Over 5 yrs, 47 cases of severe infiltration causing catheter use prolongation
- 32% annual rate
- 6x more likely to occur in first 6 months of use
- More common in >65 y/o and upper arm
- Associated with AVF thrombosis 26%
- Lead to 2.4 diagnostic tests or interventions
- Median prolongation of catheter use 97 days

Need to use catheter

Lee T. Am J Kidney Dis 2006;47:1020-1026

Severe Infiltration*
**Cannulation Techniques**

Alternate Site (Rope Ladder) Cannulation

- Technique recommended for grafts and AVFs
- Prolongs access life expectancy and reduces infection
- Decreases aneurysm formation in AVFs and AVGs
- Requires at least 10 cm long cannulation zone
- Restart cannulation cycle every 2 weeks to allow previous sites to heal

Site by Inspection (Area Method)

- Quick, reliable puncture with minimal pain.
- Tends to produce alternating areas of aneurysm and stenosis. Not a recommended technique.
- Limits life expectancy of access.
- Associated with higher incidence of ulcers and bleeding.

Site by Inspection (Area Method of Cannulation) Stenosis in AV Graft

- Venous needle site
- Arterial needle site

Same Site (Buttonhole)

- Useful for short cannulation zone
- Decreased aneurysm formation (Can convert “area” aneurysm to BH)
- Technique more difficult to learn and perform
- Increased infection risk is partly technique dependent
- Often less painful cannulation with fewer infiltrations

- Normal BHs
- Inverted buttonhole due to “hubbing” of needle
- BH often looks like little volcano
- New and mature buttonholes


Kromang, Dial & Trans, 1984
Important Developments in VA:

- Use of stent grafts supported over PTA alone or with bare metal stents for several indications by multiple RCTs.

References

- Bioengineered hemodialysis access graft in phase III RCT trial
- Drug coated balloons being studied in multiple RCTs.
  - Focal anastomotic techniques: pSLOT, RADAR, arterial superficialization reported to improve outcomes.
  - Removal of “stuck catheter” using balloon angioplasty reported

Figure 4. Creating a longer tract using the 'lateral approach'.
References

- Antiseptic catheter locking solutions would reduce catheter related bacteremia by 50% but are not approved by the FDA yet.
- To determine fistula suitability for a particular patient, the use of clinical risk factors other than quality and size of vessels as well as patient longevity and diet are controversial.
- Intimal hyperplasia is necessary but not sufficient to cause stenosis and failure to mature in fistulas. Predominance of inward over outward vessel remodeling is also necessary.

References

- Topical application at surgery of recombinant human elastase (Vonapanitase from Proteon Therapeutics) showed improved primary and secondary patency for radiocephalic avf in phase II study. Now in phase III RCTs.
- Mobile phone app (VAPS) being submitted to FDA for approval. Based on Rand/UCLA appropriateness method study, patient data would be entered and recommendations for type and location of access would appear.