What a nephrologist should know about vascular access

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Why should a nephrologist bother about vascular access?
Because that is the right thing to do for your patients!
Dialysis Issues

- Socioeconomic Factors
- Cost Factor
- Adequacy
- Compliance
- Modality Selection

Vascular Access
Ideal Vascular Access

• Easy to construct
• No foreign material
• No thrombosis
• No infections
• Easy to cannulate
• Long lasting
• Good blood flow
Life line and Achilles heel
Types of vascular access

• Arteriovenous fistula
• Arteriovenous graft
• Central venous catheter
Central Venous Catheters

- Temporary non-cuffed – emergent situations
- Bridging - cuffed
  - Internal jugular vein
  - Femoral vein
  - Subclavian vein
  - Translumbar IVC
  - Transhepatic IVC
Why is AVF the preferred vascular access for dialysis?
A. Lower infection rate
B. Lower thrombosis rate
C. Less expensive
D. Less overall morbidity
E. All of the above
Catheter events & complications

Events:
- Removal
- Replace with catheter
- Replace with int device

Complications:
- Infection
- Sepsis

Rate per patient year

Year: 98, 99, 00, 01, 02, 03, 04
Arteriovenous graft events & complications

Events:
- Replace with graft
- Replace with catheter
- Revision

Complications:
- Infection
- Sepsis
- Declot
- Angioplasty
Arteriovenous fistula events & complications

Events

- Removal
- Replace with fistula
- Replace with catheter
- Revision

Complications

- Infection
- Sepsis
- Declot
- Angioplasty

Rate per patient year

Years: 98, 99, 00, 01, 02, 03, 04

Graph showing trends in fistula events and complications over time.
PPPY expenditures, by type of access

- Catheter
- Graft
- AV fistula
- PD catheter

PPPY expenditures ($, in thousands)

PPPYP access costs by type of access
Common issues with vascular access

- Infection – Catheters > AVG > AVF
- Primary failure due to poor maturation of AVF
  - ~ 60% failure rate - NIH sponsored DAC study, JAMA 2008
- Stenosis due to neo-intimal hyperplasia
  - AVG: Mainly at the venous anastomosis
  - AVF: Arterial (inflow) anastomosis, venous (outflow) track
Primary Patency of AVF Compared to AVG

AVF is the preferred access

- ↓ incidence of infection
  - AVF < AVG < CVC
- ↓ incidence of thrombosis
  - AVF < AVG
- ↑ patency rate
  - AVF > AVG
Vascular access in incident HD patients


How are we doing with vascular access care?
Vascular access care

- Historically has remained fragmented between
  - Nephrologist
  - Surgeon
  - Radiologist
Drawbacks of fragmented care

- Missed dialysis treatments
- Treatment decisions sporadic rather than planned
- Increases
  - morbidity/mortality
  - Hospitalization
  - Cost of care
Nephrologist as a team leader

- Better understands the complexity of the dialysis process and needs of an ESRD patient
- Better understands the importance of access patency
- Coordinate with the dialysis personnel
Role of a nephrologist

- Arrange for timely intervention to avoid missing dialysis treatment
- Can easily coordinate the surveillance program
- Can supervise the education and training of dialysis personnel
Global Awareness

• Concept team approach
• Procedures being performed by nephrologist
• Supported by major renal societies
  - ASN, ISN, ERA-EDTA, NKF, ISHD
• Multiple meetings dedicated to access care
  - VASA, ASDIN, VEITH symposium, VAS
• How many sites are available for AVF creation on each upper extremity?

A. 3  
B. 5  
C. 6  
D. 7
Upper extremity AVF sites

- Traditional AVF
  - Snuff-box
  - Radiocephalic
  - Brachiocephalic

- Transposed AVF
  - Proximal forearm AVF
  - Transposed basilic vein in upper arm
  - Transposed basilic vein in forearm
  - Transposed cephalic vein in forearm
Radiocephalic AVF
Brachiocephalic AVF

Vachharajani – Atlas of Vascular Access - 2010
Transposed basilic vein AVF

Inset: “swing point” depicting the basilic vein mobilization from the deeper location to the superficial tunnel.
Brachial Artery-Cephalic Vein Forearm Loop Fistula
Surgical Innovations

• Transposed vessel fistula
  – Forearm – cephalic and basilic
  – Upper arm – basilic
  – Proximal forearm deep perforating vein
  – Thigh fistula
  – Secondary AVF
When is the ideal time to evaluate a new AVF for maturity?

A. 2 weeks  
B. 4 weeks  
C. 6 weeks  
D. 8 weeks  
E. 12 weeks
Timing of change in flow and size

Common lesions with Early AVF Failure

- Stenosed forearm basilic vein
- Stenosis with collaterals
- Ulnar art
- Radial art.
- Juxta-anastomotic stenosis
- Transposed forearm basilic vein to radial artery fistula
Accessory veins – coil embolization
Two or more derangements: 85 (71.4%)
- stenosis (≥1) and significant accessory vein 35 (29.4%)
- stenosis (≥2) without significant accessory vein 50 (42%)
Single derangement only: 34 (28.6%)
- significant accessory vein 4 (3.4%)
- deep AVF 6 (5%)
- stenosis 24 (20.2%)
KDOQI defines monitoring, as applying physical examination techniques to detect access dysfunction.

When done correctly, monitoring can identify most access dysfunction.
Vascular Access Monitoring

The One Minute Access Exam

Look

Listen

Feel

Arm elevation Test

Augmentation Test

Occlude access

Palpate pulse

Kidney Disease: Improving Global Outcomes
Central vein stenosis
Kidney Disease:
Improving Global Outcomes

KDIGO
Kidney Disease: Improving Global Outcomes
Kidney Disease: Improving Global Outcomes
### Sensitivity and Specificity of PE

- 142 consecutive patients
- Upper arm AVF 95 (67%)
- Forearm AVF 47 (33%)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Sens</th>
<th>Spec</th>
<th>PE + Angio</th>
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<tbody>
<tr>
<td>Inflow stenosis</td>
<td>85%</td>
<td>71%</td>
<td>83%</td>
</tr>
<tr>
<td>Outflow Stenosis</td>
<td>92%</td>
<td>86%</td>
<td>89%</td>
</tr>
<tr>
<td>Coexisting inflow-outflow stenosis</td>
<td>68%</td>
<td>84%</td>
<td>79%</td>
</tr>
<tr>
<td>Central vein stenosis</td>
<td>13%</td>
<td>99%</td>
<td>poor</td>
</tr>
</tbody>
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Asif et al CJASN 2:1191;2007
Newer devices

- Bioengineered blood vessels
- Novel anastomostic connectors – Optiflow
- Percutaneous Intergraft device for anastomosis
- Heparin bonded PTFE graft
Newer devices

HeRO device –
Hybrid AVG + Catheter

• Indication
  – AVF is not an option

• Clinical experience
  – Limited
  – Thrombosis rate high
Optiflow implant.

Yevzlin A S, and Valliant A M CJASN 2013;8:1244-1251

Kidney Disease: Improving Global Outcomes
Sutureless Hybrid Vascular Graft
Vascugel® wrap

Nat. Rev. Nephrol. doi:10.1038/nrneph.2013.76
Bioengineered vessels from allogeneic cells by Humacyte

a | The allogeneic cells are seeded onto a scaffold.

b | The cells then produce matrix components.

c | The scaffold is then decellularized and

d | used as an arteriovenous conduit.

Abbreviation: AV, arteriovenous.


Nat. Rev. Nephrol. doi:10.1038/nrneph.2013.76
Targeted therapy
The Bullfrog balloon is safely navigated over a 0.014” guide wire and through a vasculature within protective 6Fr sheaths. At precise injection site, the balloon is inflated with saline, securing the system for injection and sliding the micro-needle through the vessel wall. Therapy injected directly into perivascular space and Adventitia for concentrated treatment and no washout.
Venous and arterial connectors of the InterGraft device.

Yevzlin A S, and Valliant A M CJASN 2013;8:1244-1251

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Future goals

- Improve process of care specific for various regions across the globe
- Include and emphasize access care in training program
- Better understand the pathophysiology of neo-intimal hyperplasia
- Research into novel endovascular drug delivery systems and newer devices