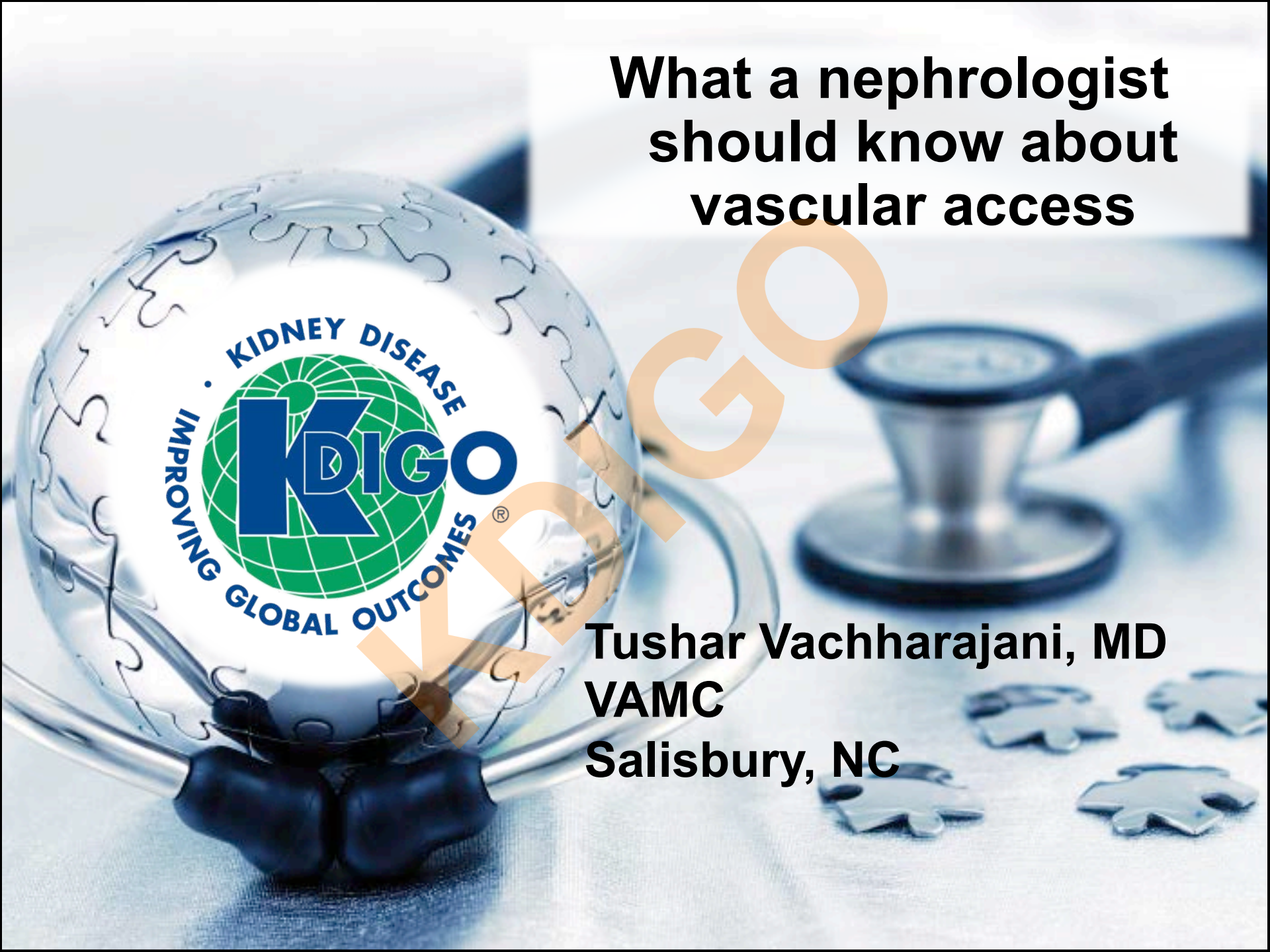


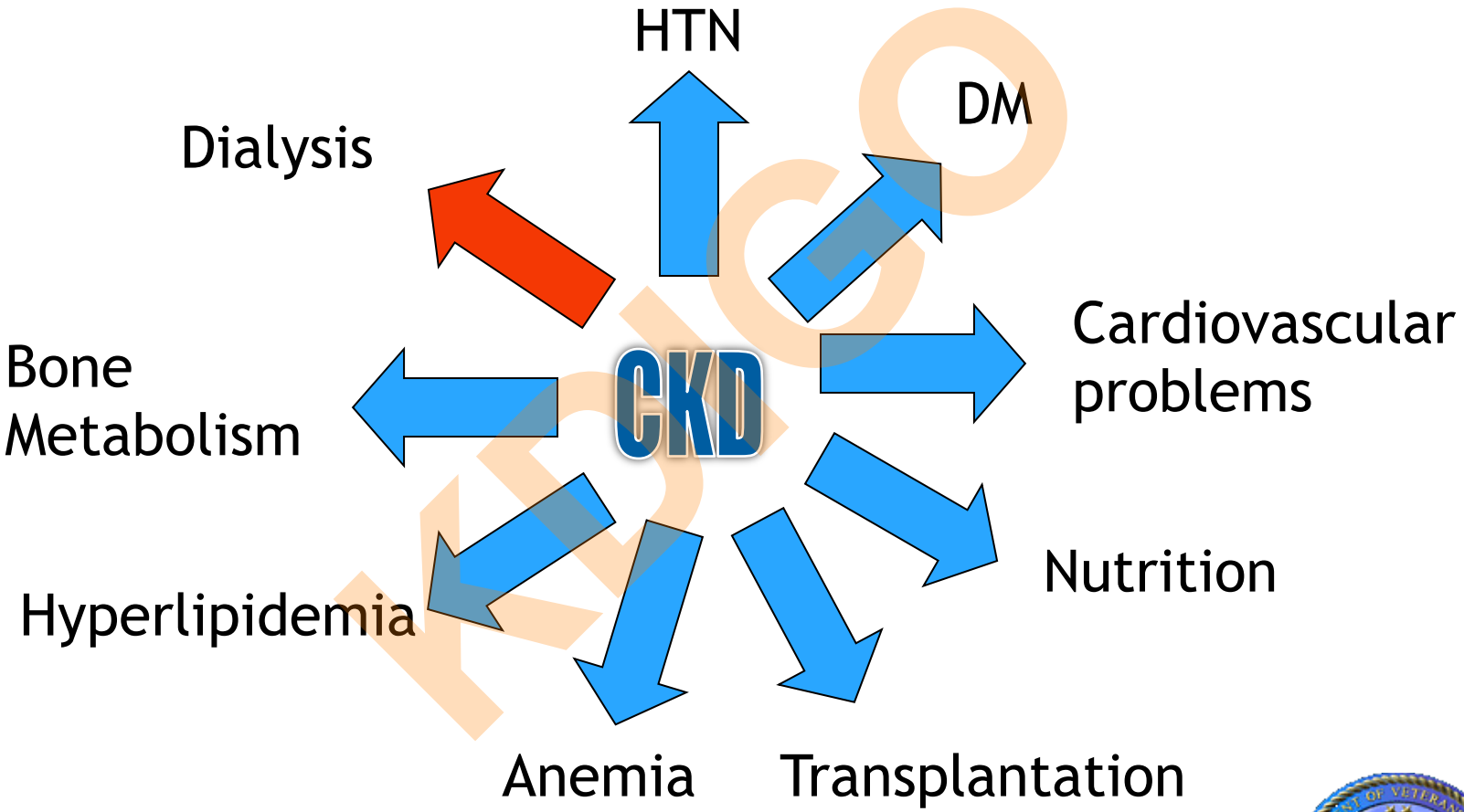
What a nephrologist should know about vascular access

Tushar Vachharajani, MD
VAMC
Salisbury, NC

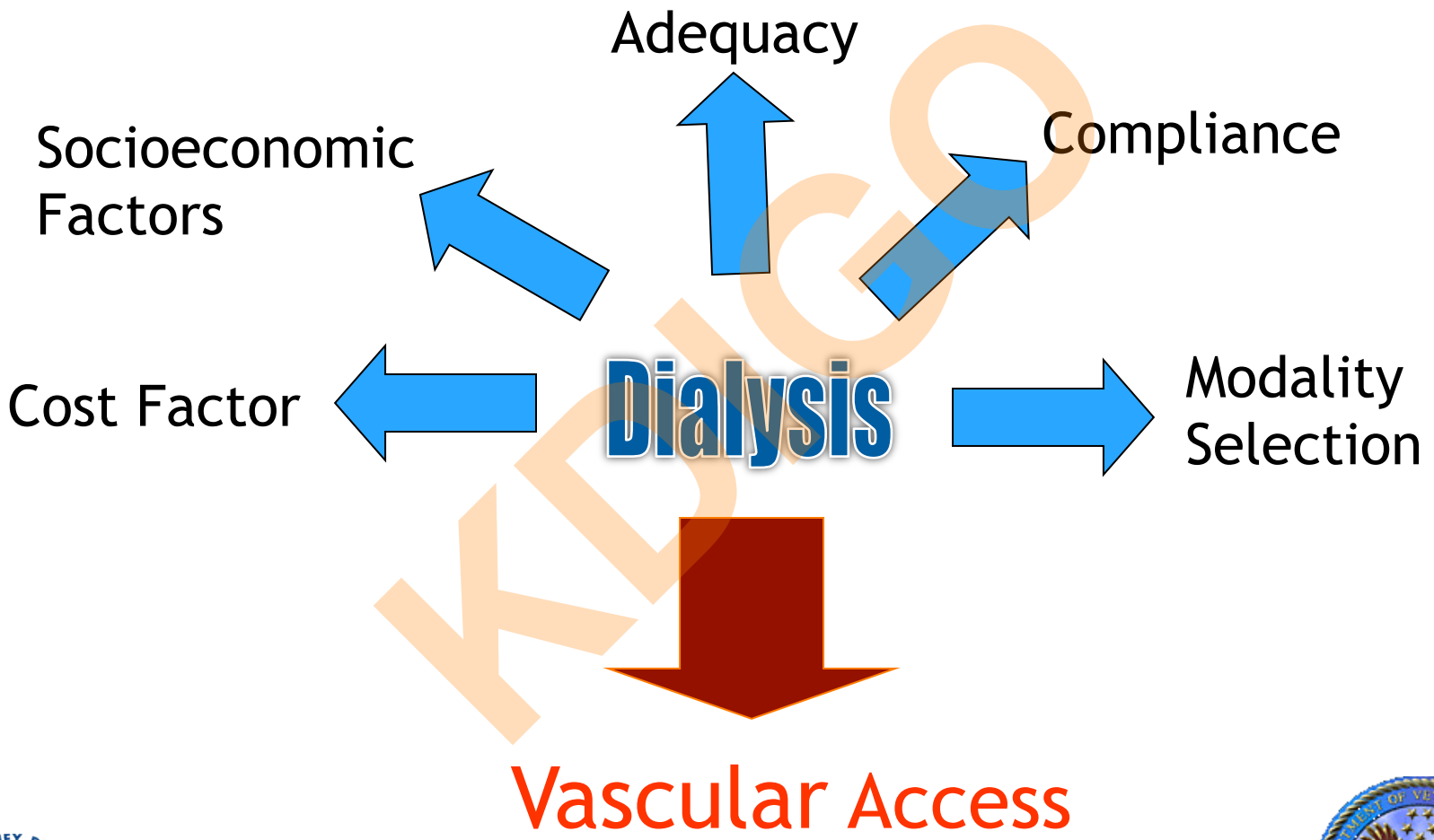
Why should a nephrologist bother about vascular access?

Because that is the right thing to do for your patients!

CKD Management



Dialysis Issues



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

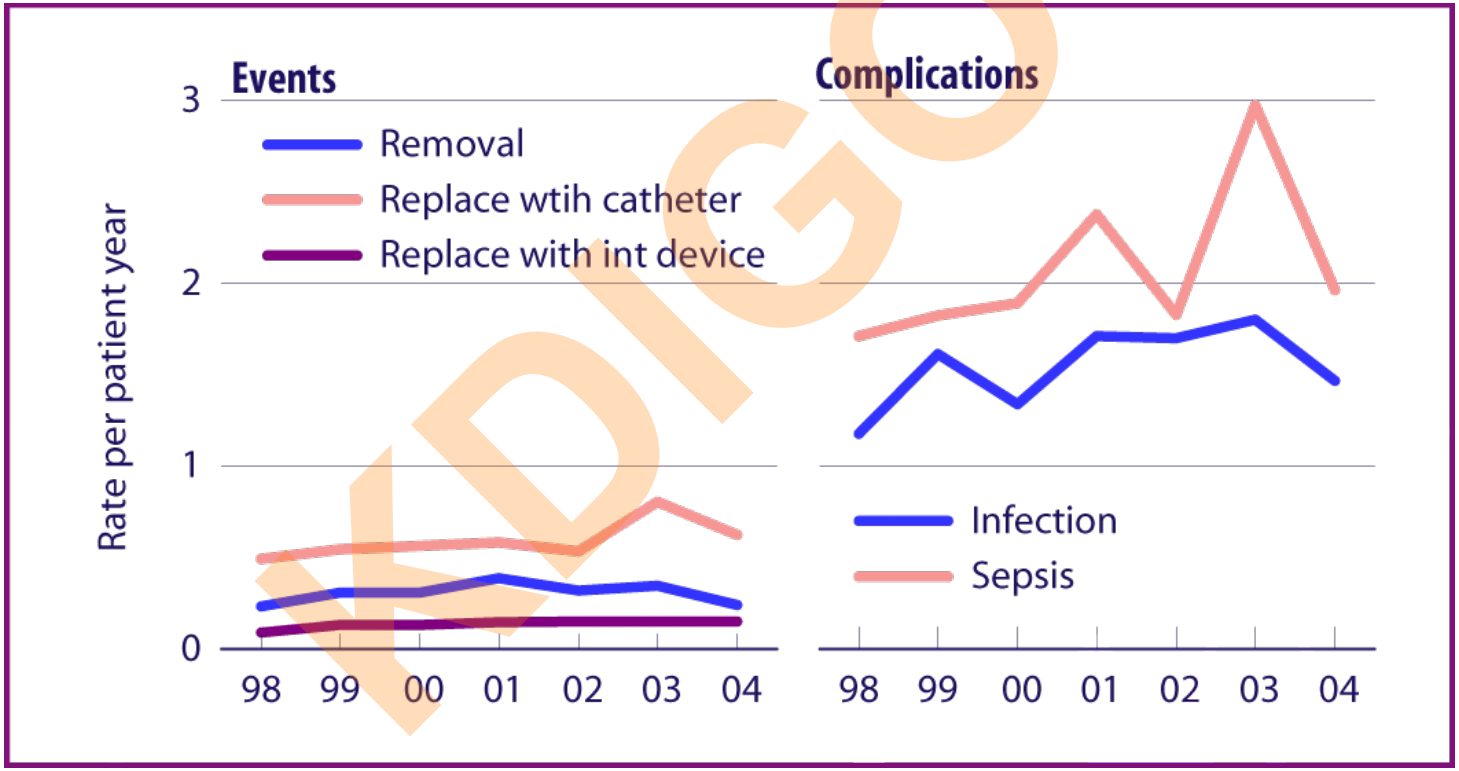
B. Lower thrombosis rate

C. Less expensive

D. Less overall morbidity

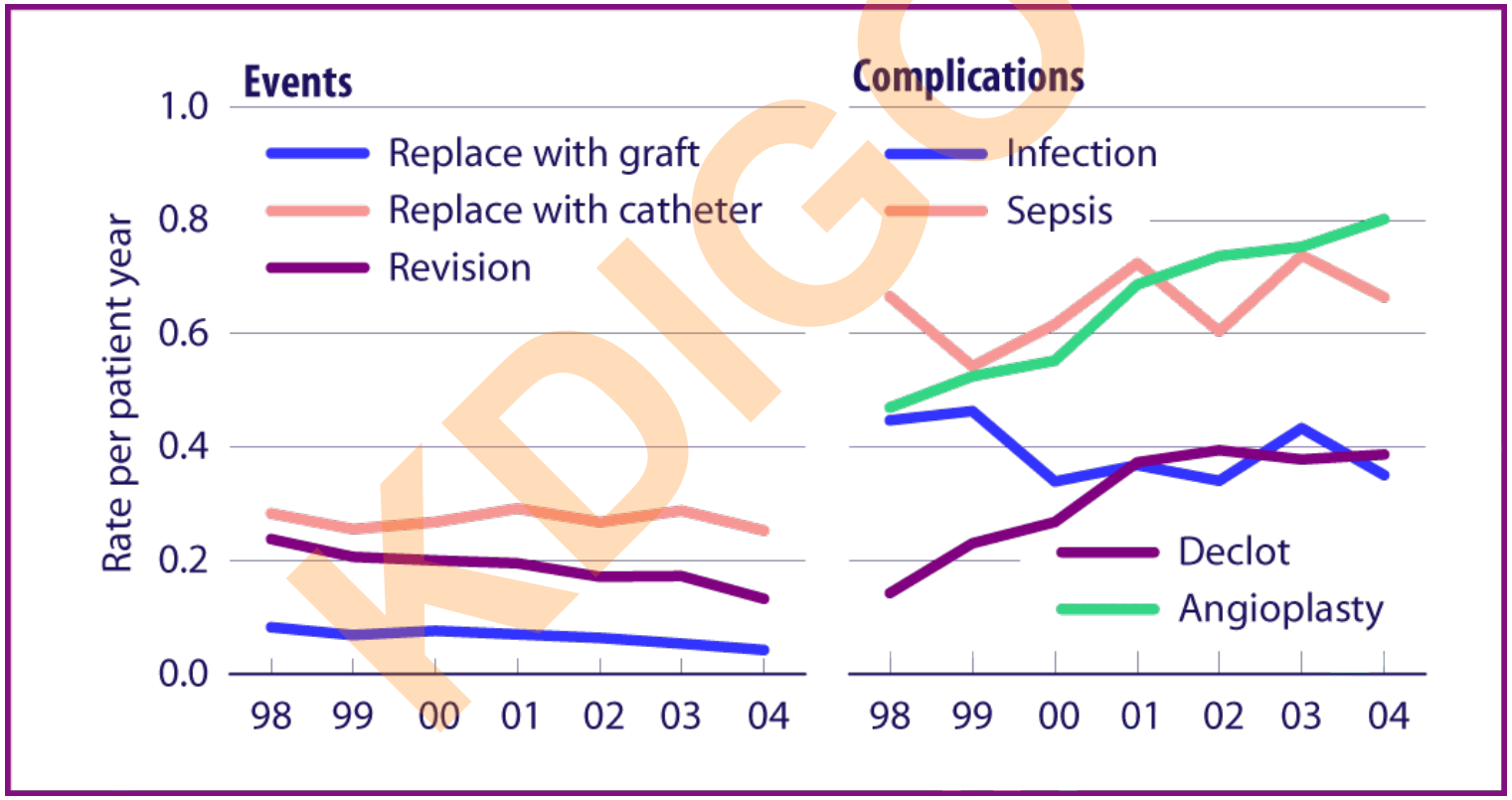
E. All of the above

Catheter events & complications



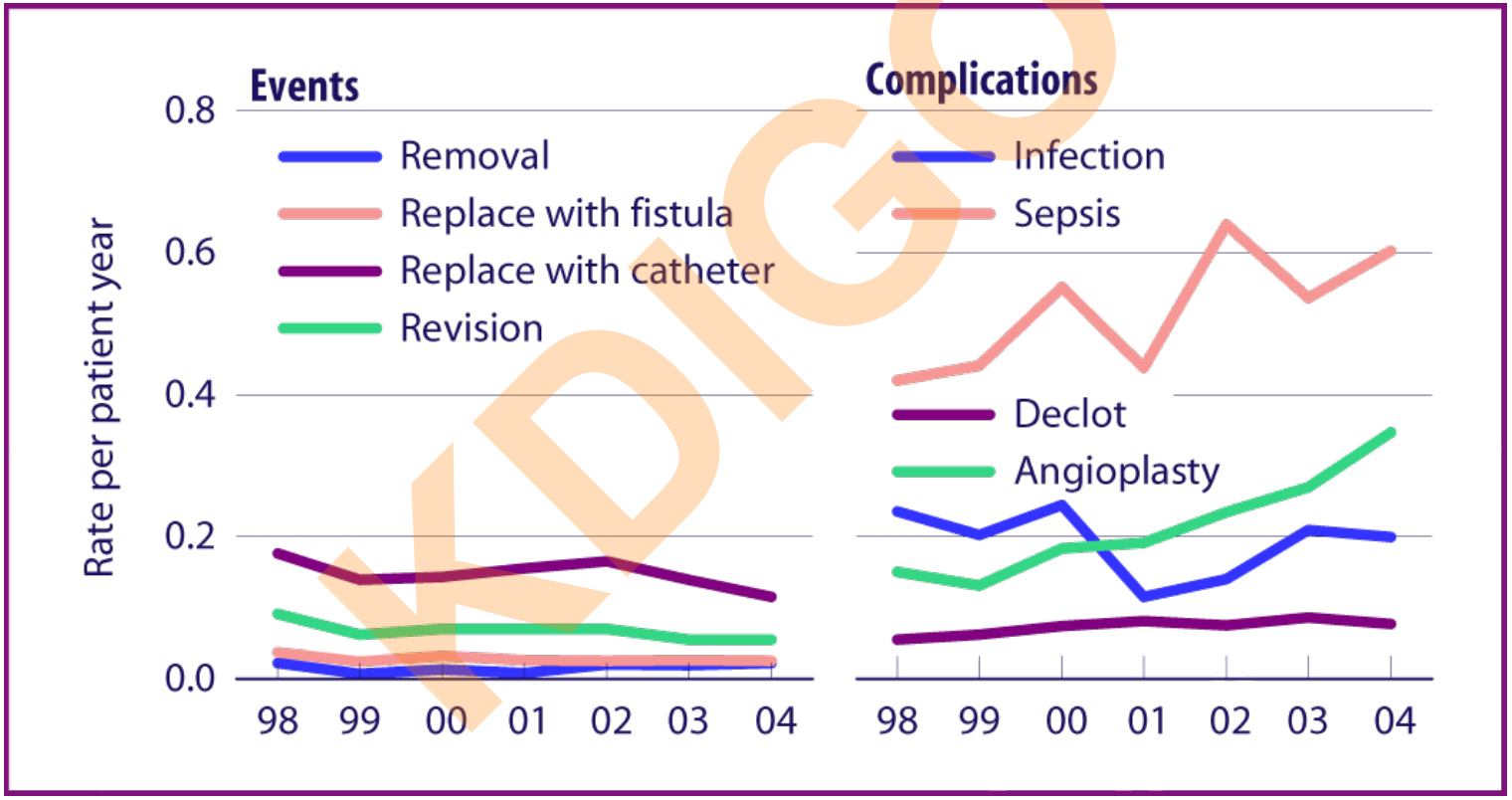
USRDS

Arteriovenous graft events & complications



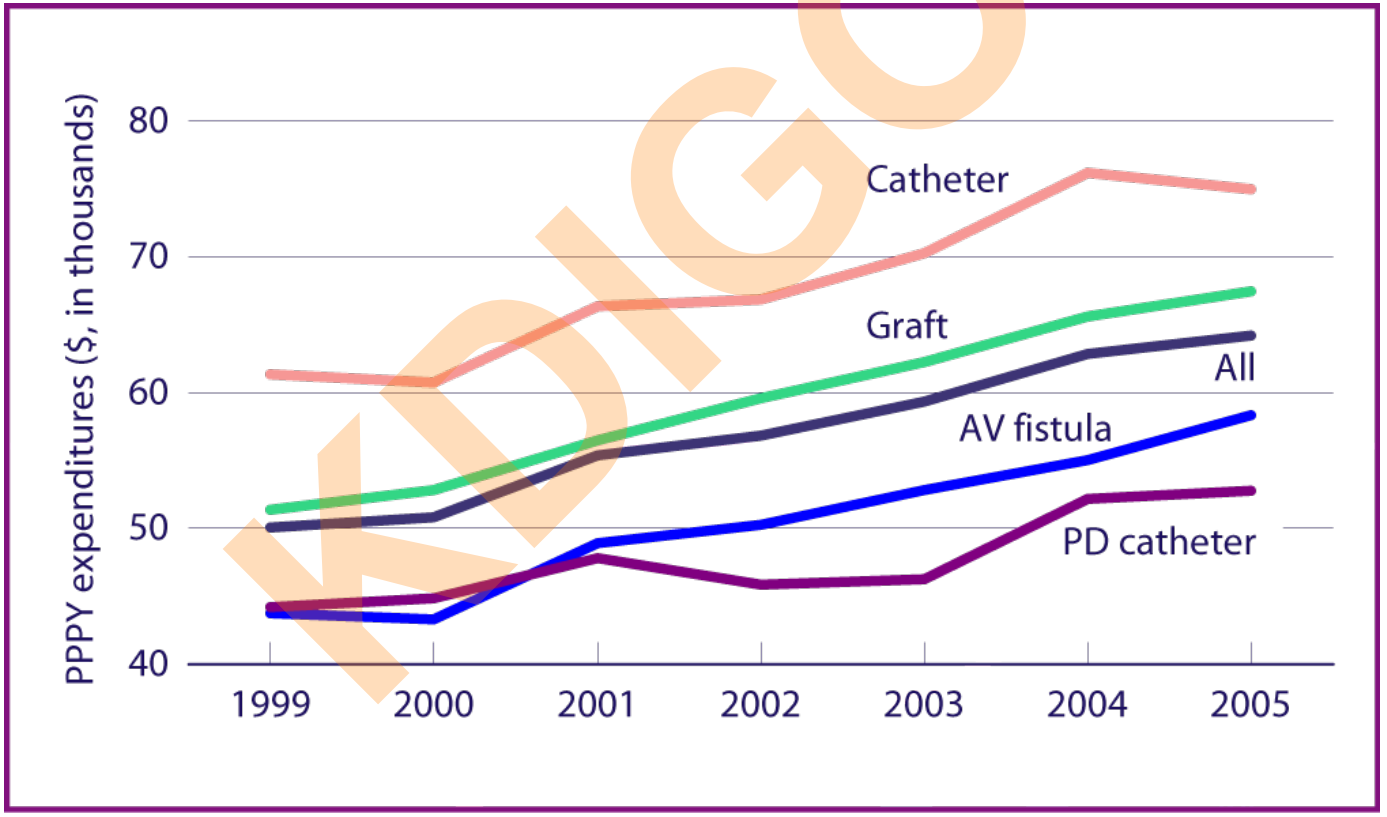
USRDS

Arteriovenous fistula events & complications

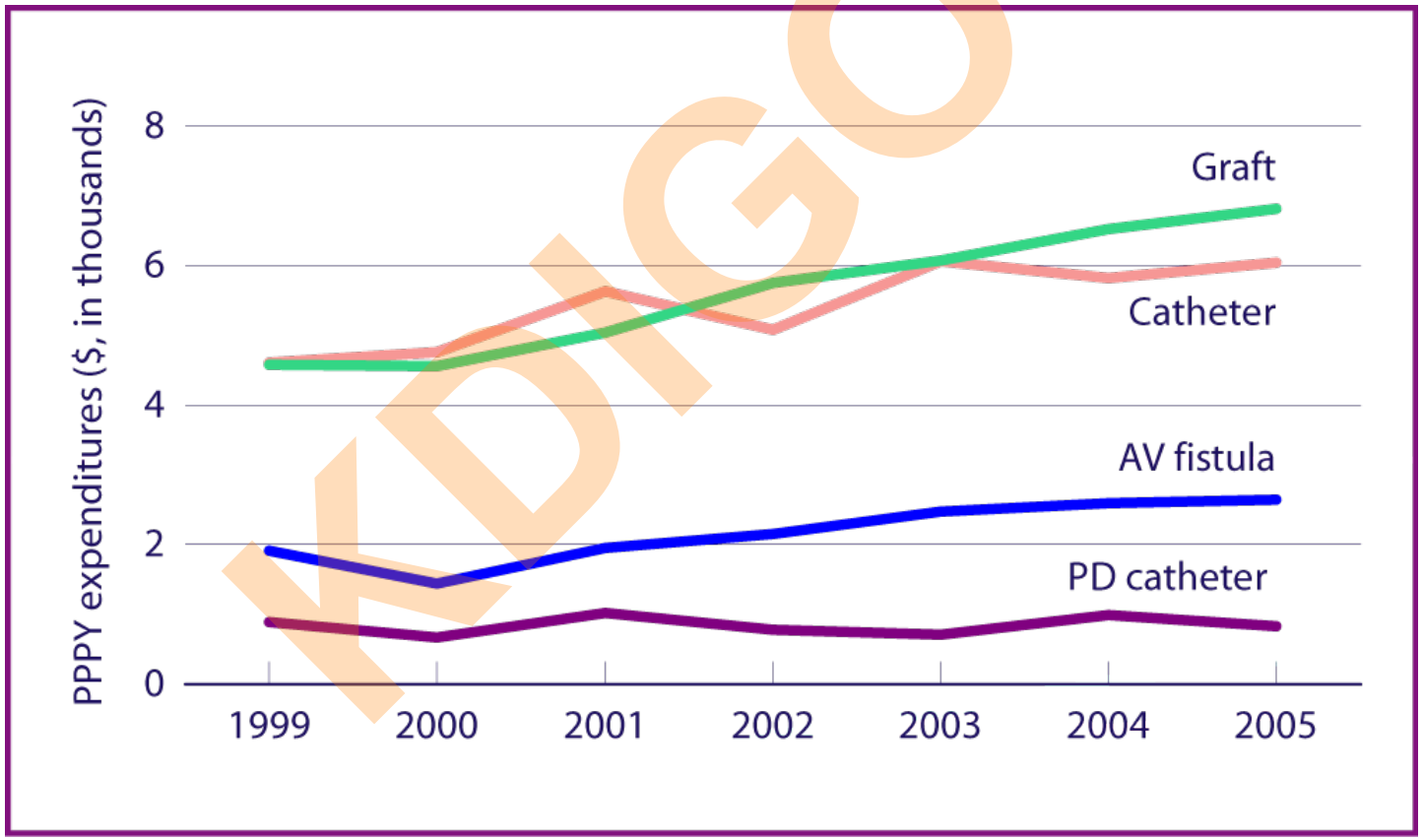


USRDS

PPPY expenditures, by type of access



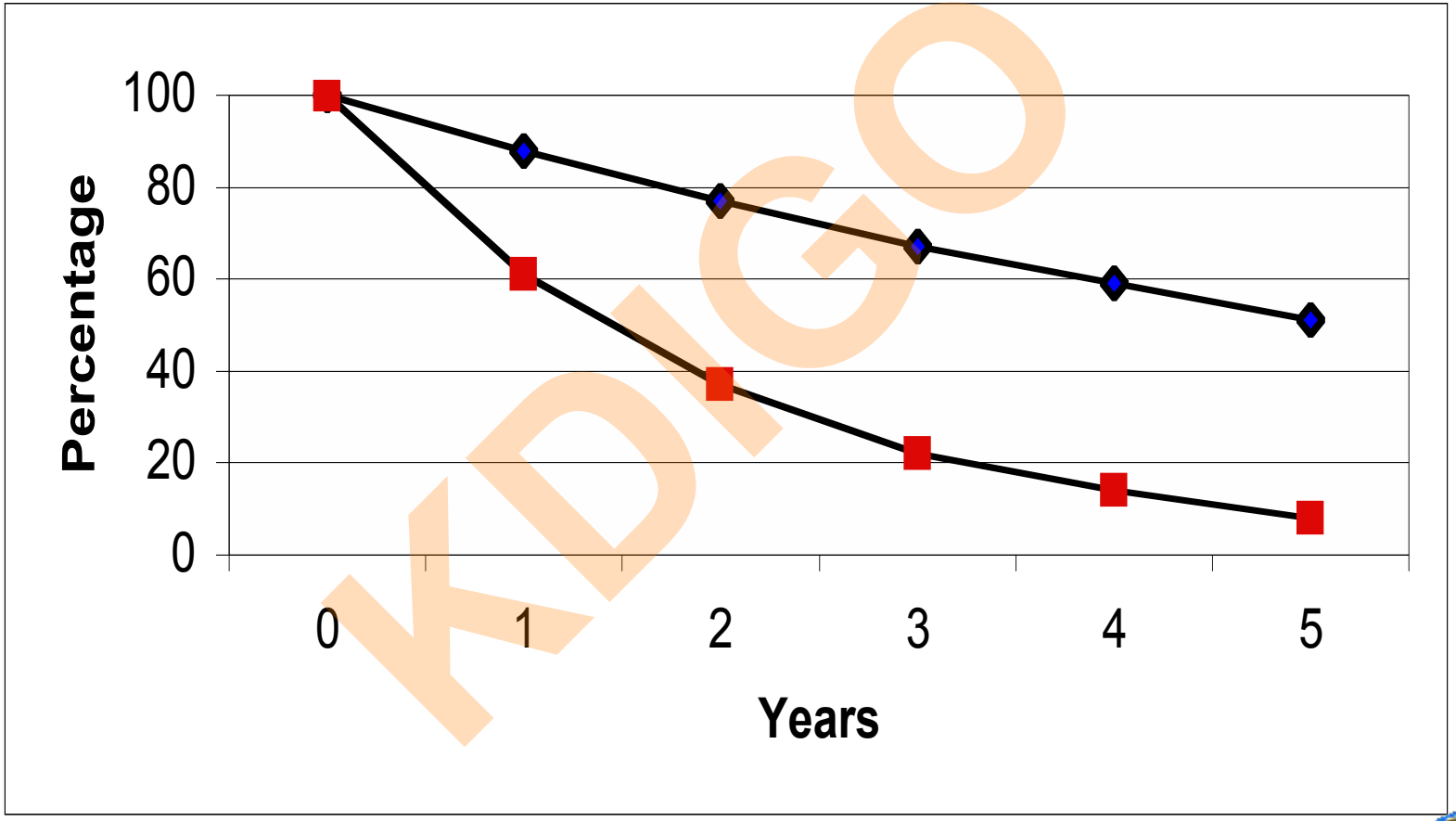
PPPY access costs by type of access



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

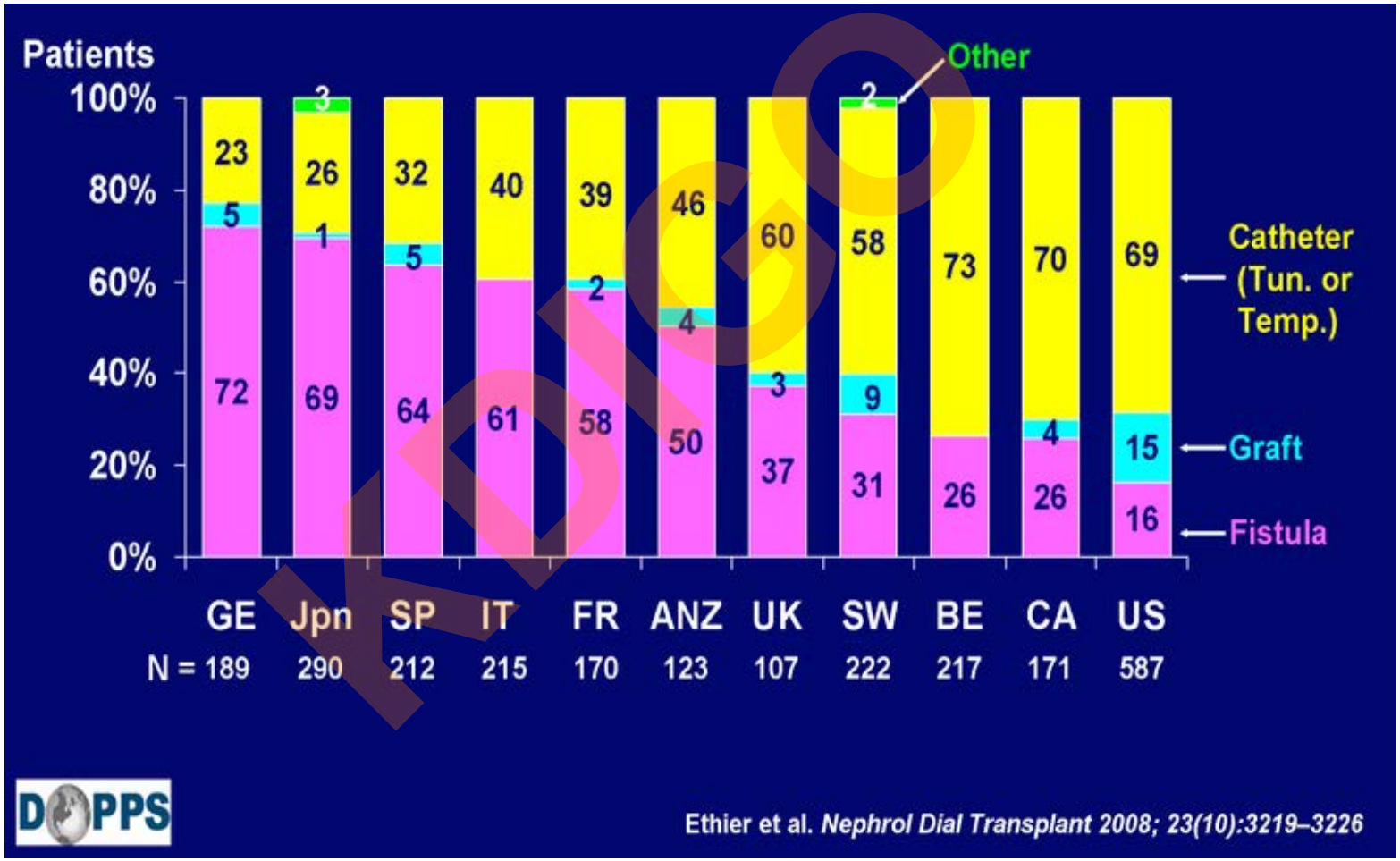


Mehta S, in Vascular Access for Hemodialysis II. Summer BG, Henry ML 1991

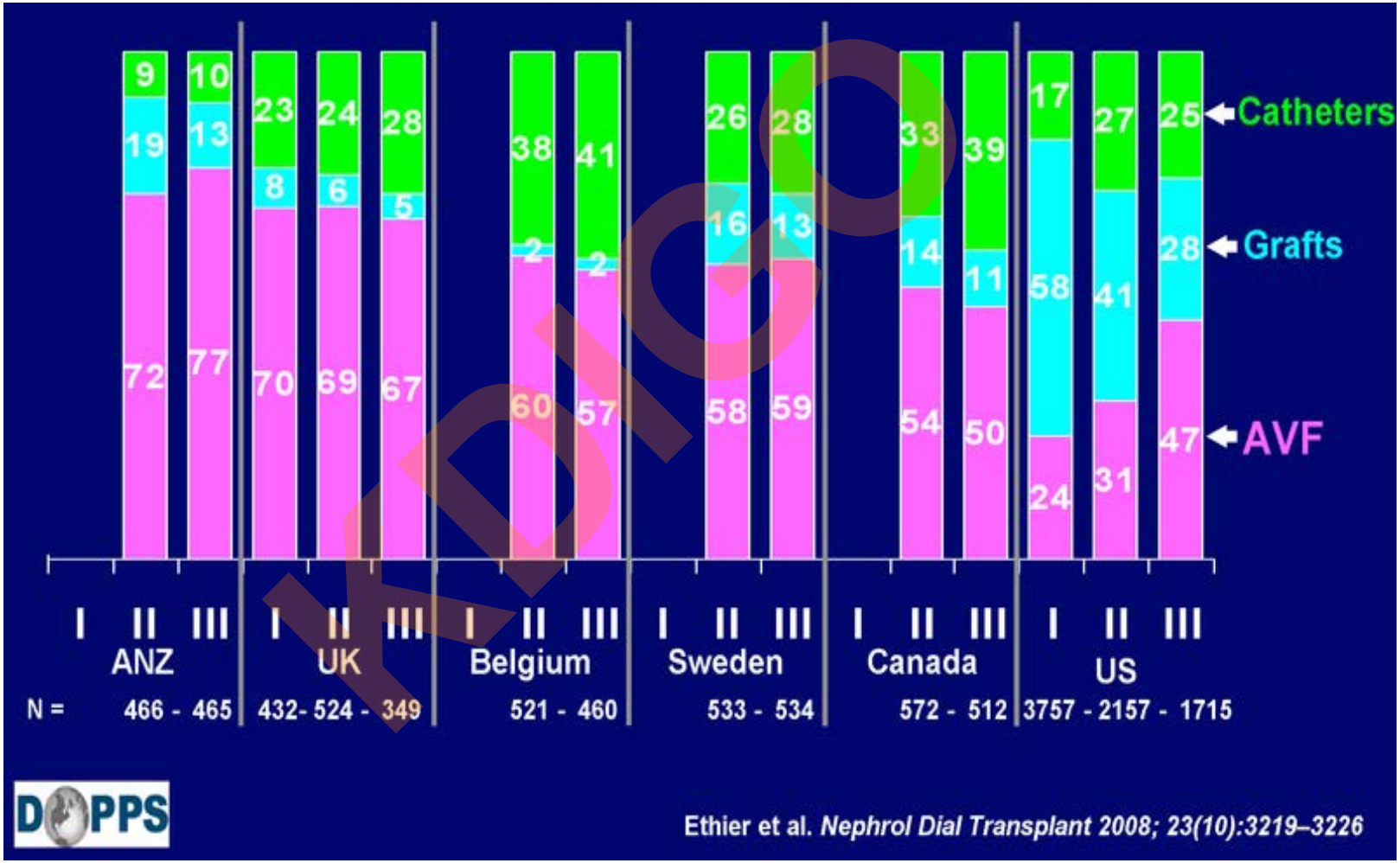
AVF is the preferred access

- ↓ incidence of infection
  - AVF < AVG < CVC
- ↓ incidence of thrombosis
  - AVF < AVG
- ↑ patency rate
  - AVF > AVG

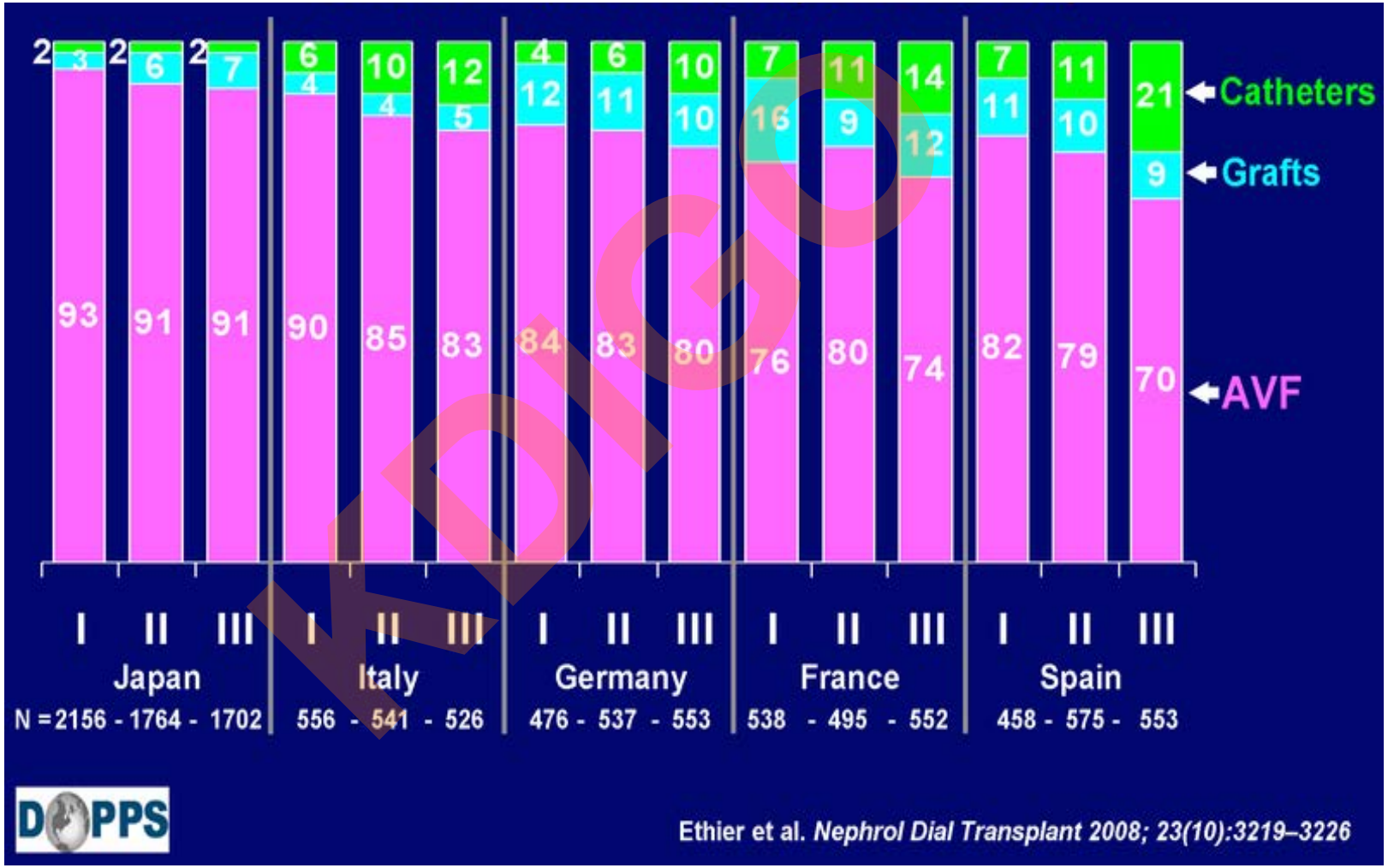
Vascular access in incident HD patients



Vascular access trends –1996 - 2007



Vascular access trends –1996 - 2007



How are we doing with vascular access care?

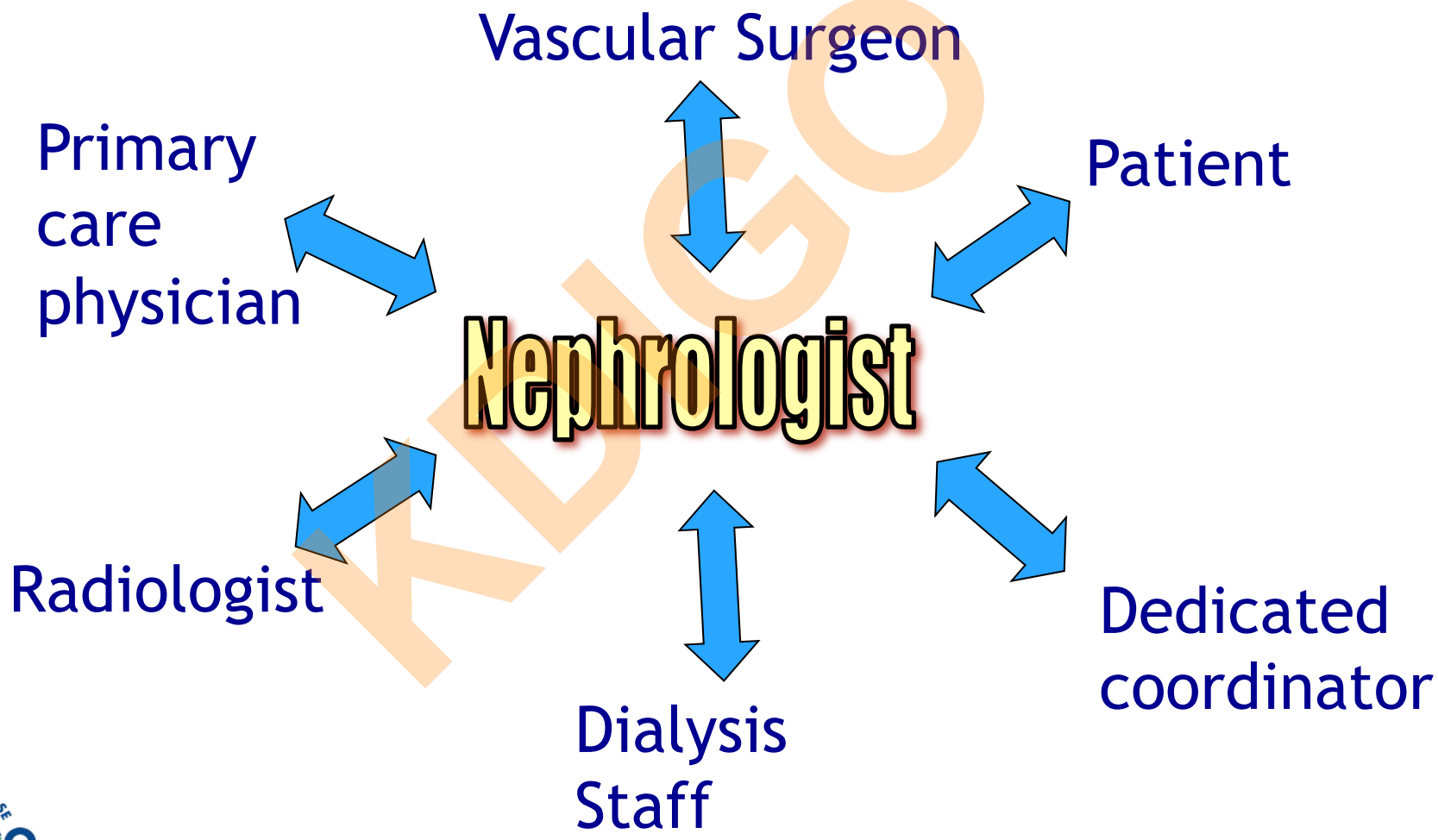
Vascular access care

- 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

Concept of Vascular Team



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

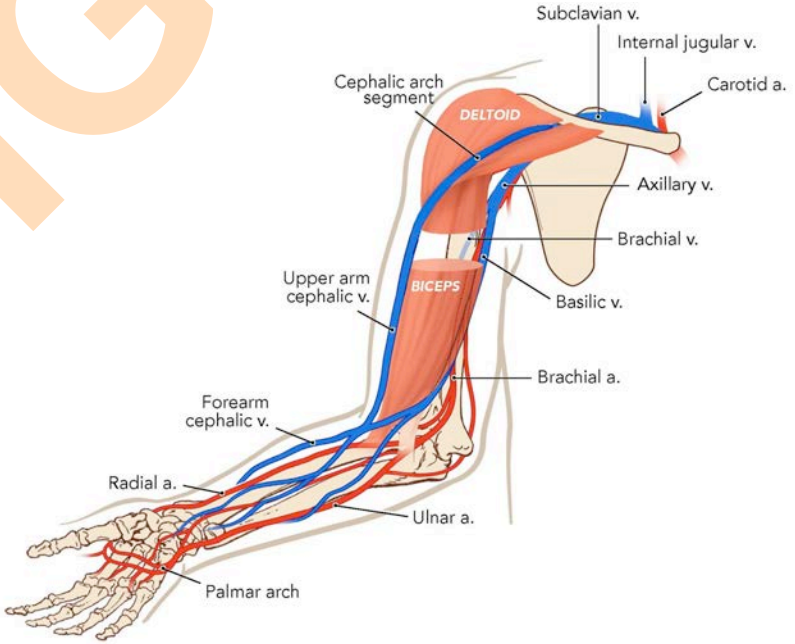
- How many sites are available for AVF creation on each upper extremity?

A.3

B.5

C.6

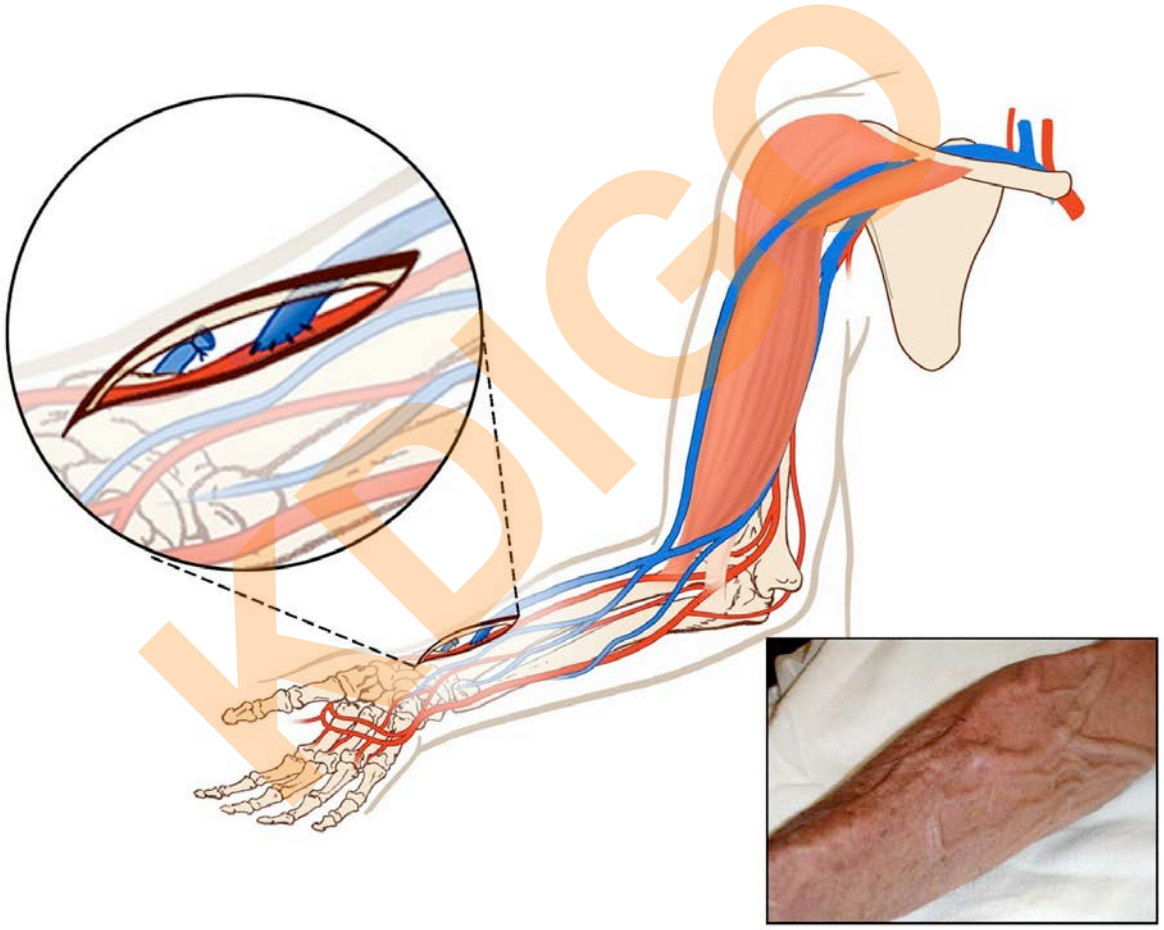
D.7



Upper extremity AVF sites

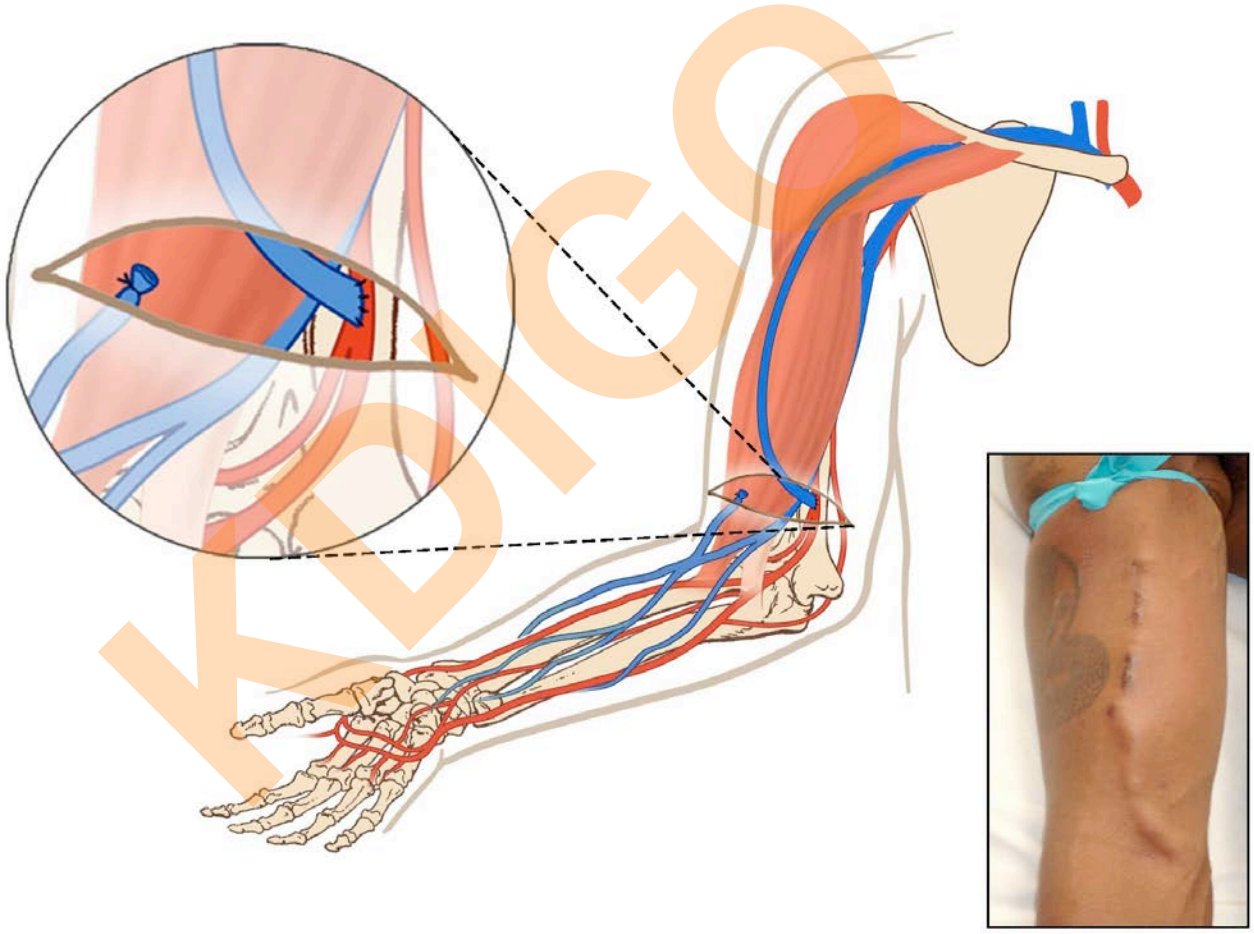
- Traditional AVF
  - Snuff-box
  - Radiocephalic
  - Brachiocephalic
- Transposed AVF
  - Proximal forearm AVF
  - Transposed basilic vein in upper arm
  - Transposed basilic vein in forearm
  - Transposed cephalic vein in forearm

Radiocephalic AVF



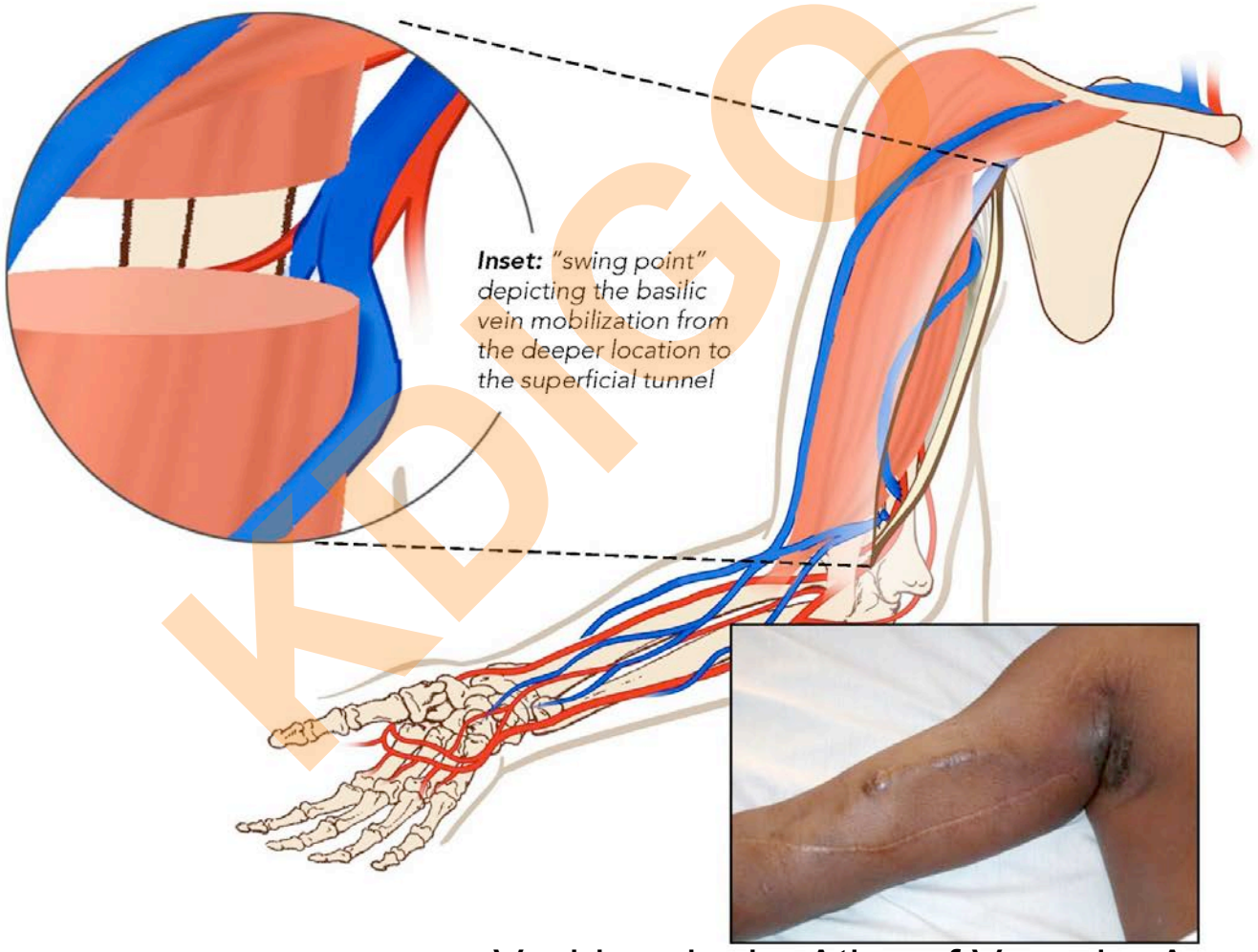
Vachharajani – Atlas of Vascular Access - 2010

Brachiocephalic AVF



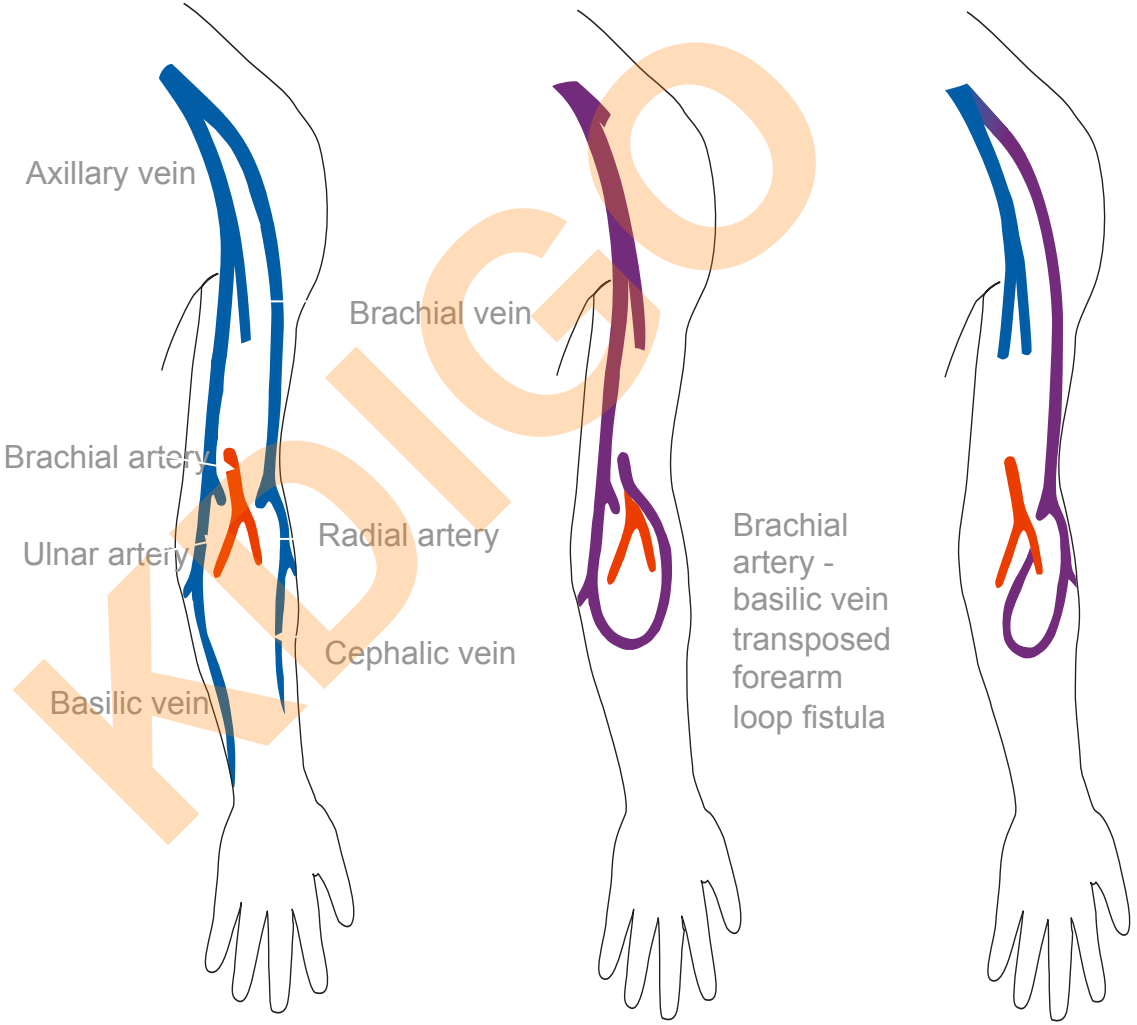
Vachharajani – Atlas of Vascular Access - 2010

Transposed basilic vein AVF

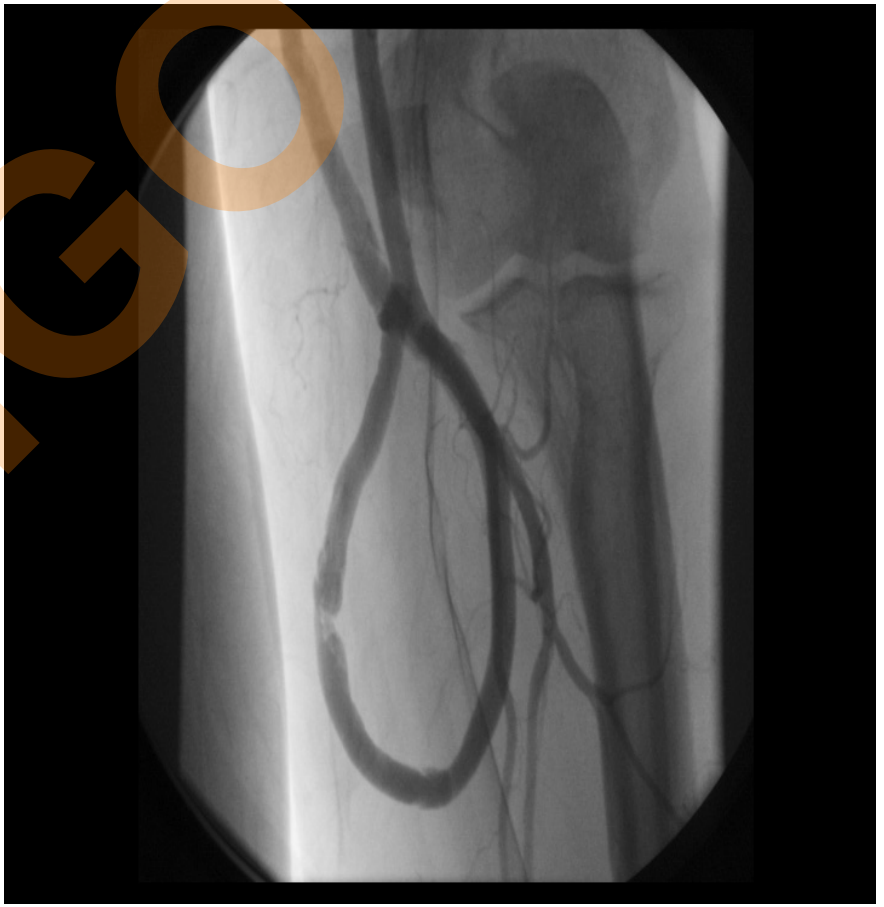


Vachharajani – Atlas of Vascular Access - 2010

Transposed forearm AVF



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

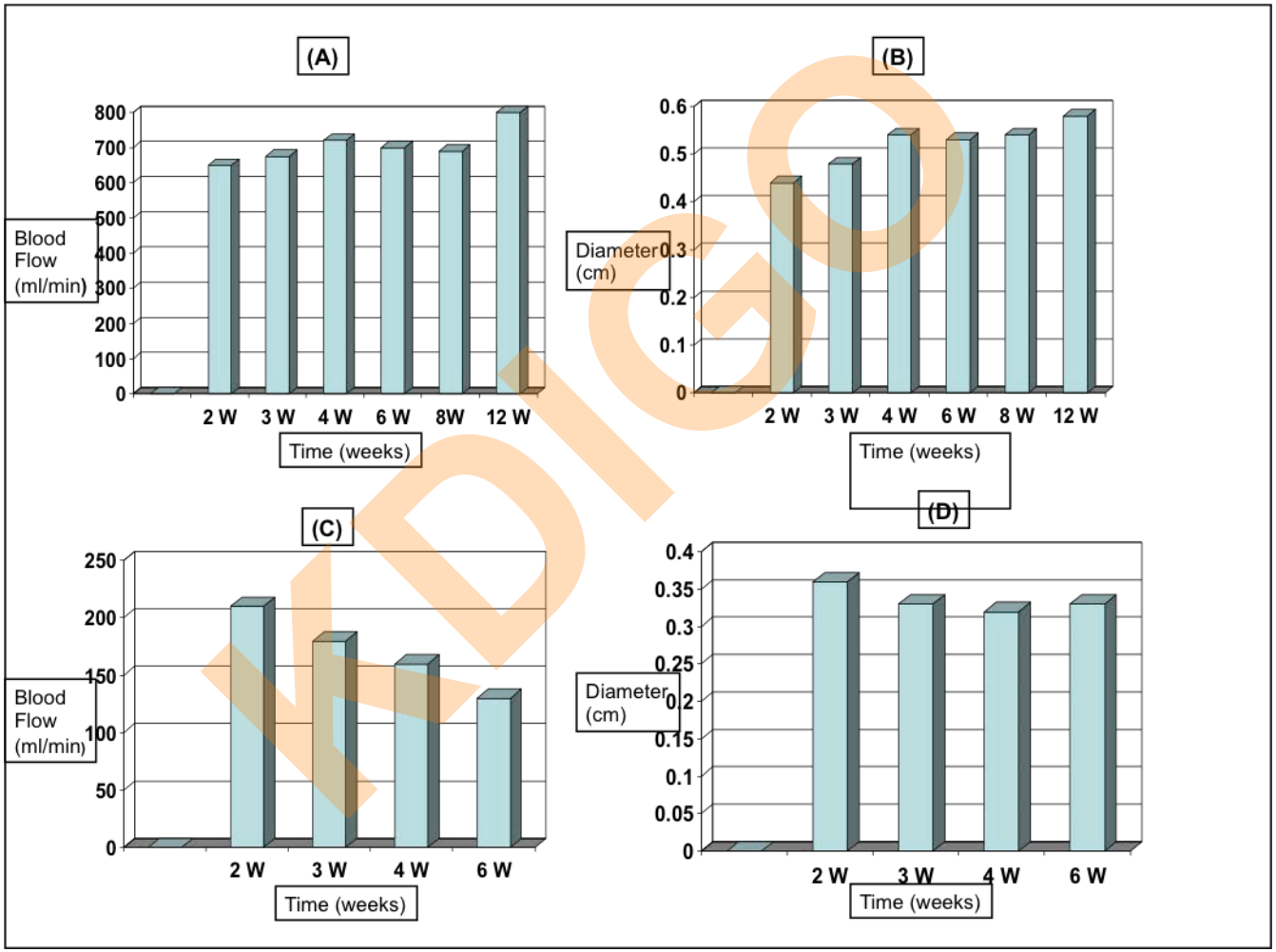
B. 4 weeks

C. 6 weeks

D. 8 weeks

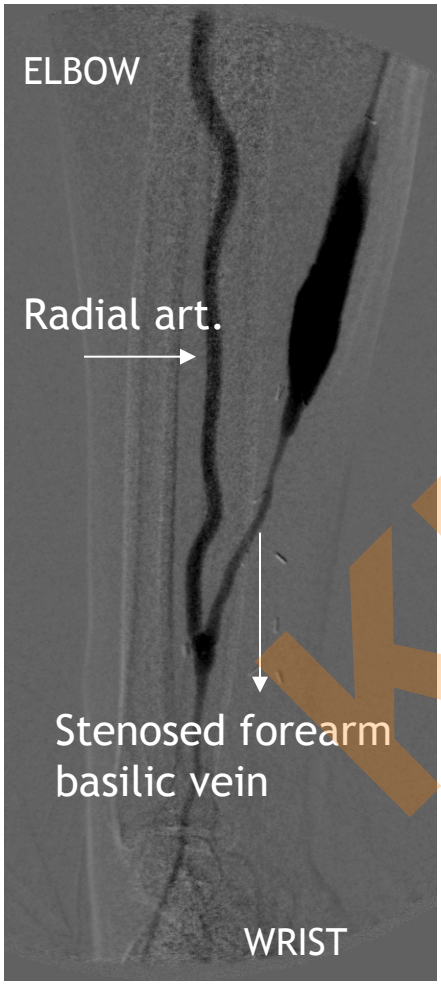
E. 12 weeks

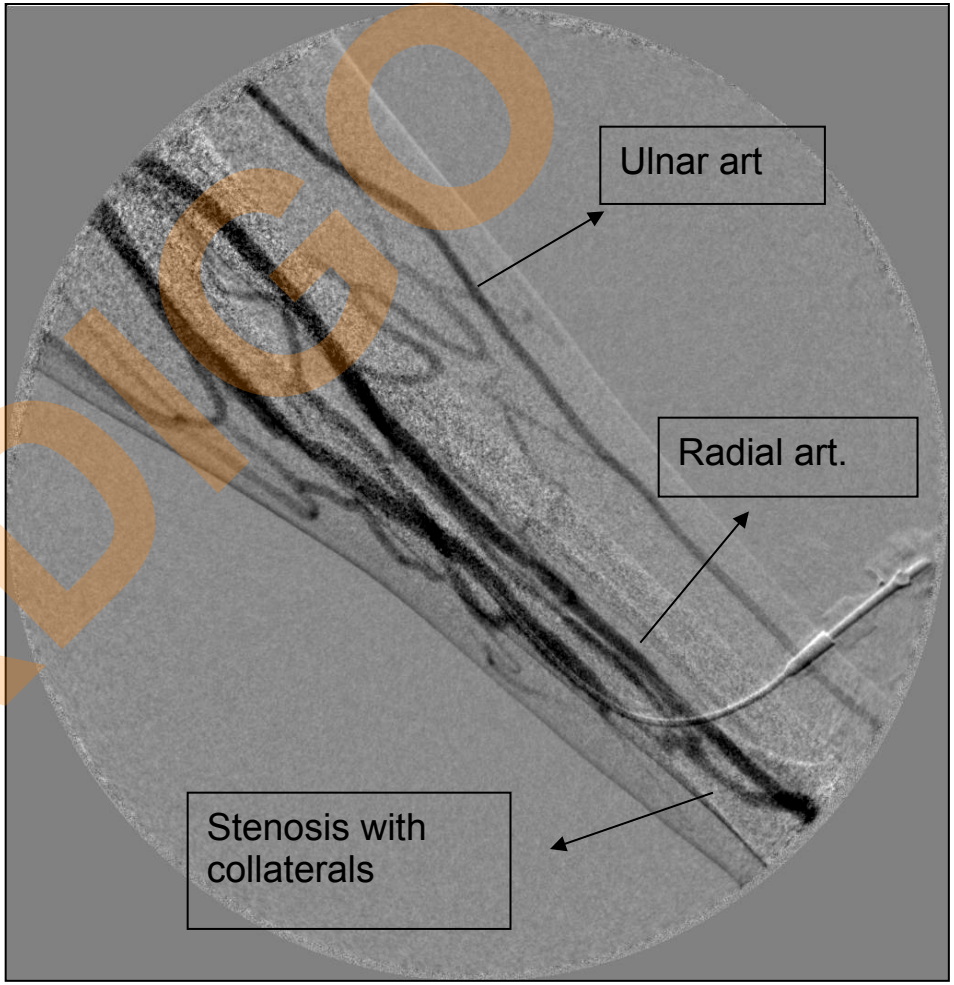
Timing of change in flow and size

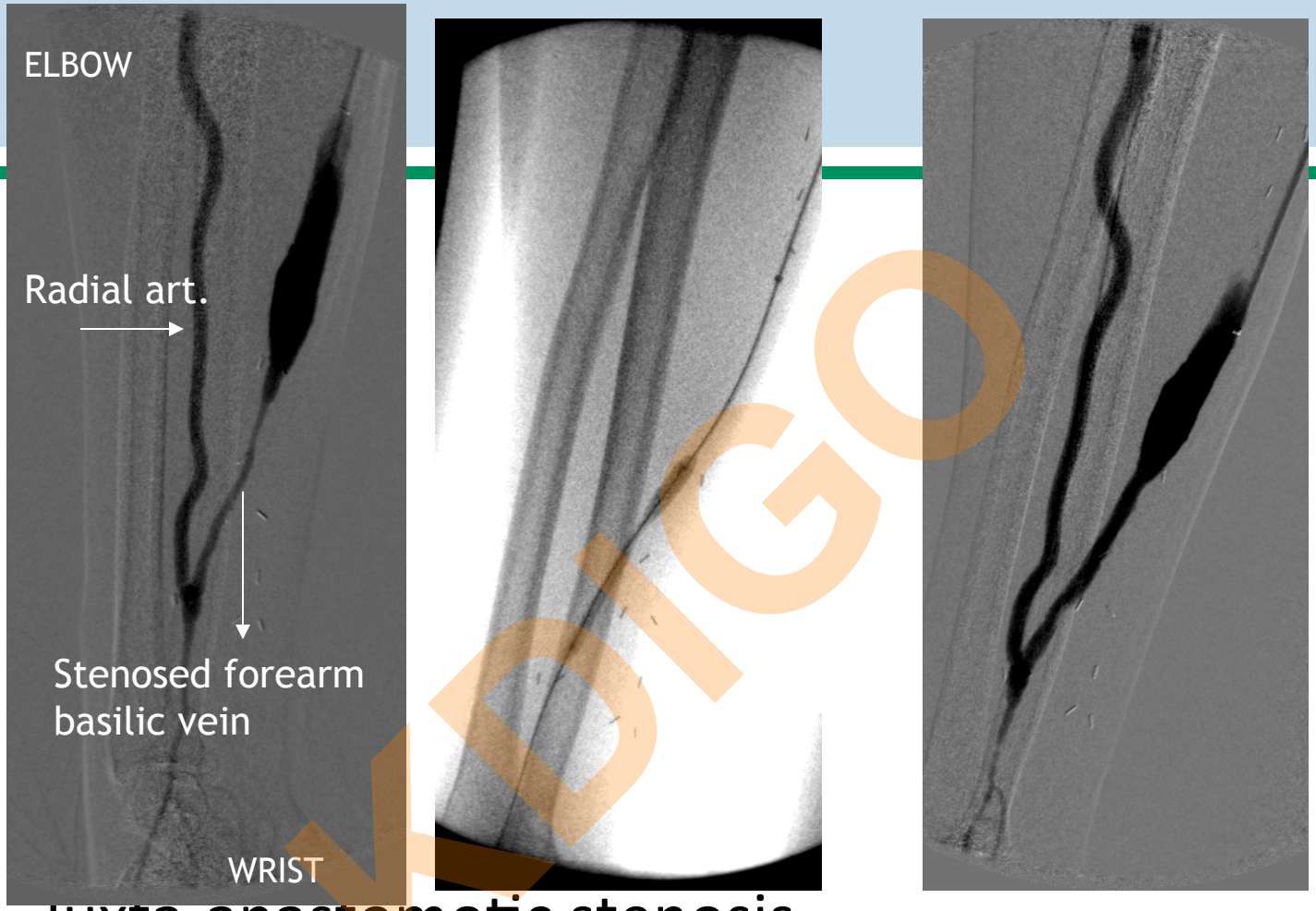


Asif A, Roy-Chaudhury P, Beathard GA: CJASN 1:332-339, 2006

Common lesions with Early AVF Failure

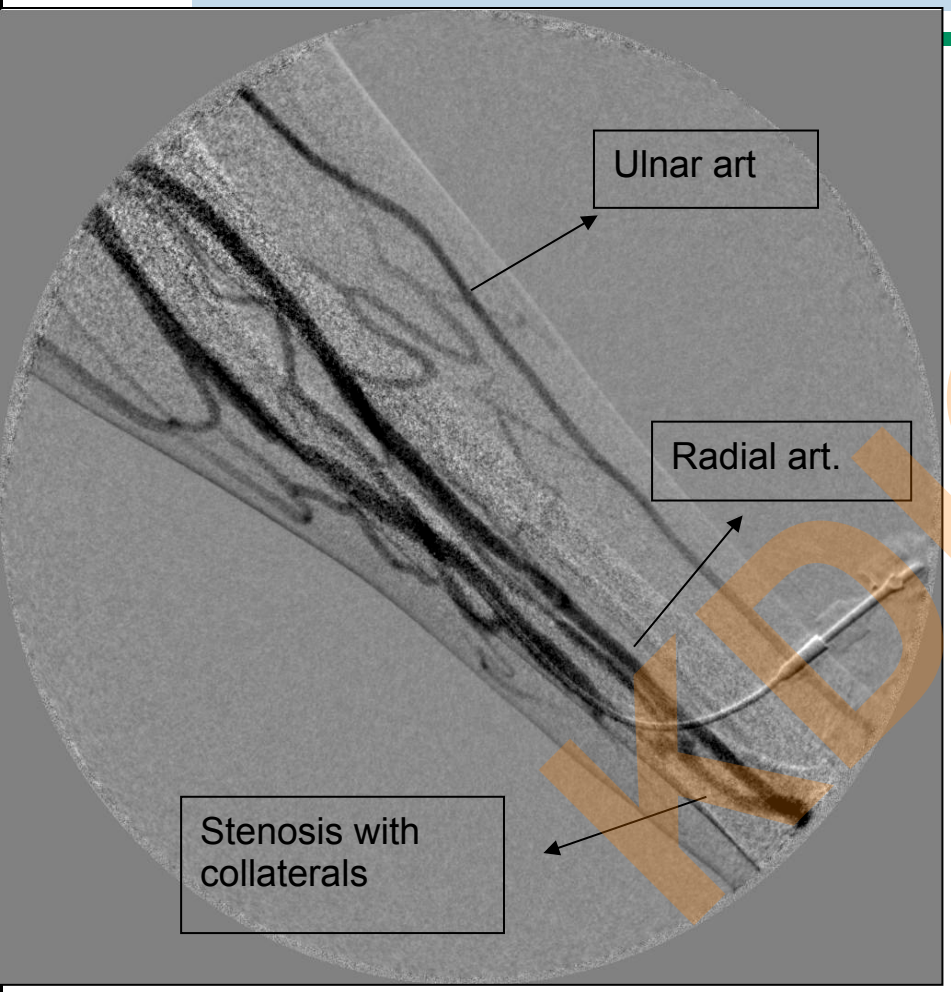


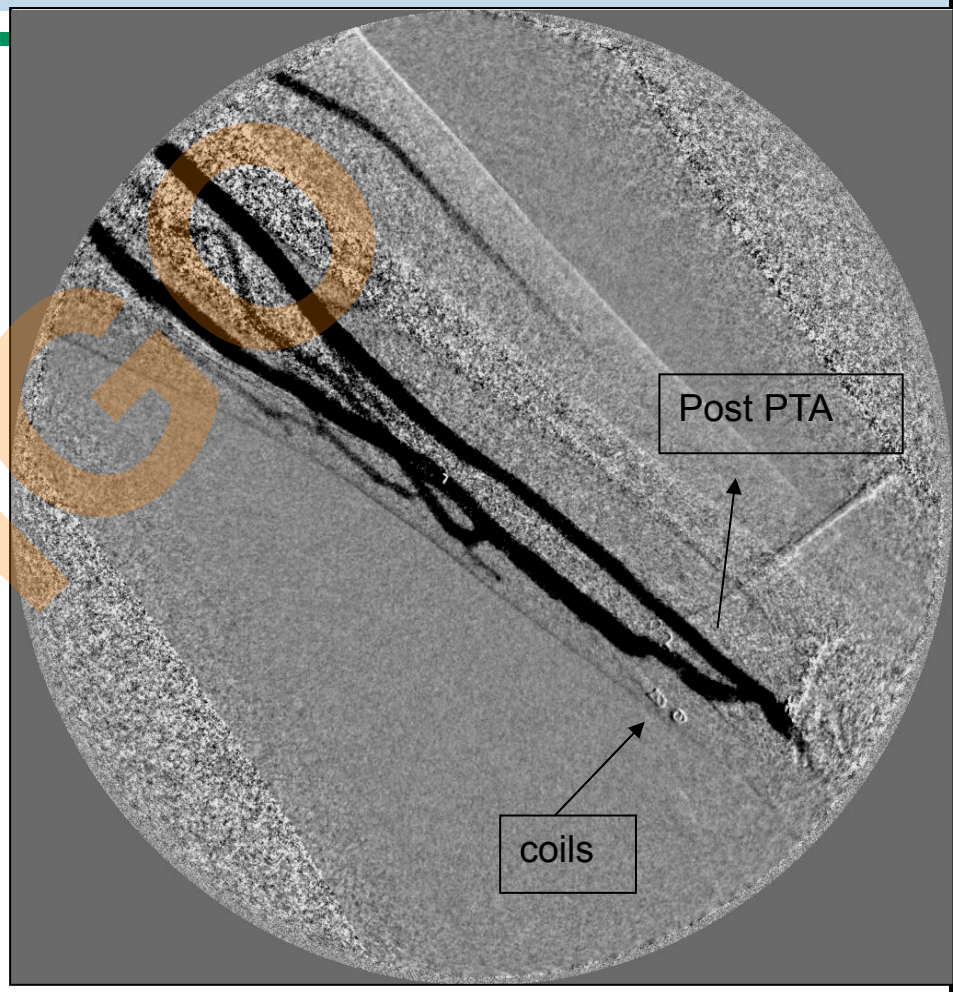




- Juxta-anastomotic stenosis
- Transposed forearm basilic vein to radial artery fistula

Accessory veins – coil embolization





Overview of FTM problem

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%)

Nassar et al - Clin J Am Soc Nephrol 1: 275–280, 2006

Access Monitoring

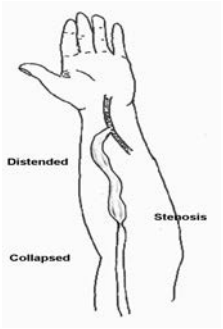
KDOQI defines monitoring, as applying physical examination techniques to detect access dysfunction.

When done correctly, monitoring can identify most access dysfunction.

Vascular Access Monitoring

The One Minute Access Exam

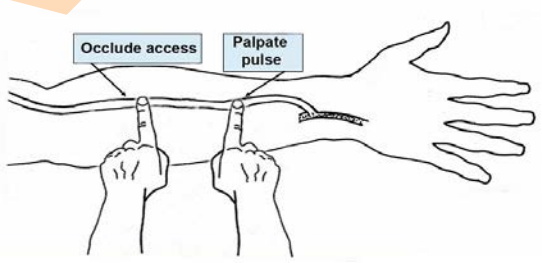
Look



Listen

Arm elevation Test

Feel



Augmentation Test

Central vein stenosis


KDIGO

Sensitivity and Specificity of PE

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

Diagnosis	Sens	Spec	PE + Angio
Inflow stenosis	85%	71%	83%
Outflow Stenosis	92%	86%	89%
Coexisting inflow-outflow stenosis	68%	84%	79%
Central vein stenosis	13%	99%	poor

Asif et al CJASN 2:1191;2007

Newer devices

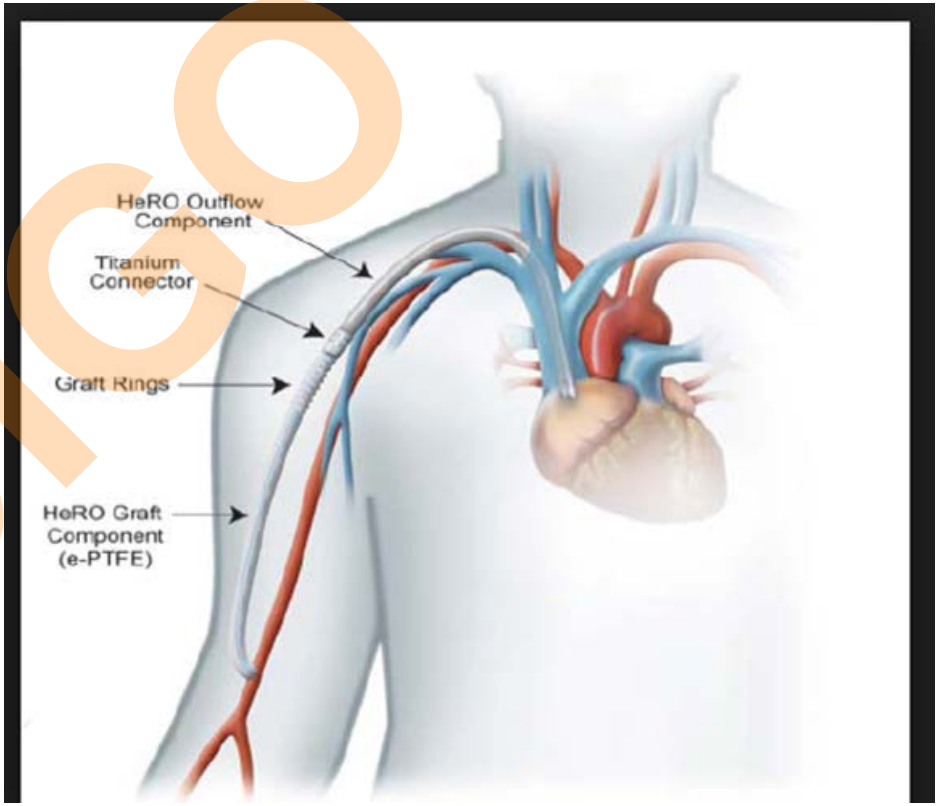
- Bioengineered blood vessels
- Novel anastomostic connectors – Optiflow
- Percutaneous Intergraft device for anastomosis
- Heparin bonded PTFE graft

Newer devices

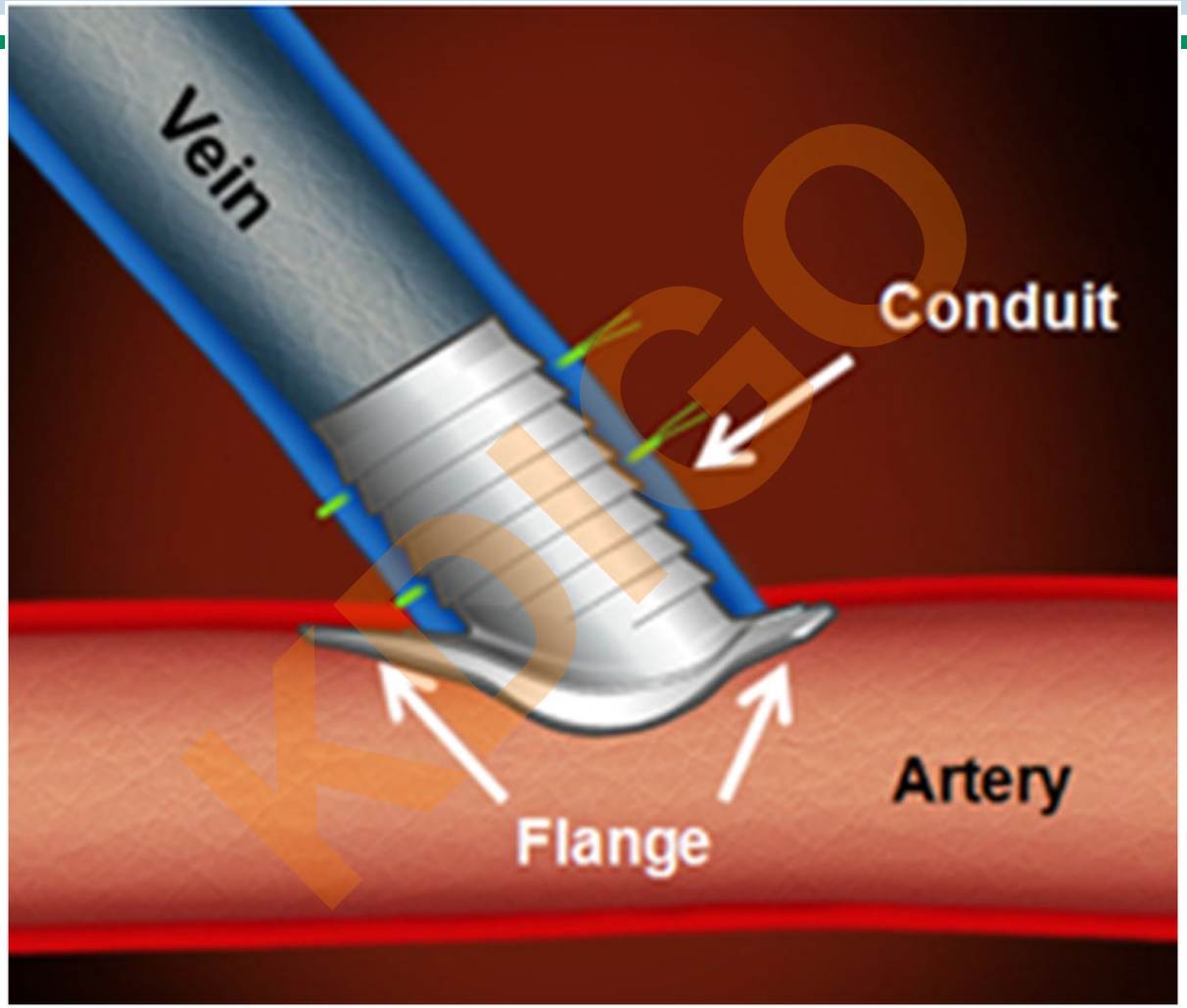
HeRO device –

Hybrid AVG + Catheter

- Indication
  - AVF is not an option
- Clinical experience
  - Limited
  - Thrombosis rate high

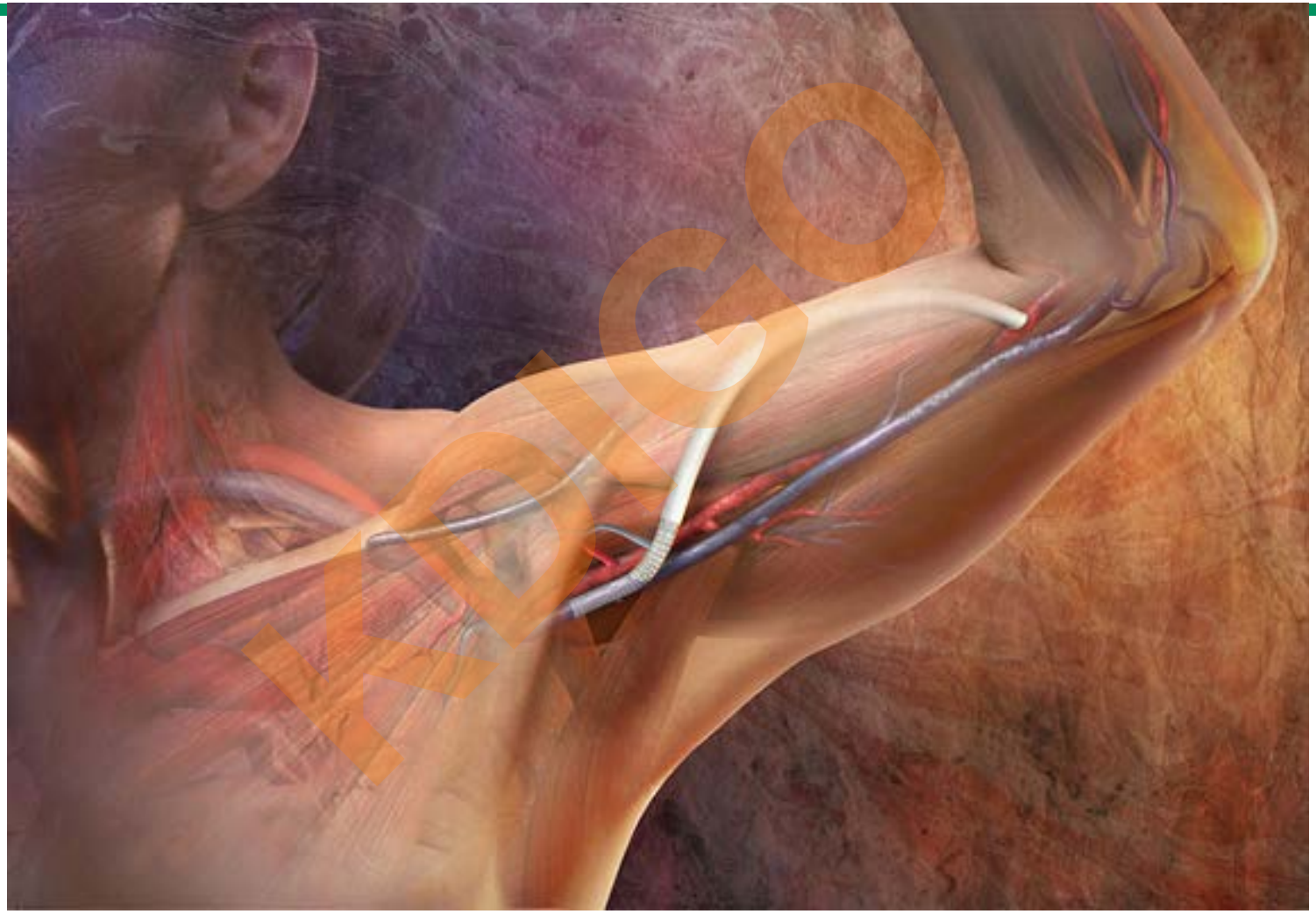


Optiflow implant.

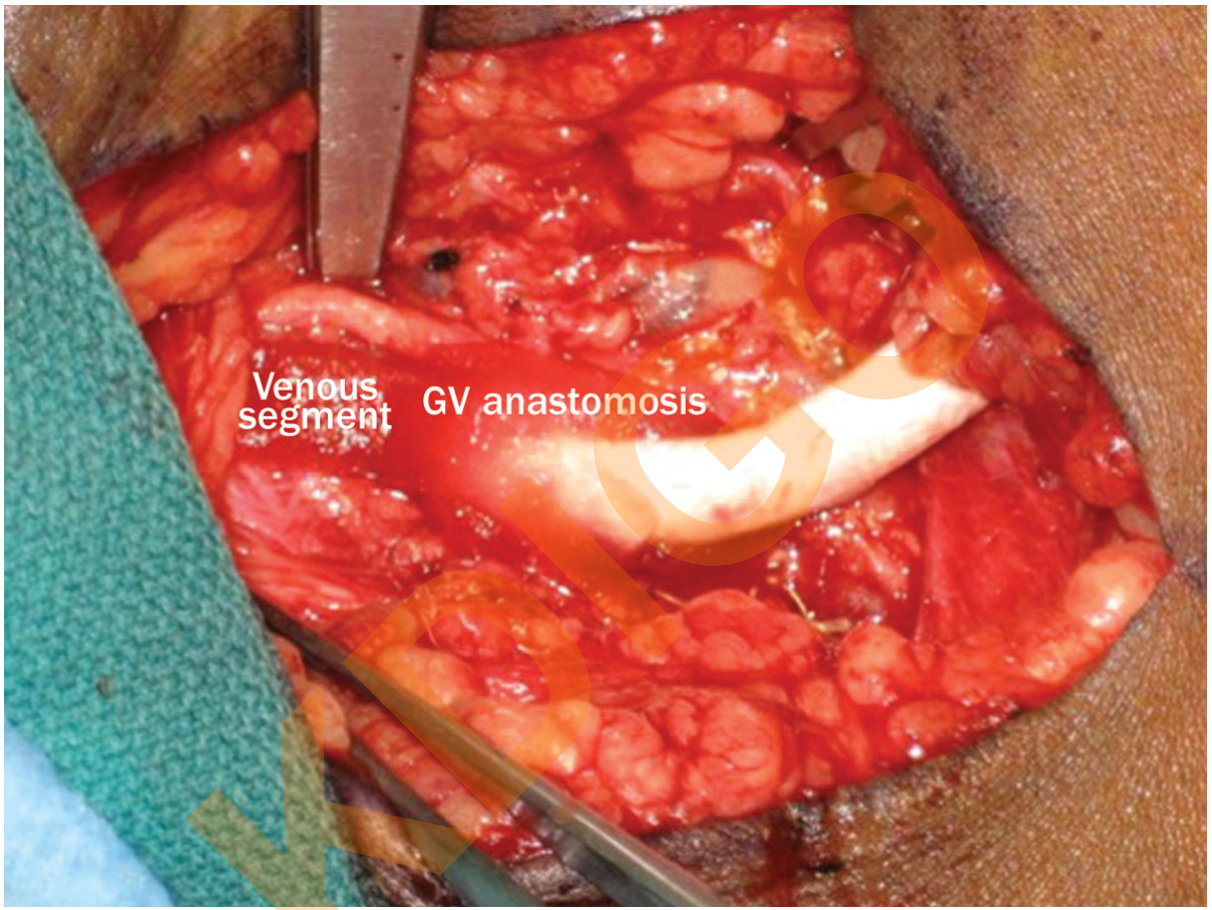


Yevzlin A S , and Valliant A M CJASN 2013;8:1244-1251

Sutureless Hybrid Vascular Graft



Vascugel® wrap

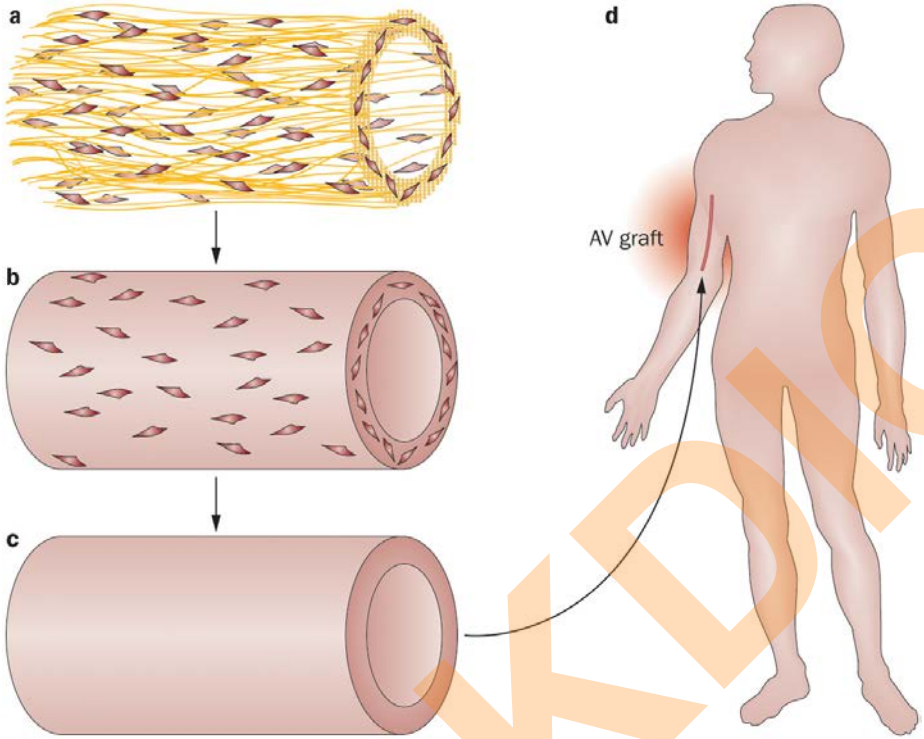


Conte, M. S. *et al. J. Vasc. Surg.* **50**, 1359.e1–1368.e1 (2009)

Riella, M. C. & Roy-Chaudhury, P. (2013) Vascular access in haemodialysis: strengthening the Achilles' heel
Nat. Rev. Nephrol. doi:10.1038/nrneph.2013.76

nature REVIEWS NEPHROLOGY

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

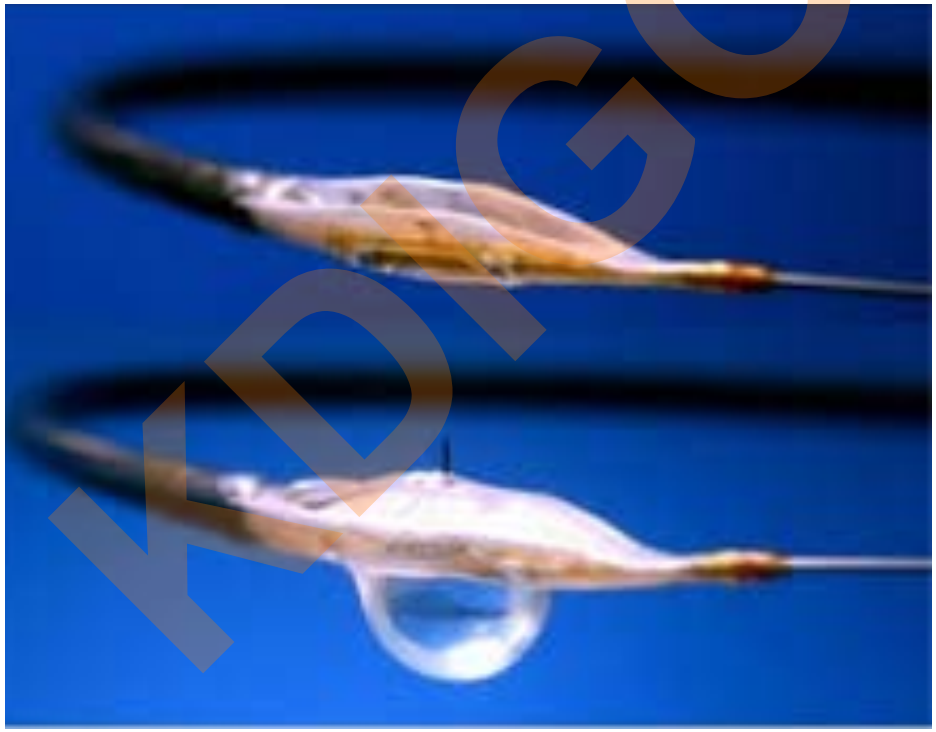
d | used as an arteriovenous conduit.

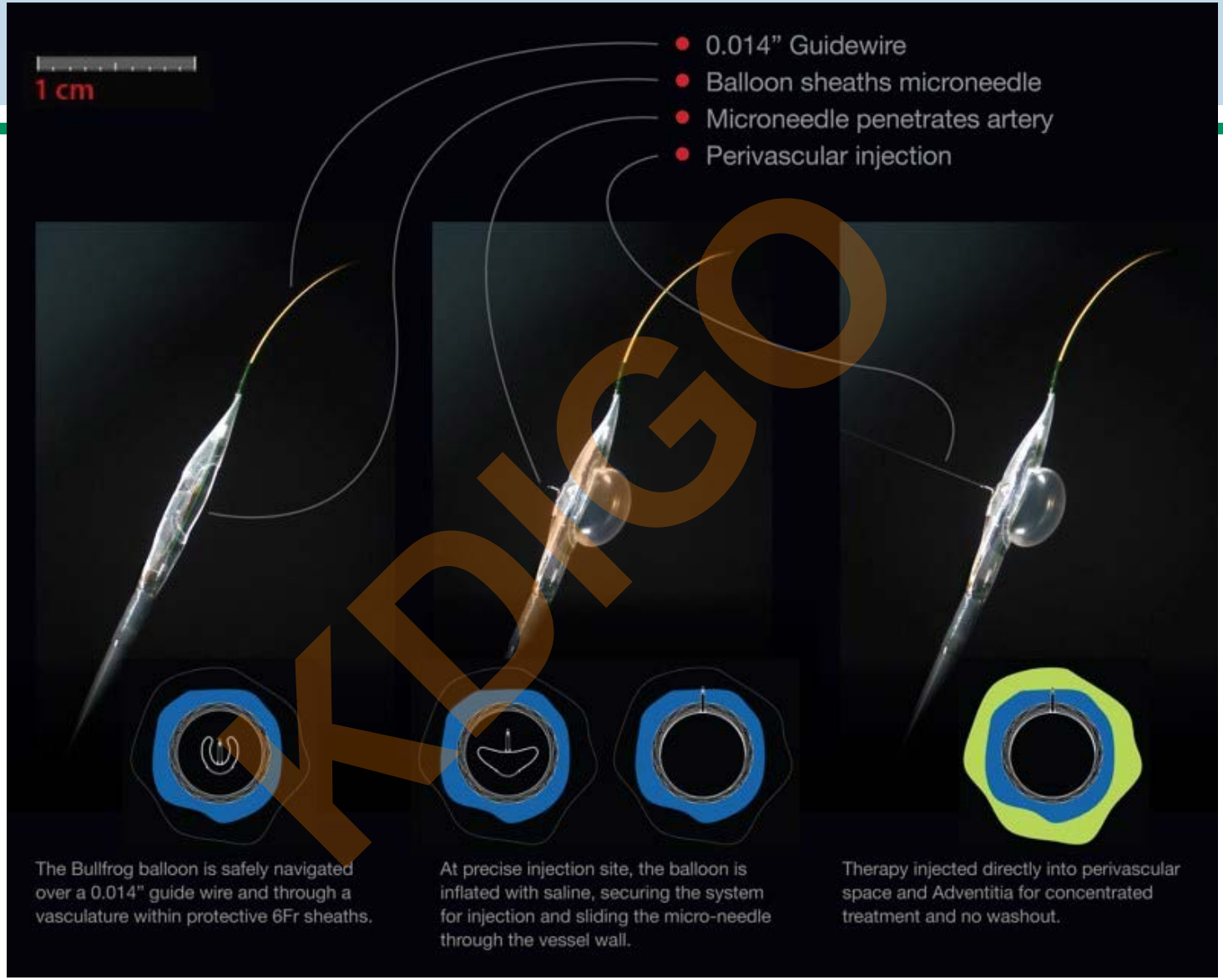
Abbreviation: AV, arteriovenous.

Riella, M. C. & Roy-Chaudhury, P. (2013) Vascular access in haemodialysis: strengthening the Achilles' heel
Nat. Rev. Nephrol. doi:10.1038/nrneph.2013.76

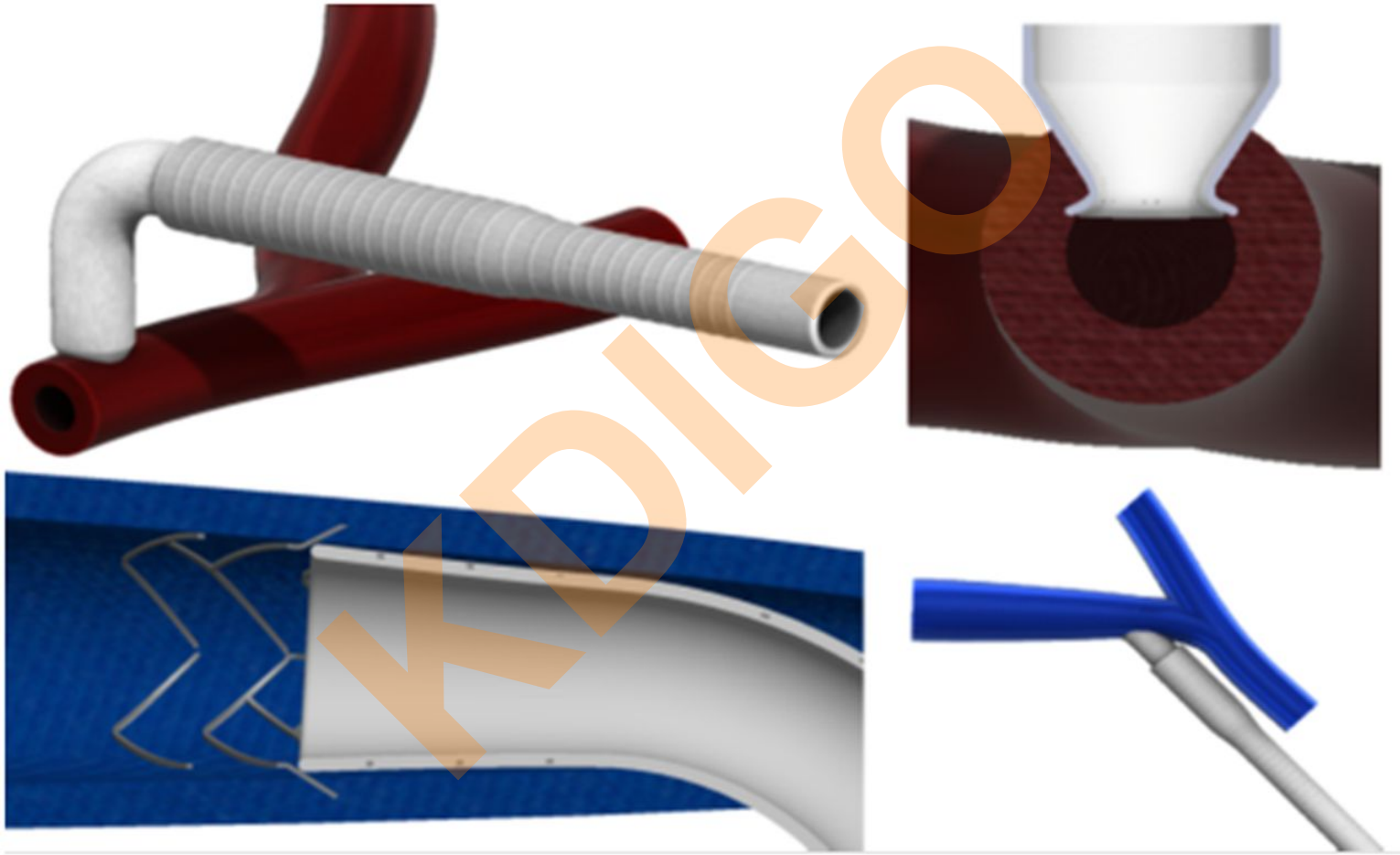
nature REVIEWS NEPHROLOGY

Targeted therapy




1 cm
0.014" Guidewire
Balloon sheaths microneedle
Microneedle penetrates artery
Perivascular injection
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

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