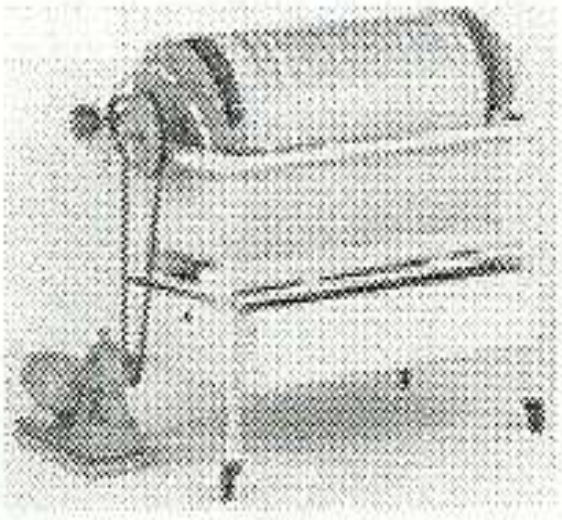
Vascular access

Ιωάννης Γ. Γριβέας, MD, PhD

athens-NEPHROLOGY

No dialysis without access

Dr. Willem Kolff



rotating drum kidney

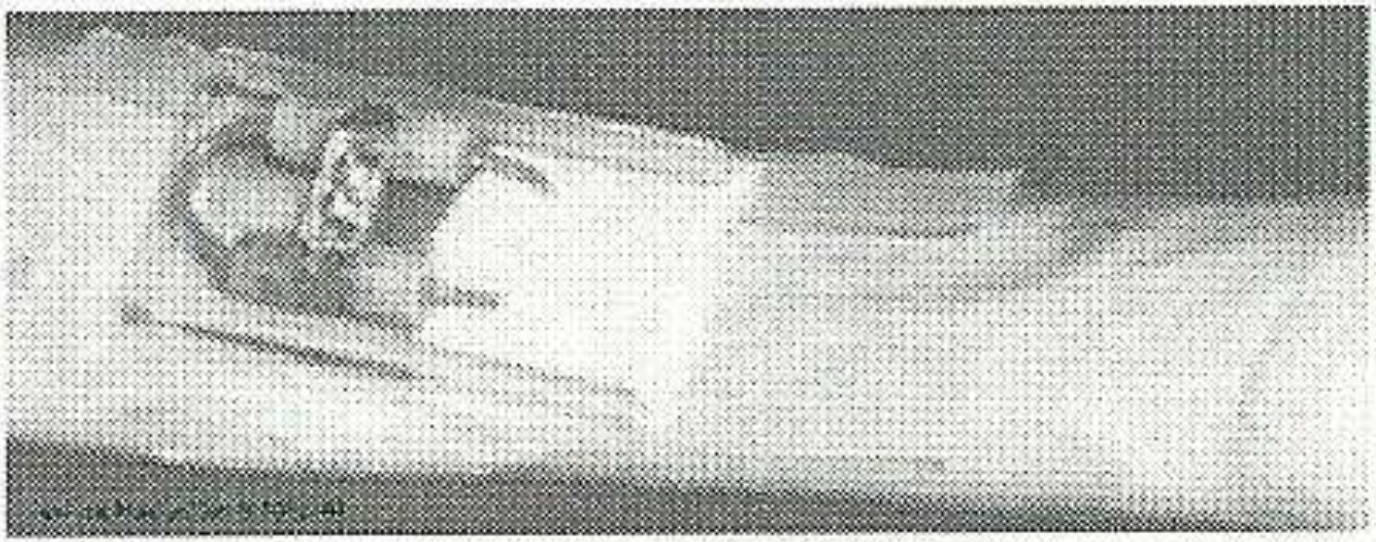
In 1943 Kolff treated his first patient with CDK, a 29-year-old household maid.

Each placement of cannulas for access required a cut-down to an artery. After 12 treatments the patient had no more suitable access sites and died.

Access Milestones

1960 Scribner shunt

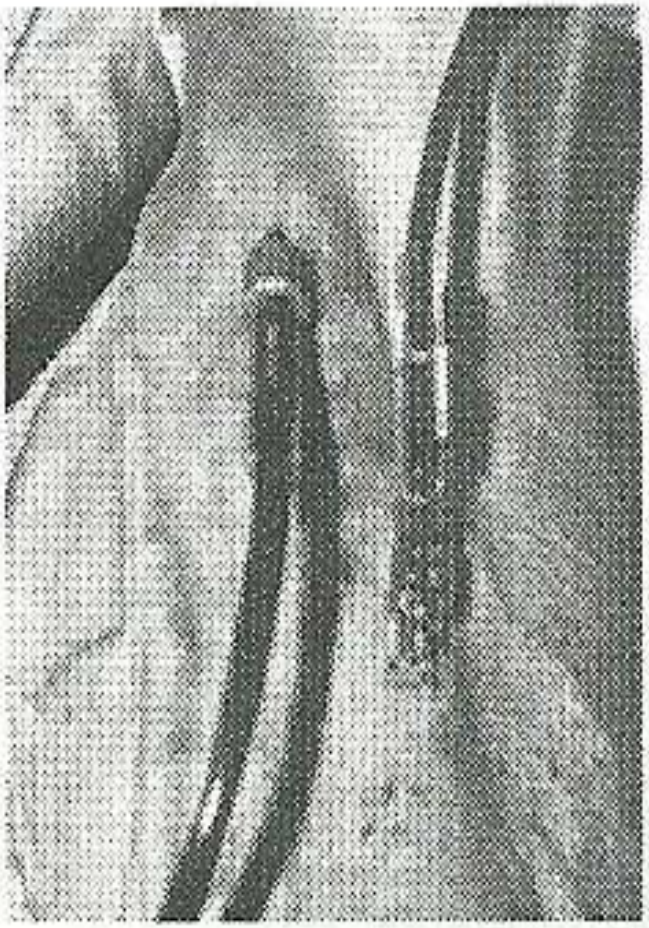
Dr. Belding Scribner, 1921-2003



Access Milestones

1966 Cimino Fistula

Dr. James E. Cimino



Access Milestones

1961 Shaldon - catheter in femoral artery and vei

1988 Tunneled cuffed catheter

1976 LD Baker - ePTFE graft

Nephrologists have been the driving force f
innovations in dialysis access care.

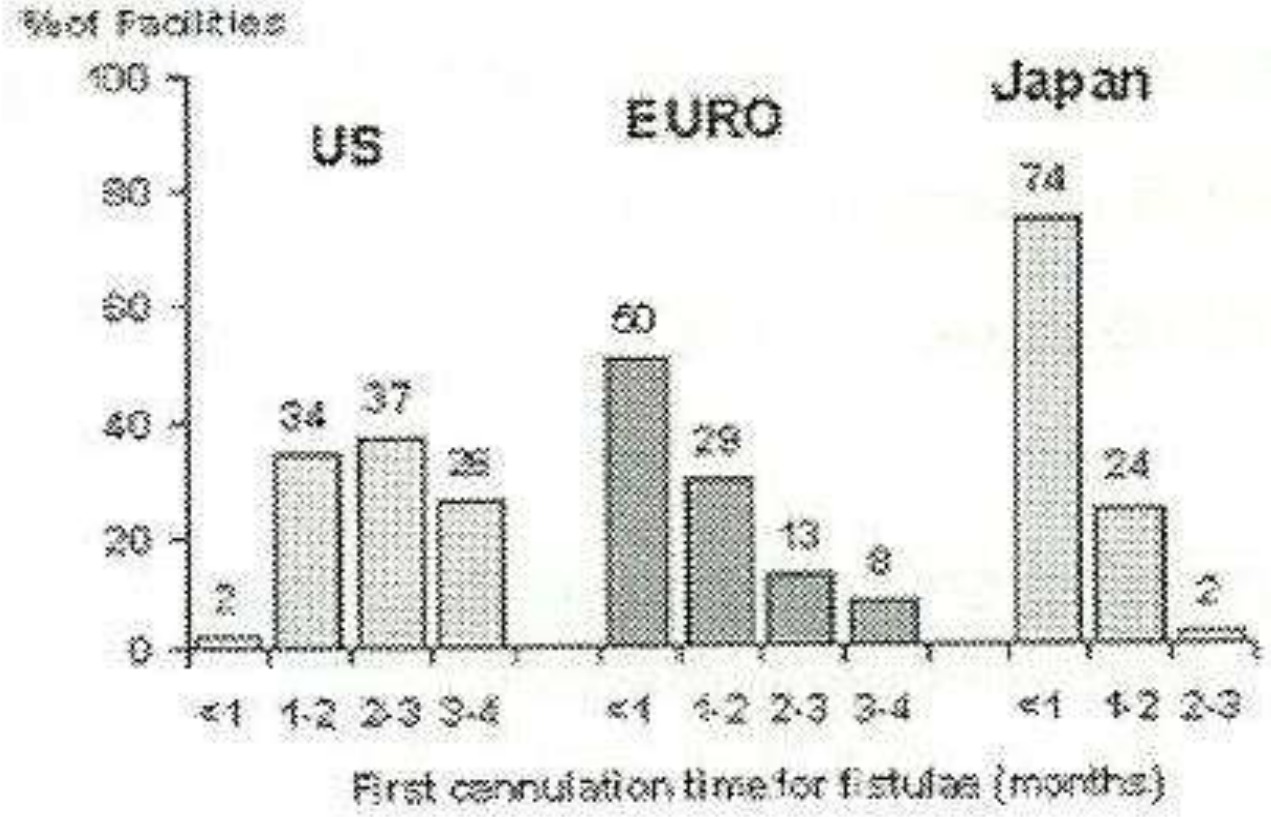
True / False

1. Cannulation of a fistula can be performed 6 weeks after it is created.

2. Maturation of AV fistulas is associated with pre-operative venous diameters > 2.5mm and arterial diameters >2 mm.

3. Twelve weeks after creation a fistula should have a diameter >6mm, be less than 5mm below the skin surface, and have a blood-flow of > 800ml/min.

1. AVFs can safely be cannulated 1-2 months after creation



Saran Nephrol Dial Transplant (2004) 19: 2334–2340

2. AVF Duplex-evaluation

- arterial diameter > 2.0mm
- venous diameter > 2.5mm

Silva MB Jr, J Vasc Surg 27:302-307

- blood flow increases within weeks to 500-800ml/min

Malovrh Nephrol Dial Transplant 13;125-129
Yerdel Nephrol Dial Transplant 12; 1684-1688

- 80% accuracy of experienced examiner to predict AVF success

Robin Radiology 225; 59-64

CPG 3 - Cannulation of AVF and AVG

1. Aseptic technique [A]

2. AVF [B]
   - Rule of 6s: at 6 weeks Q>600ml/min, d_{AVF}> 6mm, < 6mm deep
   - hand-arm exercises
   - failure to mature at 6 weeks: imaging/fistulogram

3. AVG [B]
   PTFE - wait 2 weeks/swelling down
   composite/PU - > 24 hours
   rotate cannulation sites (pseudoaneurysms)

4. CVC
   - examine tunnel site [B]
   - dressing change each HD treatment [A]
   - aseptic technique: mask, gloves [A]

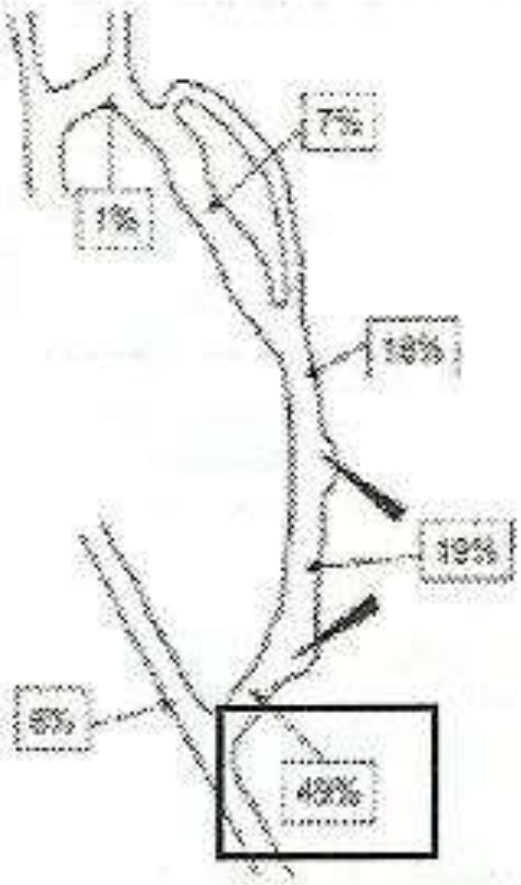
CPG 1 - Patient Preparation

1. GFR < 30ml - education (HD, PD, Tx) [A]
2. CKD Stage 4 and 5 - venipuncture/IV/PICCs NOT on upper or forearm [B] [hands are site of venipuncture!]
3. Timing at least [B]
   - AVF 6 months prior
   - AVG 3-6 weeks prior
   - PD cath 2 weeks prior
4. Evaluations before HD access placement:
   - H and P [B]
   - Duplex US upper extremity [B]
   - central vein evaluation if prior CVC or PM [A]

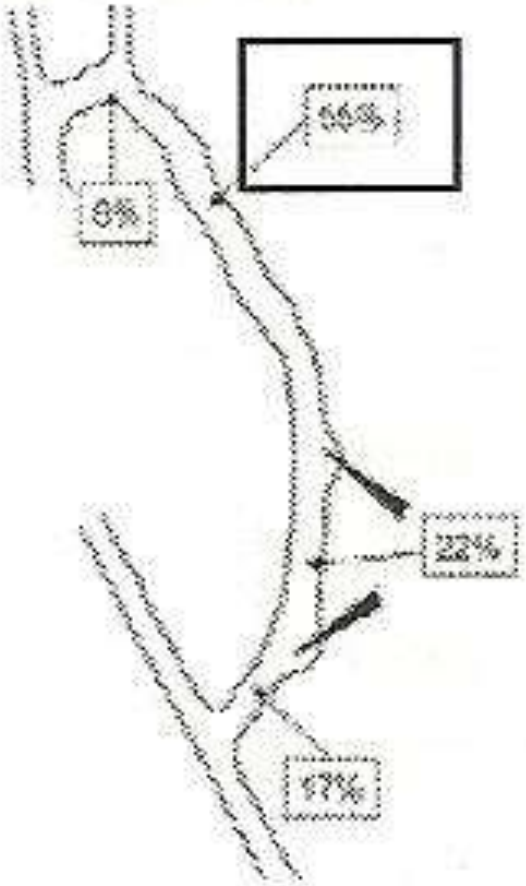
Physical Exam - Look Listen Feel

	AVF		Graft	
	nl		nl	
Look	straight main vein no aneurysm collaps c elevation	aneuryms surface collaterals	uniform sized no aneurysm site rotation	
Listen	low pitch continuous	high pitch discontinucus systolic	low pitch continuous	high pitch discontinuous systolic
Feel	thrill throughout easy to compress	water-hammer pulse at stenosis loss of thrill	thrill arterial anstomosis strong but throughout easy to compress	water-hammer pulse thrill may be increased at stenosis

Location of Stenoses in Native Fistulas

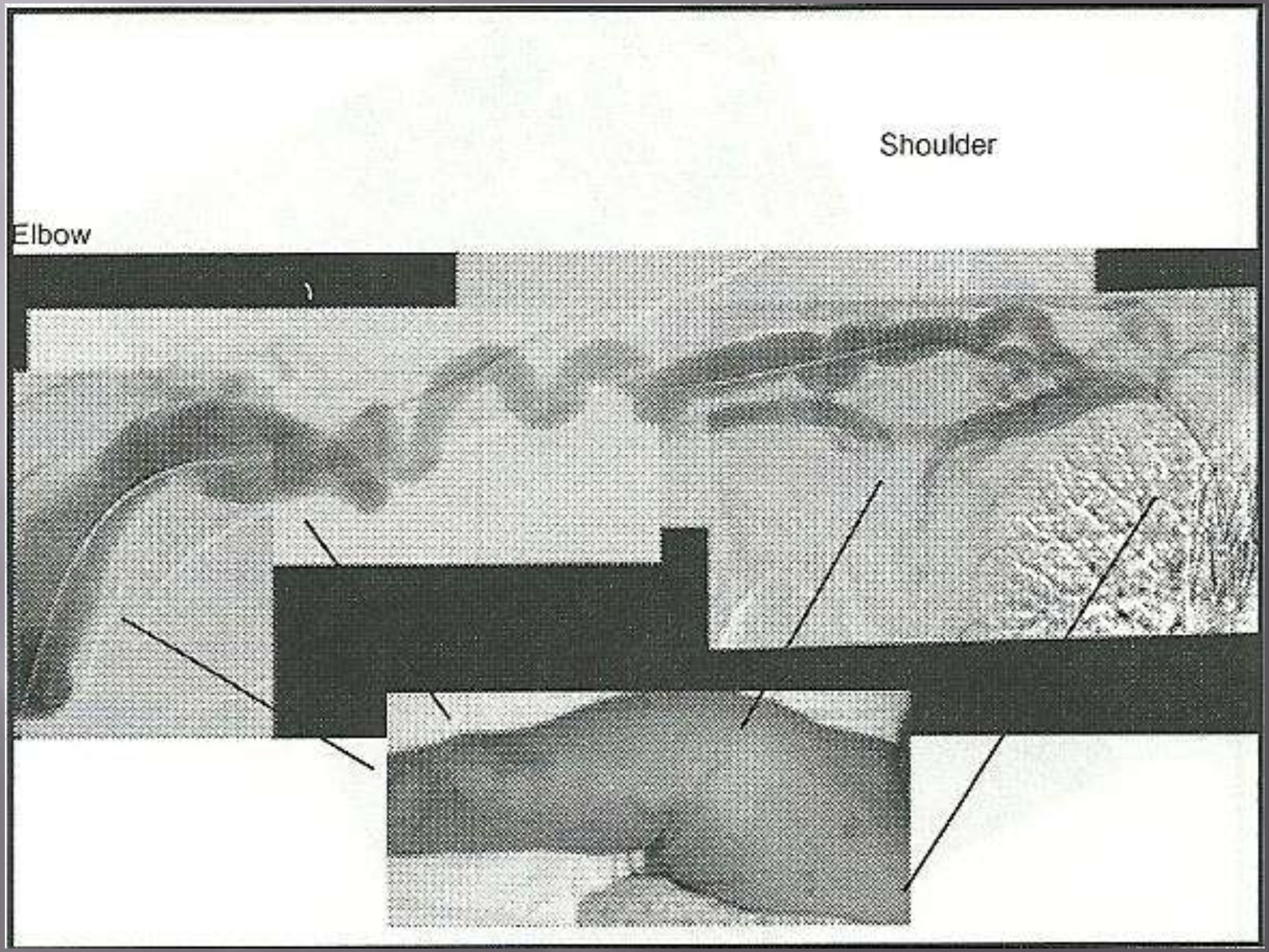


radio-cephalic

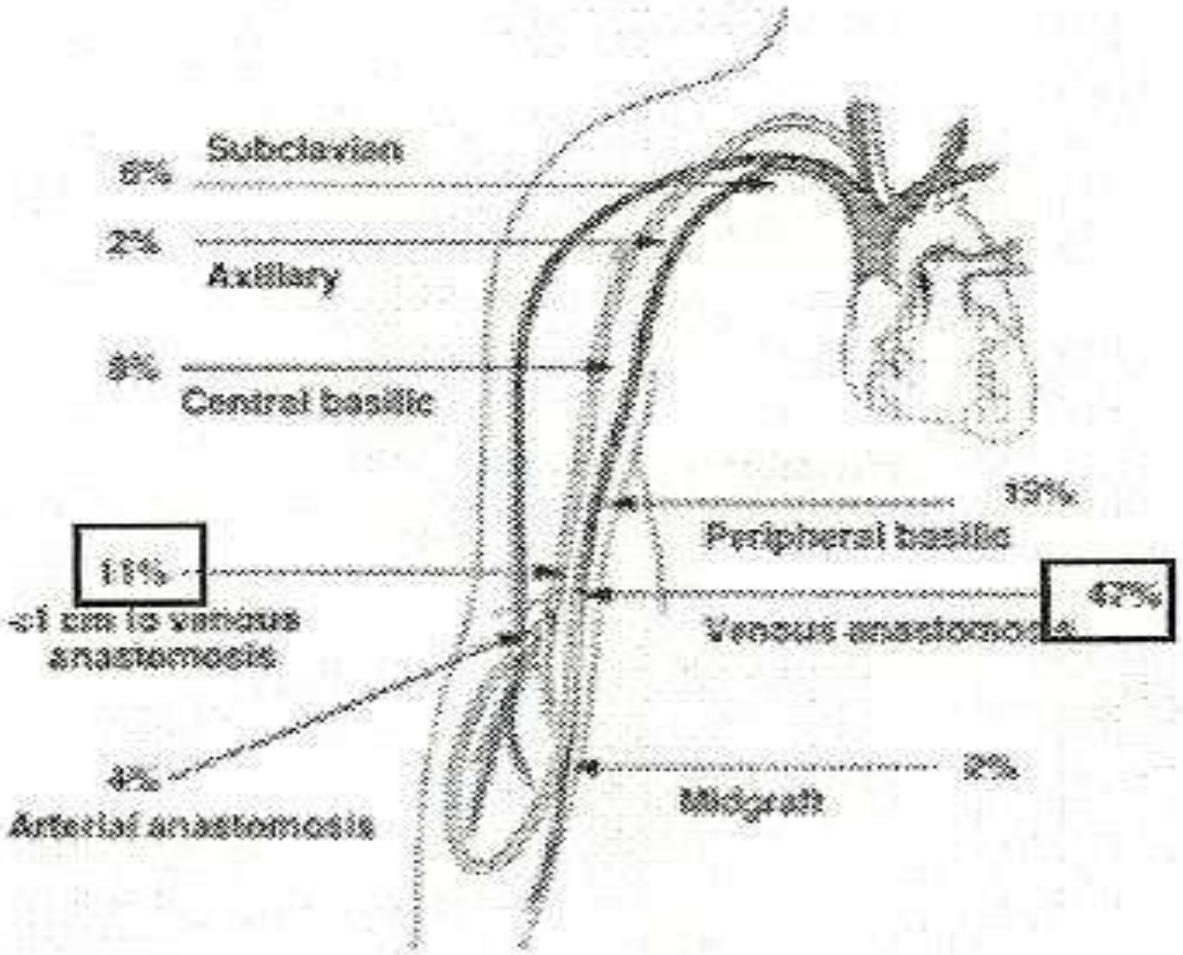


brachio-cephalic

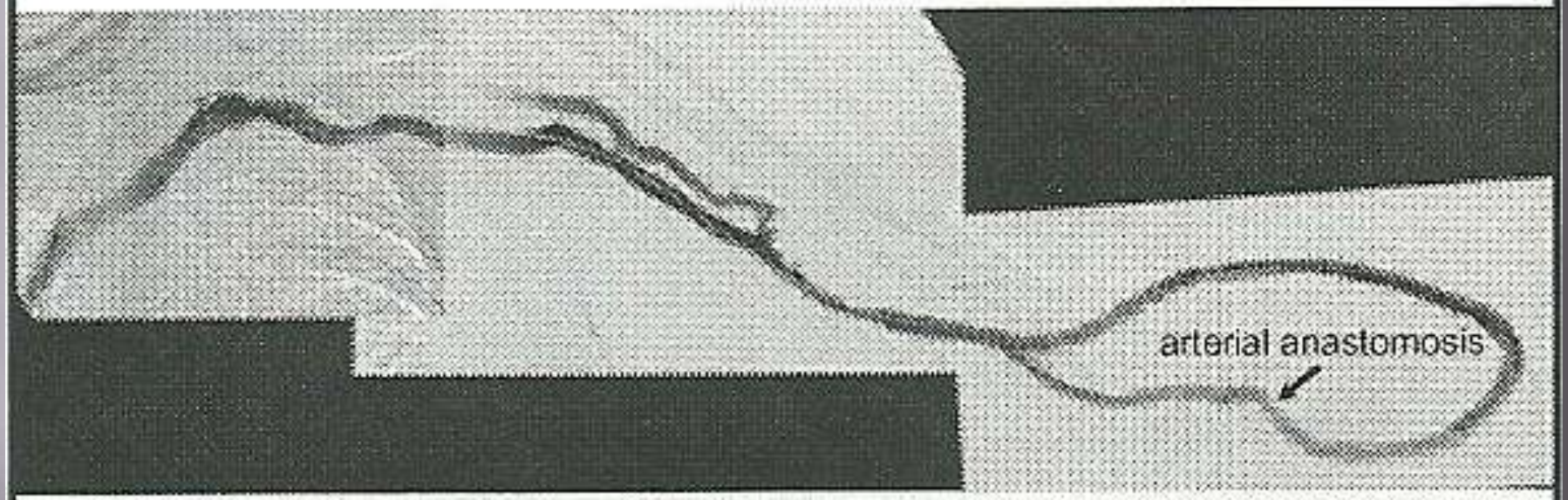
Nephrol Dial Transplant 2000; 15:2029-2036


Shoulder
Elbow

Location of Stenoses in Grafts

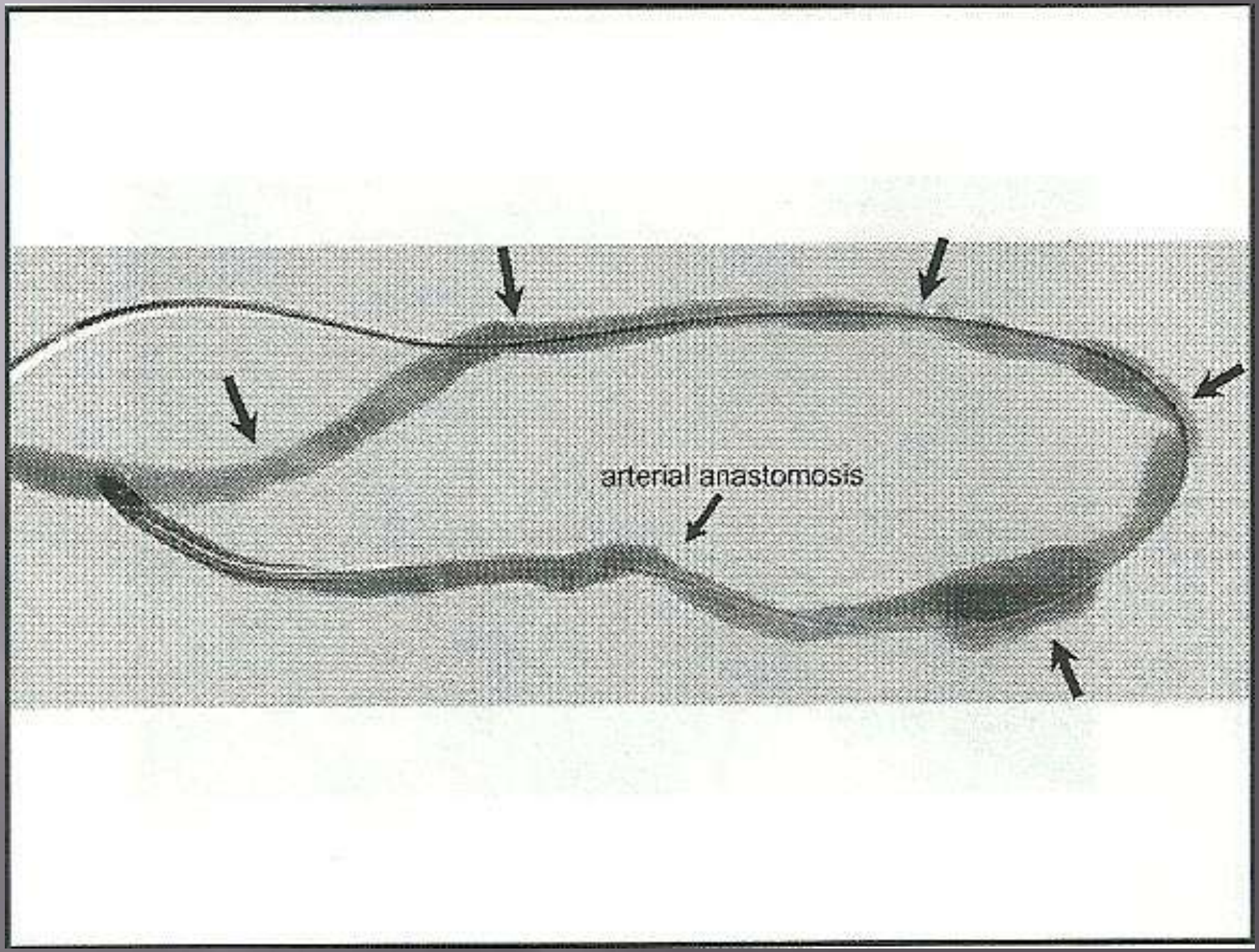


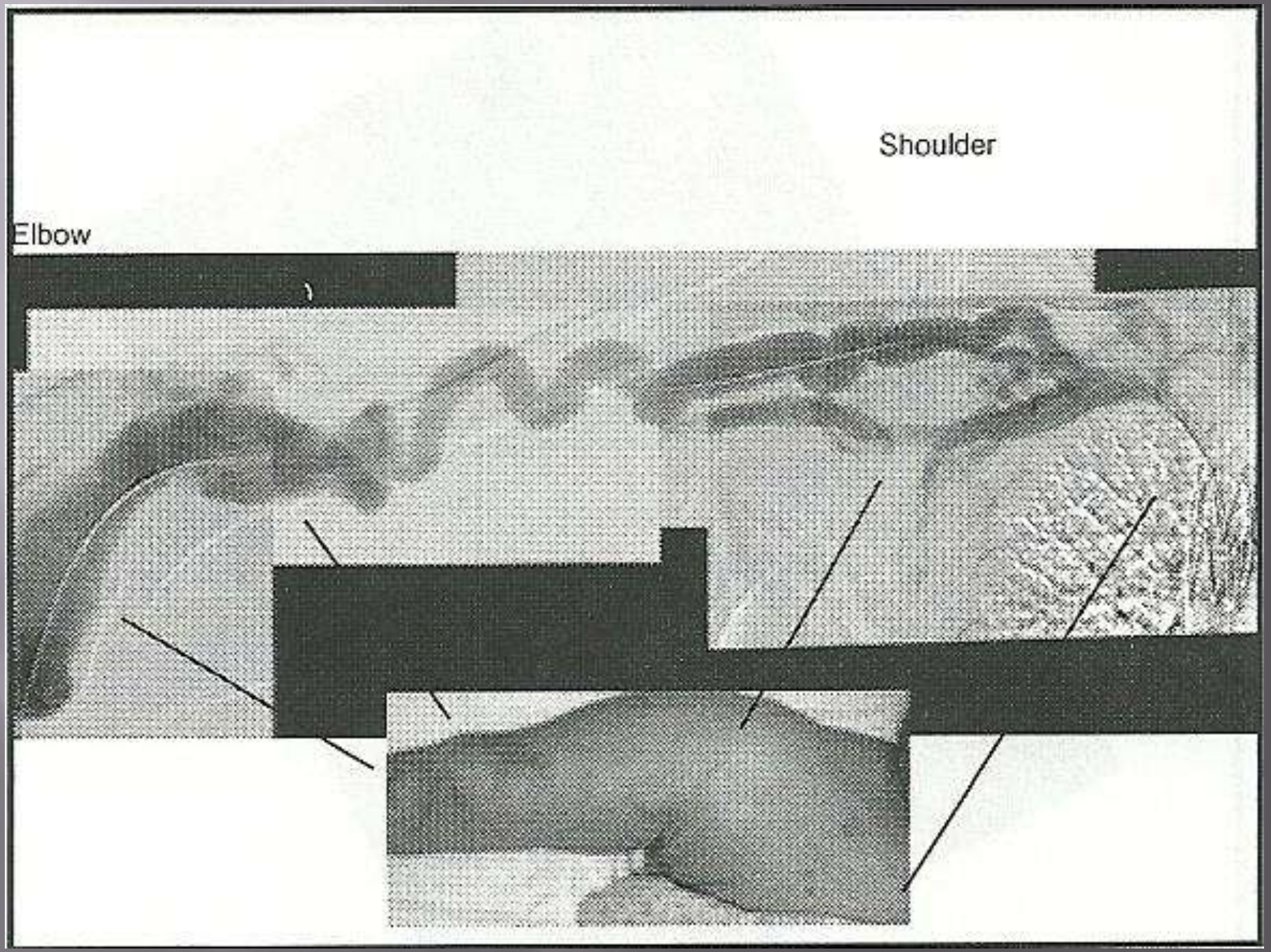
Courtesy TM Vesely



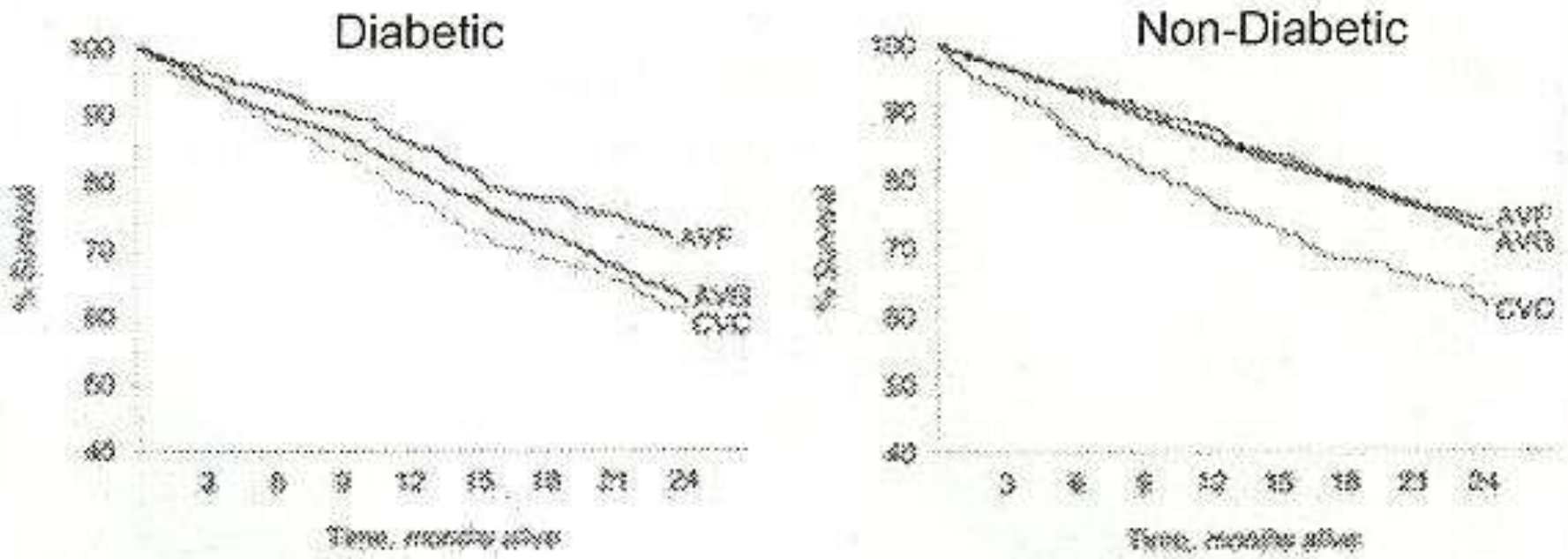
Stent of arterial loop aneurysm, multiple angioplasties

New graft on the right side.


arterial anastomosis


Shoulder
Elbow

Dhingra KI 2001



5507 pts; random sample from USRDS 1994

Diabetic patients: RR for death CVC (1.54) and AVG (1.41)

Non-Diabetic patients: RR for death CVC (1.70) and AVG (1.08 ns)

Fistula First
vs
Catheter Last

AVF success

- Hemodialysis Access (Fistula) requires:

- creation of fistula (Surgeon)
- assisted maturation and maintenance (Interventionalist)
- protection of veins and careful use (Nephrologist)

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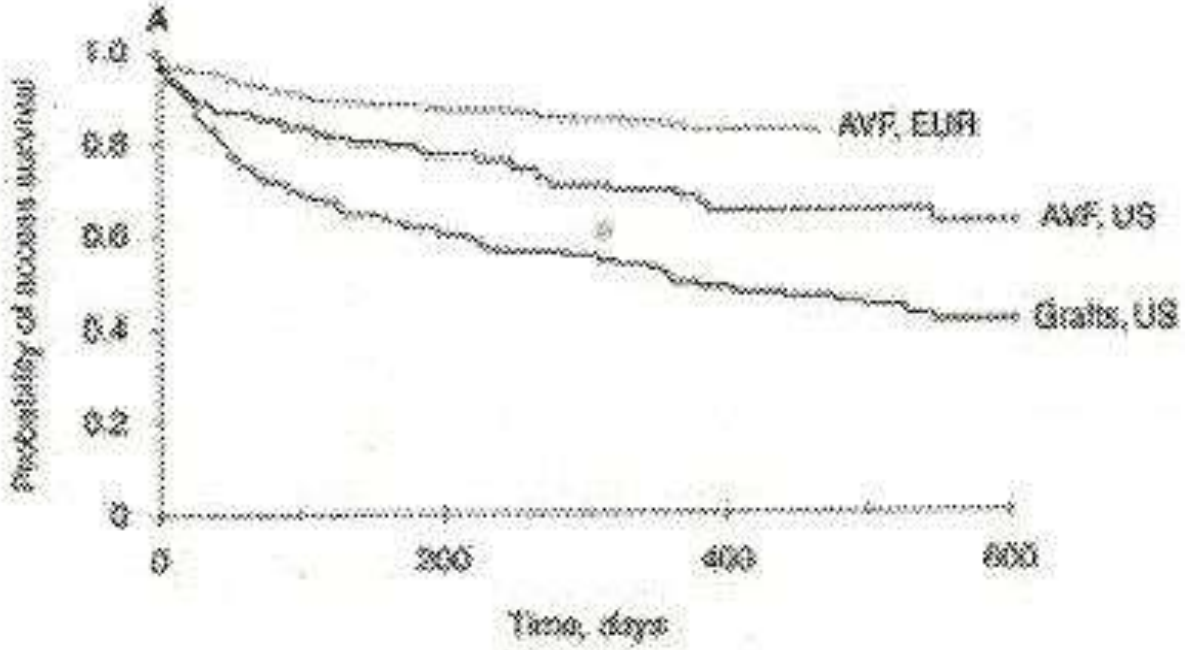
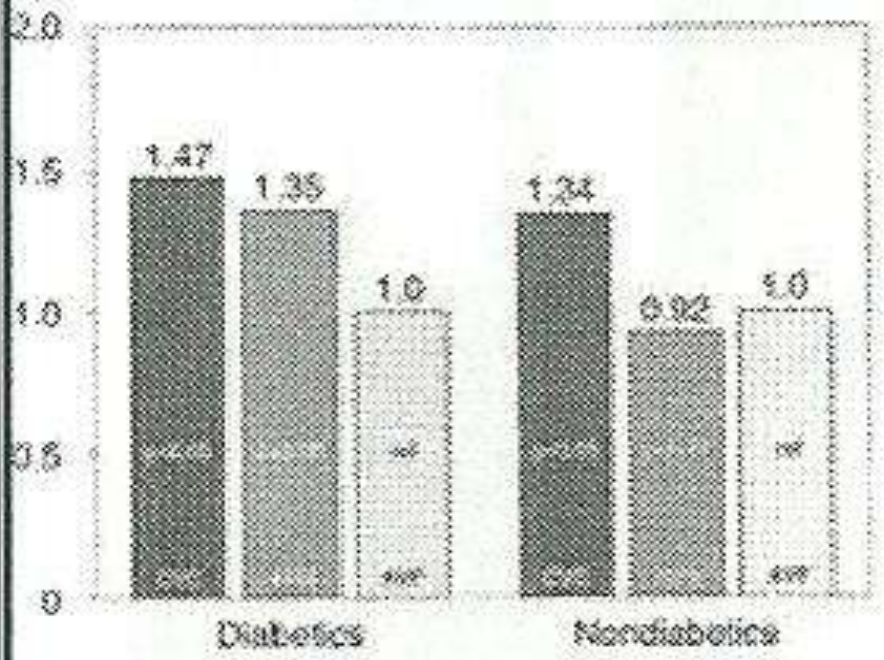
Pisoni KI 2001

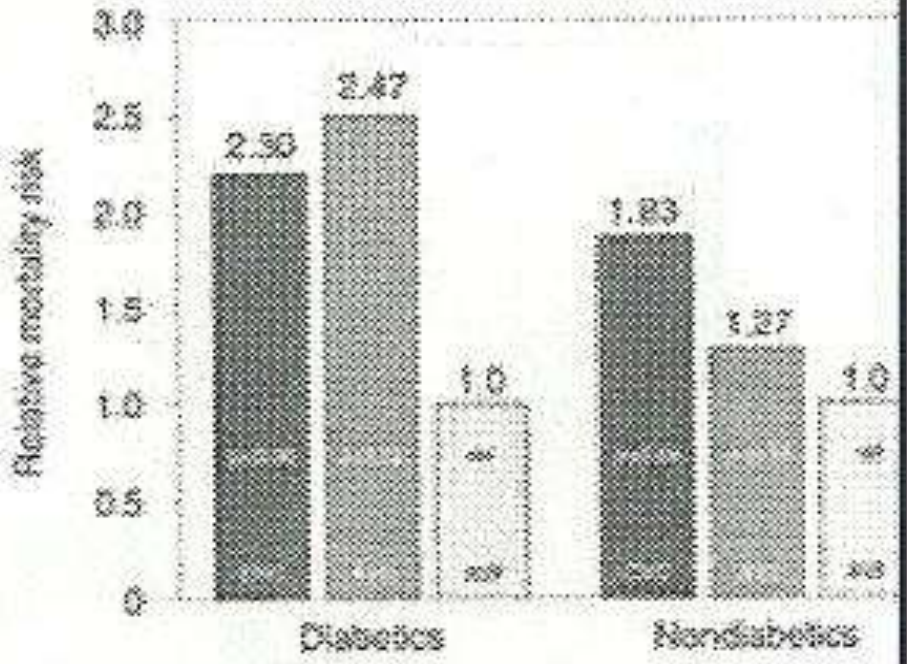


6479 patients from DOPPS, observational study
incident pts with permanent access: 430 Europe an 428 US
one-year survival: AVF Europe 83%, AVF US 68%, AVG US 49%

Why catheters are not fun...



Cardiac Mortality



Infectious Mortality

Dhingra KI 2001

Role of the Surgeon

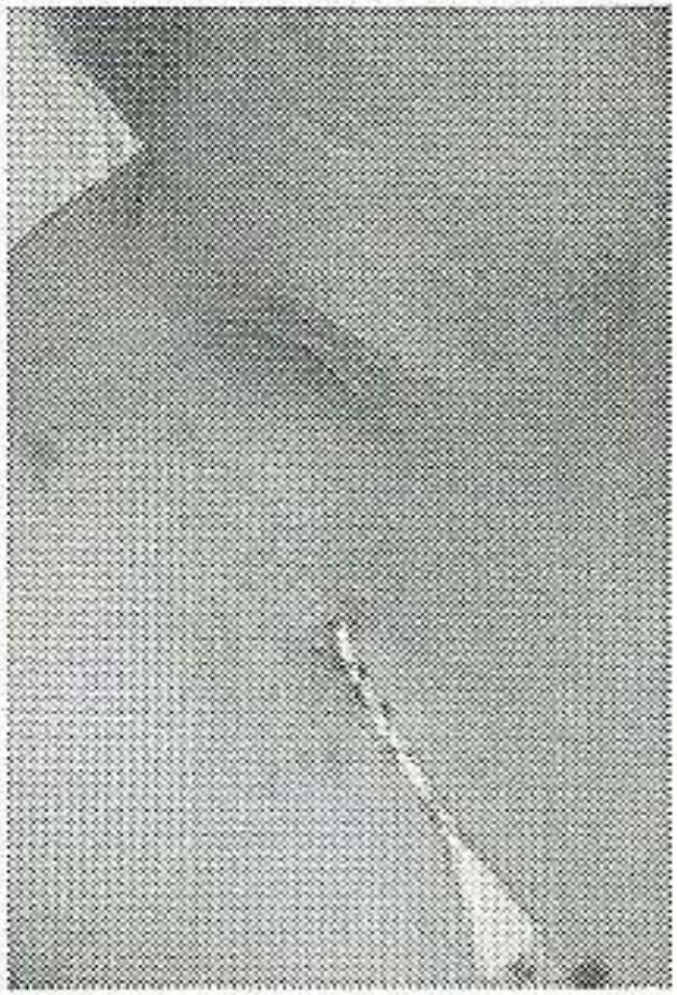
Dember JAMA 2008;299(18):2164-2171: 60% failure to attain suitability for dialysis

877 AVFs by 71 surgeons over the course of the study for 3.2 fistulae per surgeon per year

Konner Kidney Int 2002;62(1):329-338: >100 fistulas per year, failure to mature rate <11%

Fassiadis Semin Dial 2007;20(5):455-457: >100 fistulas per year per surgeon, <7% failure to mature rate

It must be the goal of patient and nephrologist to build a fruitful relationship with a dedicated access surgeon.



Tunnel infection

Remove catheter
Treat with antibiotics

Move tunnel to different site

Courtesy of TM Vesely

CPG 7 - Details 2

Infections:

a) Exit-site - topical and oral antibiotics

) CRB (catheter related bacteremia) - without catheter removal salvage <25%, guide wire exchange 80-88% salvage "salvage site rather than catheter";
recently, systemic Abx plus antibiotic lock 65-70% salvage;
catheter exchange if persistent fever or +ve Bcx

Bacteremia with tunnel-tract involvement - catheter removal; emergent if patient is unstable

- Minimum 3 weeks Abx for CRB; new access only after BCx negative for 48 hrs

Prevention: gent/citrate or taurolidine lock; Medihoney… RCT still missing

PG 7 - Prevention and Treatment of CVC complications

Dysfunction := cannot maintain 300ml/min bloodflow at -250mmHg prepump arterial pressure

Treatment: repositioning; thrombolytics; catheter exchange with sheath disruption

Infection
- parenteral Abx, empiric followed by specific
- exchange as soon as possible (<72hrs)
- follow-up Cx 1 week after cessation of Abx

True / False

1. PICC-lines are good long term access optior in dialysis patients with limited peripheral vein

2. Non-healing cutaneous ulcers on the access are a sign of poor needle insertion technique.

3. Tunneled hemodialysis catheters are associated with subsequent central venous stenosis.

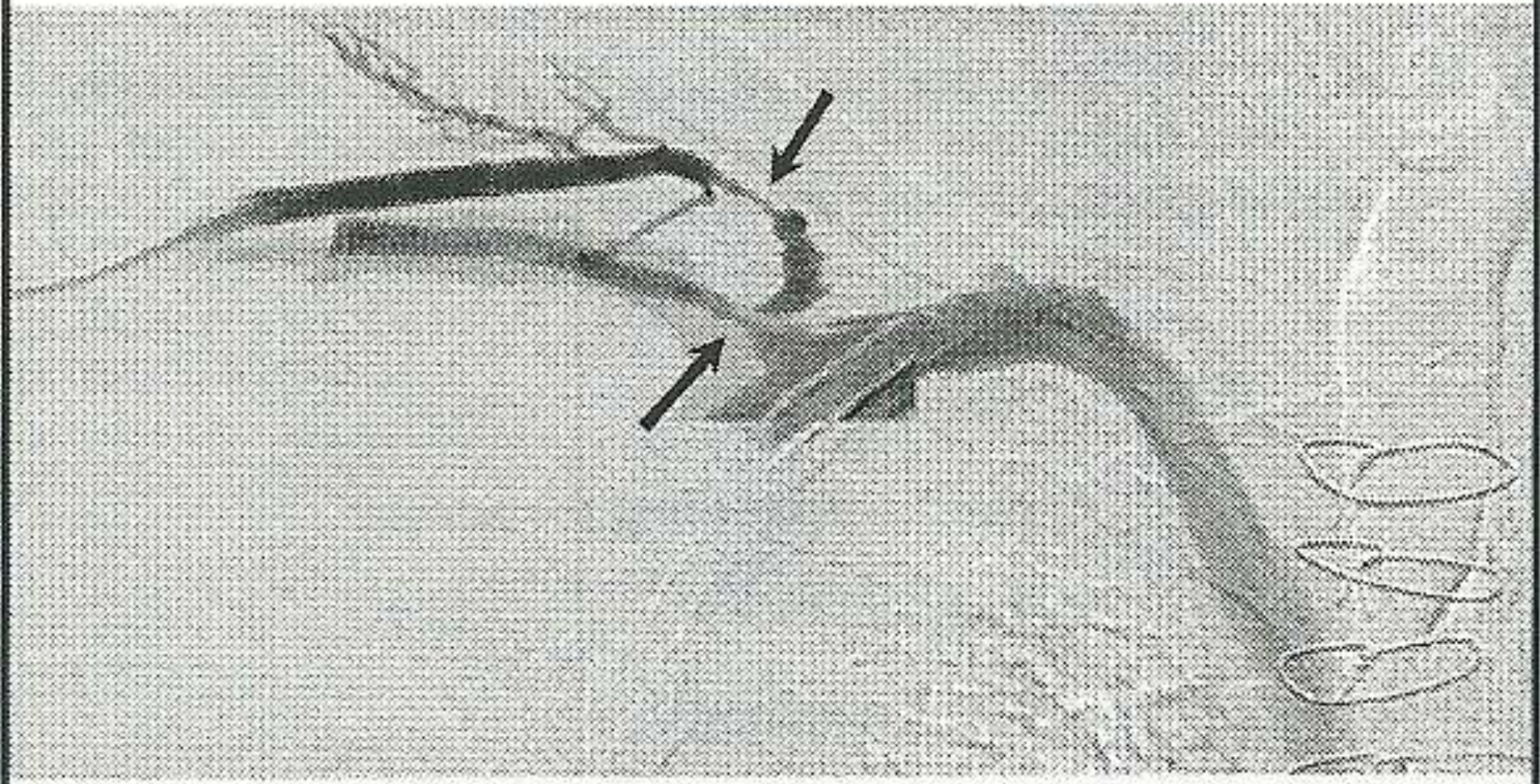
What one should know about indwelling catheters...

1. PICCs
   - central vein stenosis and occlusion 7% Gonsalves, 2003
   - upper arm thrombosis 11-85% Abdullah, Br J Radiol 2005

2. All indwelling vascular catheters are colonized within 24 hours after insertion. Raad J Infect Dis 1993;168:400

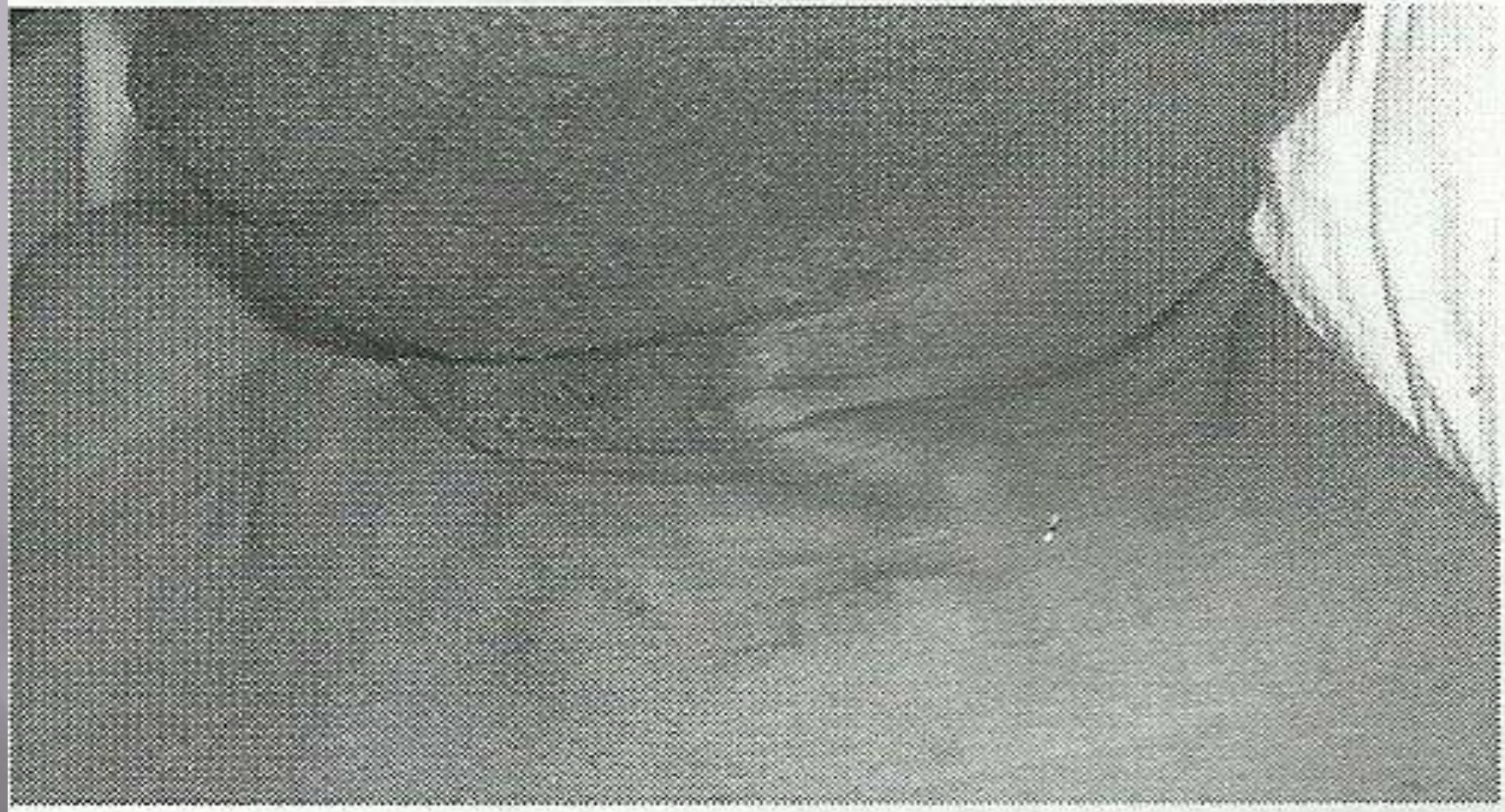
Shoulder

Sternum



Case 8

- A 74-year-old chronic hemodialysis patient who uses a left upper extremity brachio-basilic graft for dialysis recently noted arm swelling and prominent neck veins.
- Prior to the current graft he had left internal jugular tunneled hemodialysis catheter.



CPG 2 - Selection and Placement of Hemodialysis Access

1. AVF > AVG (> CVC): thrombosis, infection, duration
2. Distal to proximal; arm before leg or neck
3. CVC: R IJ > R EJ, L I/EJ, Fem, trans-lumbar, trans-hepatic; (subclavian)
4. Tip position: cuffed vs non-cuffed
5. Graft material: PTFE vs other