Dialysis Access – creating and maintaining “The Thrill”

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Overview

- Definitions (RRT, CKD)
- Indications dialysis: uremia, edema, HF, respiratory distress, encephalopathy
- Options for patients: TXP, HD, PD
- AVF's and AVG's
- Complications dialysis access
- Interventions

Definitions

- Renal Replacement Therapy (RRT)
- Chronic Kidney Disease (CKD): Kidney damage (usually detected as urinary albumin excretion of 30 mg/day or more, or equivalent) **or** decreased kidney function (defined as an estimated glomerular filtration rate [eGFR] <60 mL/min/1.73 m^2) **for three or more months**, irrespective of the cause.

Stages of Chronic Kidney Disease of all Types		
Stage	**Qualitative Description**	**Renal Function (mL/min/1.73 m^2)**
1	Kidney damage-normal GFR	≥90
2	Kidney damage-mild ↓ GFR	60-89
3	Moderate ↓ GFR	30-59
4	Severe ↓ GFR	15-29
5	End-stage renal disease	<15 (or dialysis)

Indications for dialysis

- Uremia
  - Very high plasma urea concentration that is the result of renal failure.
  - Progressive weakness and easy fatigue, loss of appetite due to nausea and vomiting, muscle atrophy, tremors, abnormal mental function, frequent shallow respiration and metabolic acidosis
- Edema
- Heart Failure
- Respiratory distress
- Encephalopathy

Timing of initiation of dialysis

- 2015 Kidney Disease Outcomes Quality Initiative (K/DOQI) guidelines recommend that patients with an estimated glomerular filtration rate (eGFR) <30 mL/min/1.73 m^2 should be educated on the advantages and disadvantages of hemodialysis

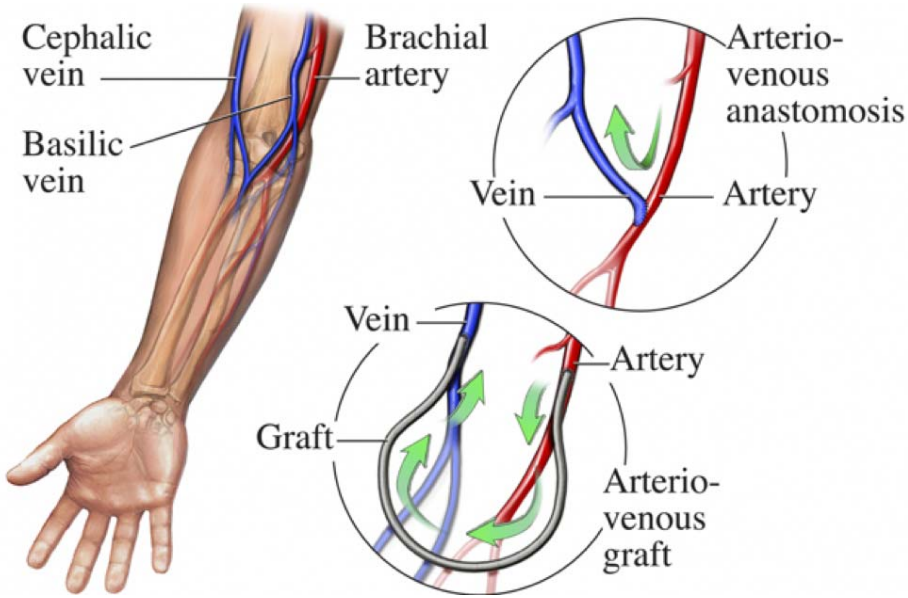
Options for patients:

- Transplant
- Hemodialysis
- Peritoneal Dialysis

AV Fistula and AV Graft

- AVF
  - Lower infections, higher flow rates, less thrombosis, more durable, fewer revisions
  - Lower maturation rates, failure to mature, aneurysm
  - Less success (higher primary failure) -> wrist fistula, older patient, obese, nonwhite, female, diabetic, and/or have peripheral artery or coronary heart disease
  - ~23 % AVF's will not be useable
- AVG – can be used much sooner (even less than 24 hours)
- Fistula First Initiative -> 65%
- Relative benefit of fistulas may vary depending on the patient population, including age and comorbidities – means AVG very reasonable in older sicker folks

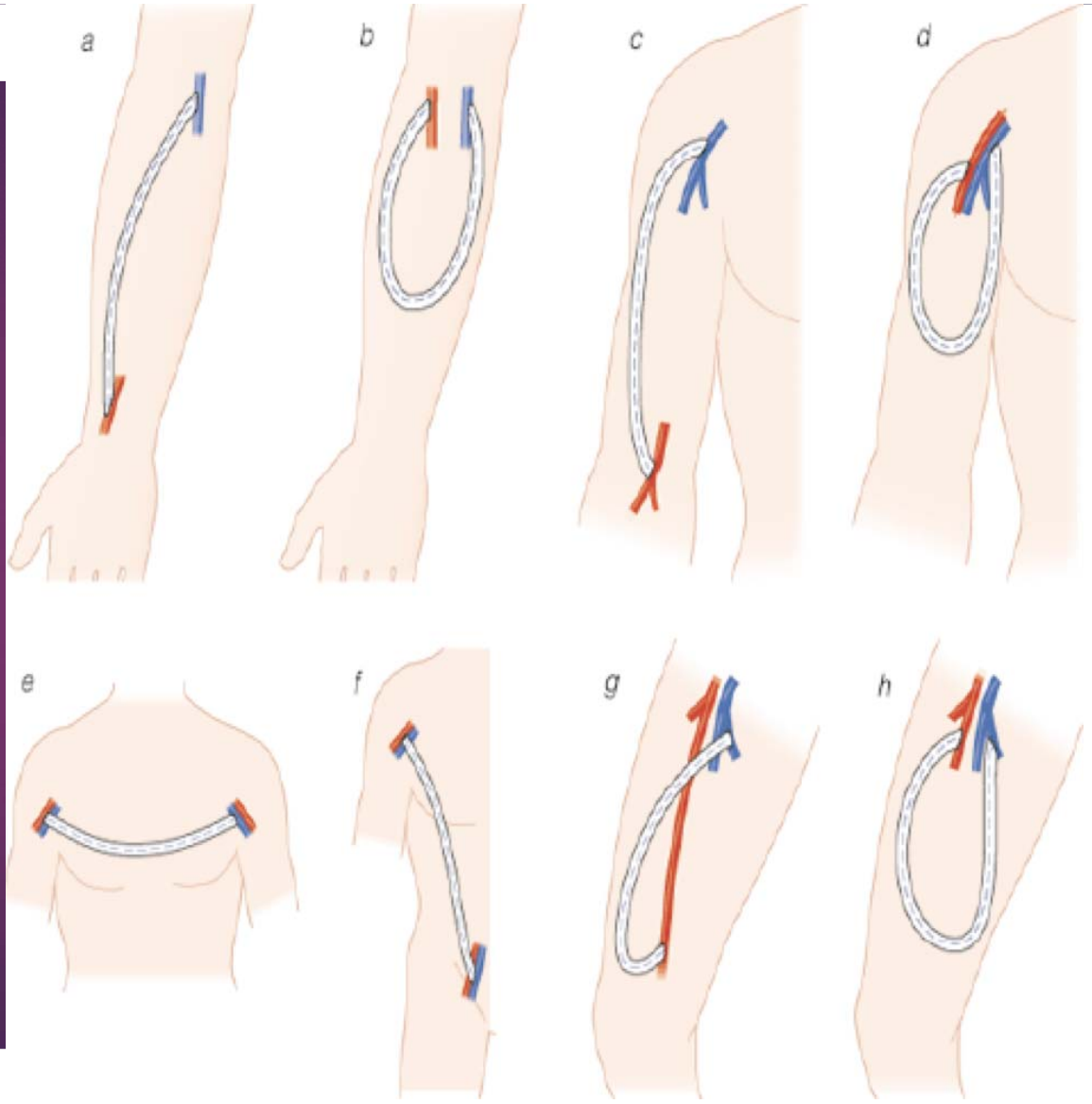
AVF's and AVG's



Pre-operative evaluation for arm access

- Ultrasound vein mapping – prefer non dominant arm and try to create as “distal” as possible
- Factors to consider – age of patient, body habitus, gender, diabetes

AVG Configurations



AVF Maturation

- Minimum time AV fistula maturation - 1 month;
- Longer lead time 6 to 12 months recommended since intervention may be required to facilitate maturation
- Rule 6's:
  - 600 mL/min flow
  - diameter at least 0.6 cm
  - no more than 0.6 cm deep

AVF/AVG creation

- Often with MAC/local; sometimes general; rare straight local
- Hybrid room allows for combo open surgery and completion imaging – treat underlying central stenosis and primary assisted maturation (PTA at index procedure)

Complications

- Failure to mature
- Thrombosis
- Stenosis
  - venous – swelling, prolonged bleeding after needle removed, collateral veins, non collapse when arm raised, strong pulse
  - recirculation – most common d/t high-grade venous stenosis leading to backflow into the arterial needle
- Aneurysm
- Infection
- Steal
- Heart Failure

Aneurysm

Steal

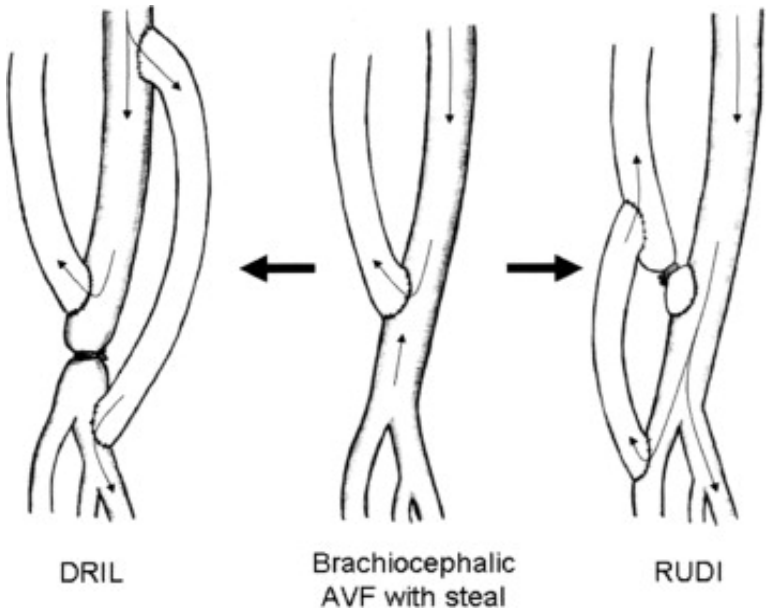
A

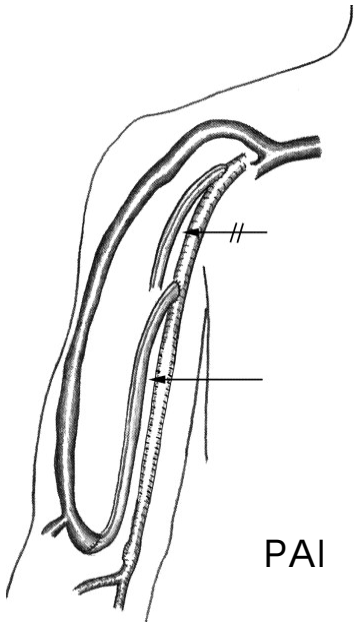
B

Treatment of Steal

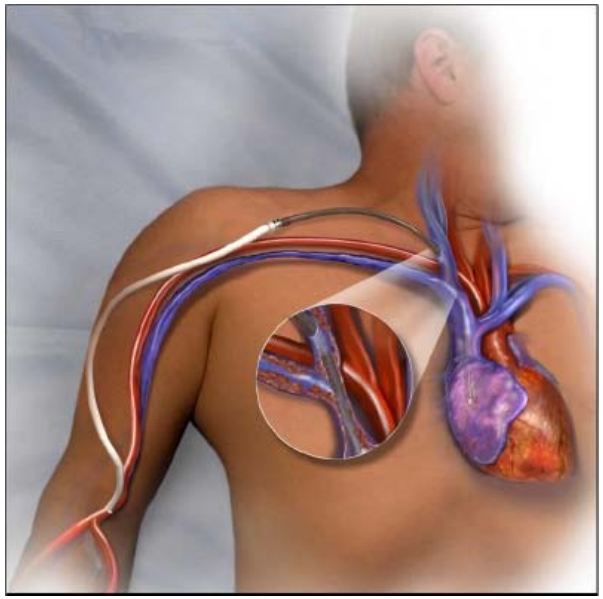
- Banding (if high flow)
  - Can place 4 mm balloon as a mandrel for sizing
- RUDI Revision using distal inflow – moves inflow of AVF/AVG to smaller, more distal artery
- PAI: Proximalization of arterial inflow (PAI) – moves inflow to proximal brachial or axillary artery; therefore there is no reduction of flow to the access. Also reduces flow reversal in the distal forearm related to the proximity of these vessels and the elbow based flow

Treatment of Steal

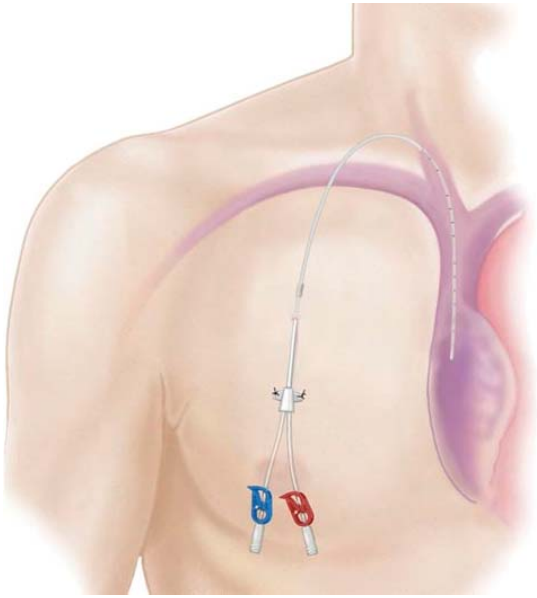




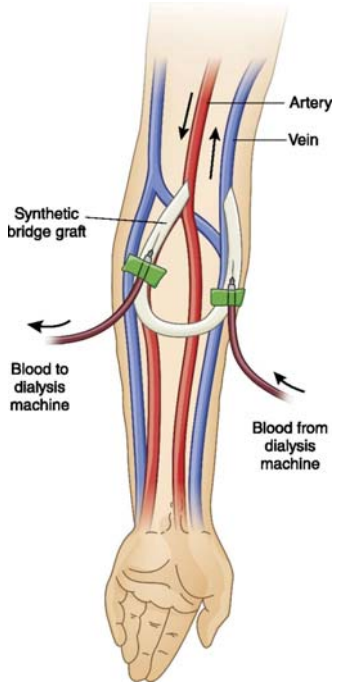
HeRO (Hemodialysis Reliable Outflow)

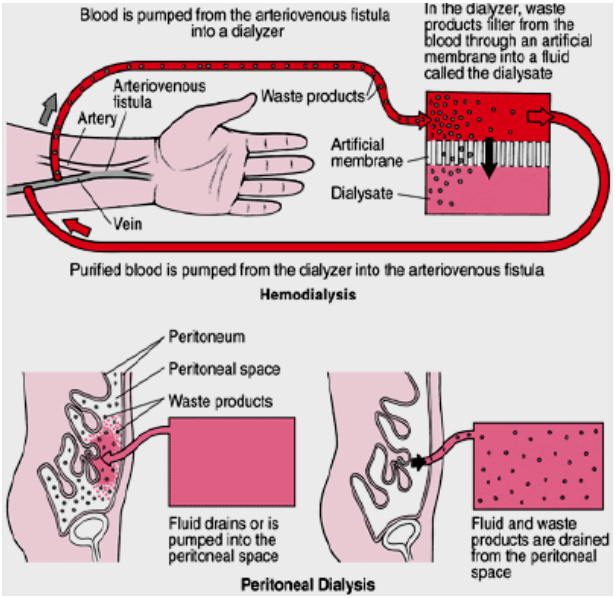


Catheters



Hemodialysis Circuit

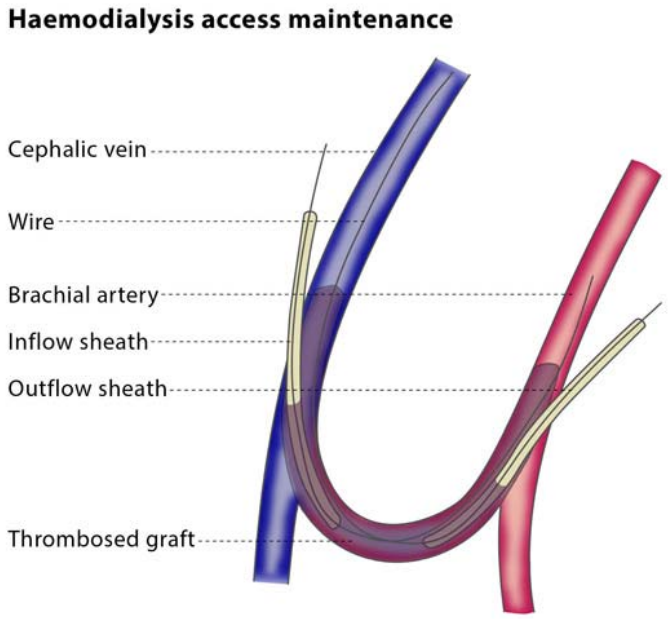




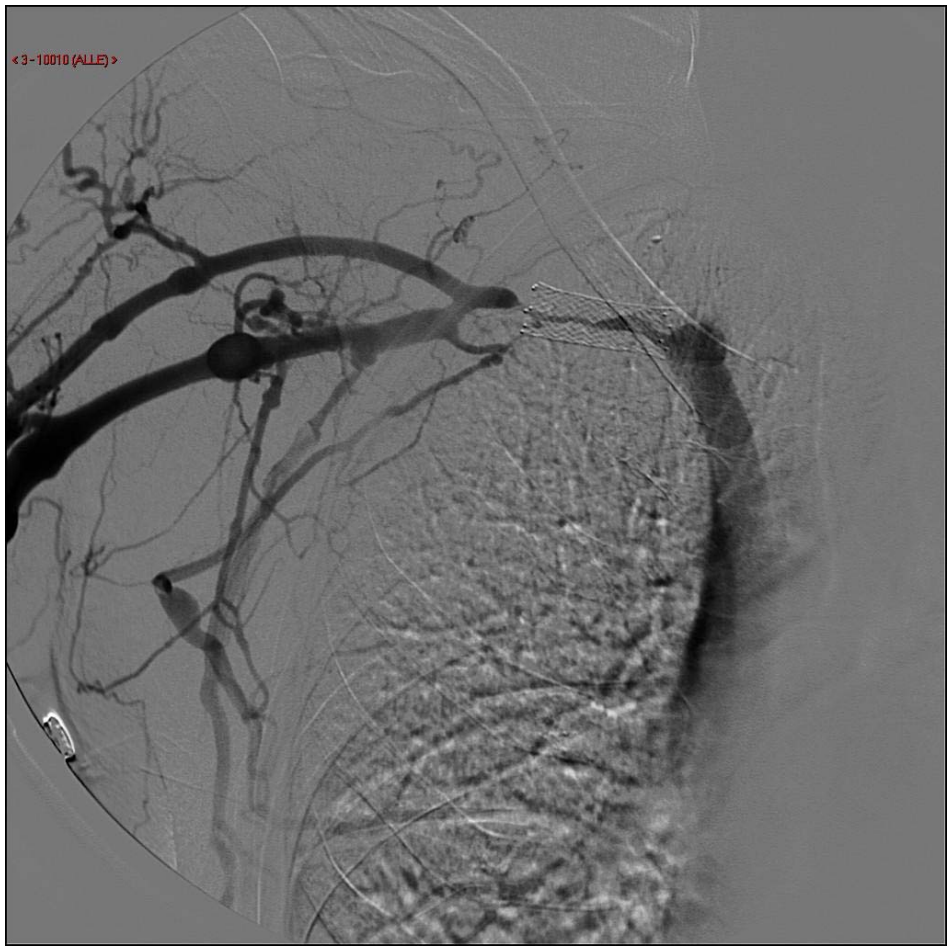
Interventions

- **AV GRAFT DYSFUNCTION AND FAILURE**
- 60's-70's % develop stenosis or thrombosis within one year
- most commonly **venous outflow anastomosis due to neointimal hyperplasia** - can lead to sudden AVG thrombosis.
- **Preemptive angioplasty** — prevent AVG thrombosis and/or failure of the vascular access may decrease risk of thrombosis and improve graft patency; no RCT's to support this. Several non RCT's showed benefit.
- **Surgical revision**
- **Thrombosis**
  - **Percutaneous thrombolysis**
  - **Surgical thrombectomy**

Access the AVG

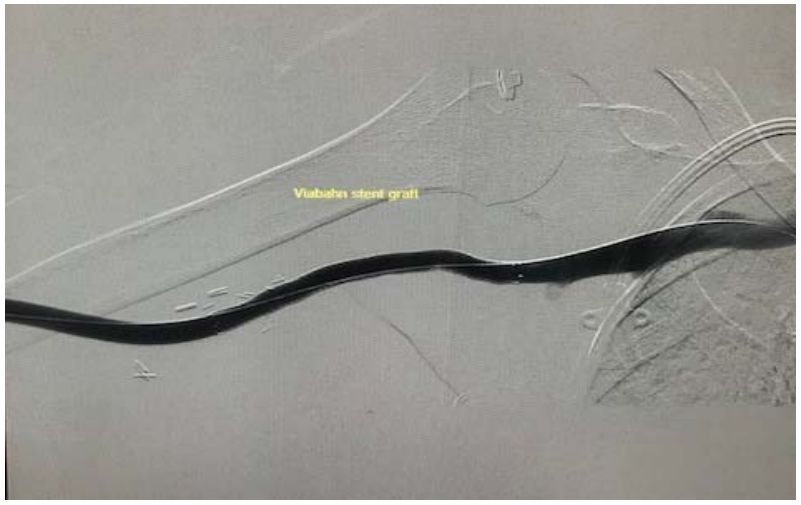


Central Vein Stenosis

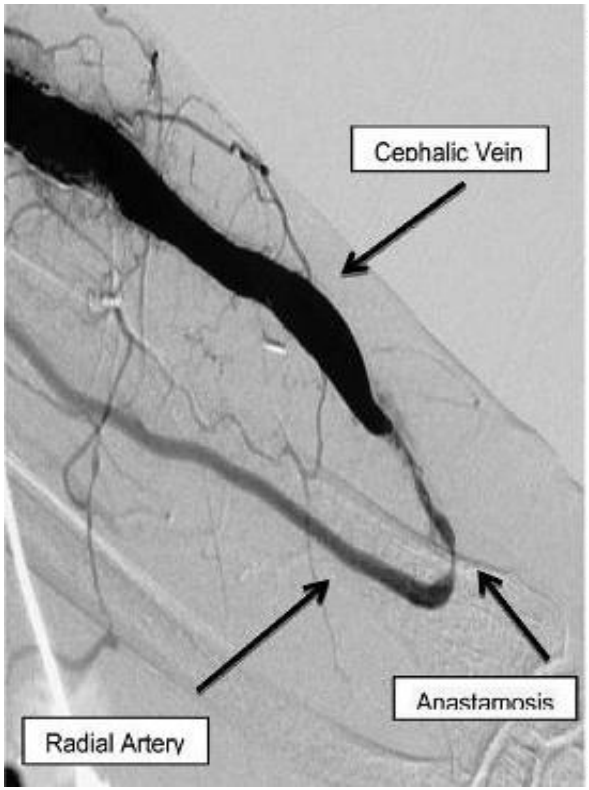


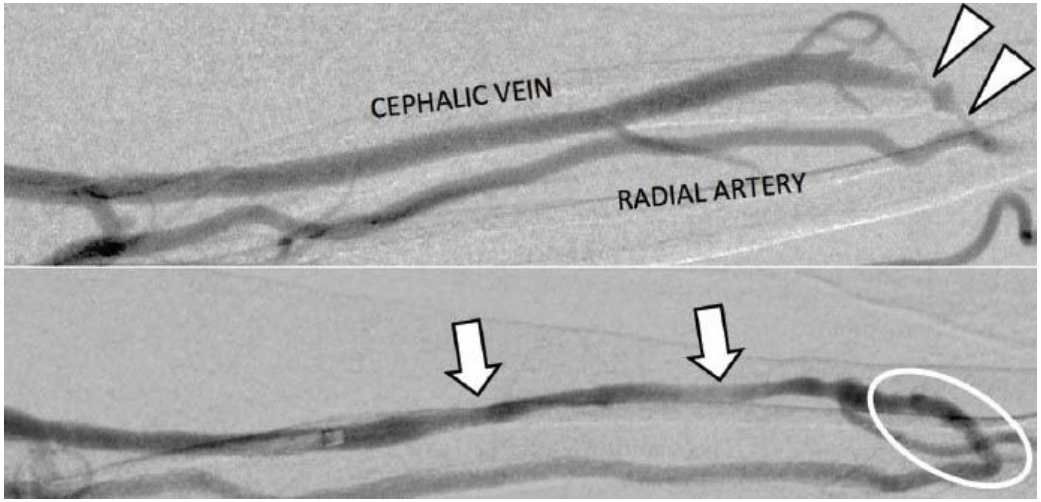
AVG creation + angio combo hybrid

AVG creation + hybrid angio

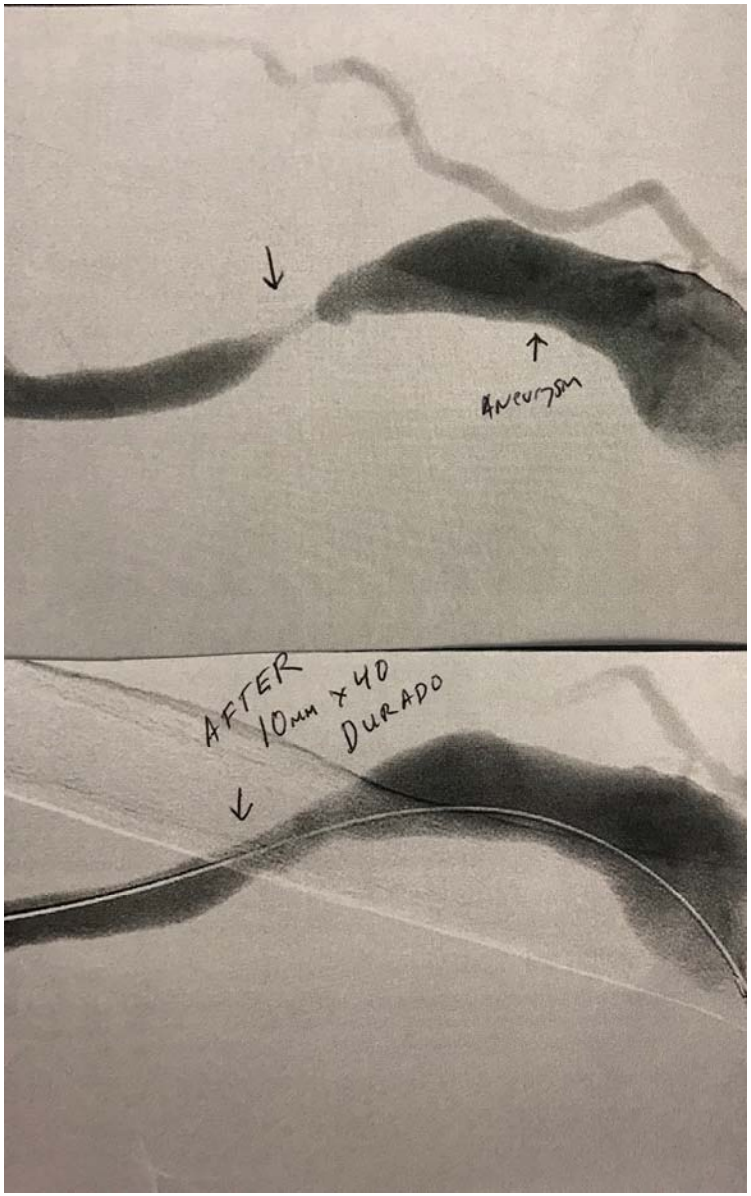


AVF Stenosis





Axillary Subclavian Junction stenosis


Aneurysm
AFTER
10mm x 40
DURADO

Stent grafts to treat AVF/AVG

- Favorably impact patency's in AVG's with lesions at the venous anastomosis
- Increase access circuit primary patency
- Increase post intervention lesion patency
- Improved freedom from restenosis

RESCUE TRIAL

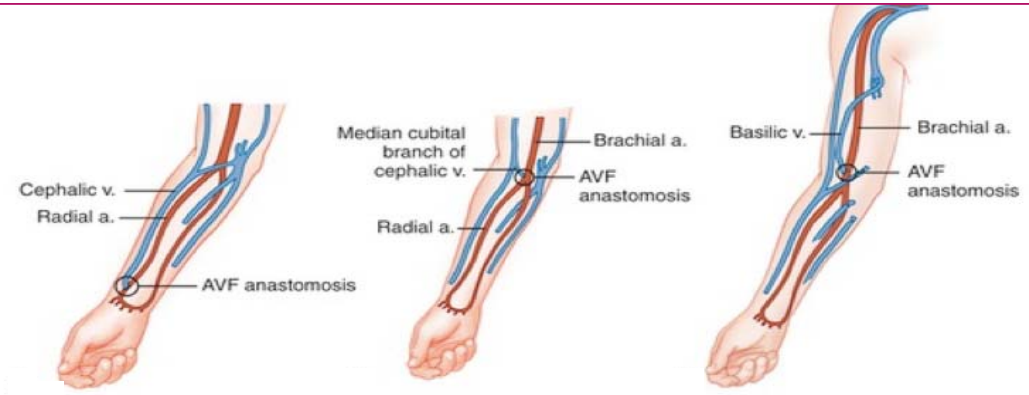
- Only prospective, randomized clinical trial demonstrating improved patency using covered stents for **in-stent restenosis in the venous outflow circuit** including restenoses in central veins and in native AV fistulae as well as synthetic grafts.
- Results favorable out to 24 months.

Summary

- Decision to initiate dialysis complex – patient factors (limited access sites and presence of PPM, etc – place AVF sooner than later to avoid catheter), rate of progression of RF (variable), nephrologist judgement
- AVF's preferred but less initial primary patency; better long term
- Complications not uncommon and associated with high morbidity, cost, and even mortality
- Interventions are to be expected
- Stent grafts promising with increased patency data and longevity of AVG/AVF's


That's all Folks!

AVF


Cephalic v.
Radial a.
AVF anastomosis
Median cubital branch of cephalic v.
Brachial a.
AVF anastomosis
Radial a.
Basilic v.
Brachial a.
AVF anastomosis

AVG

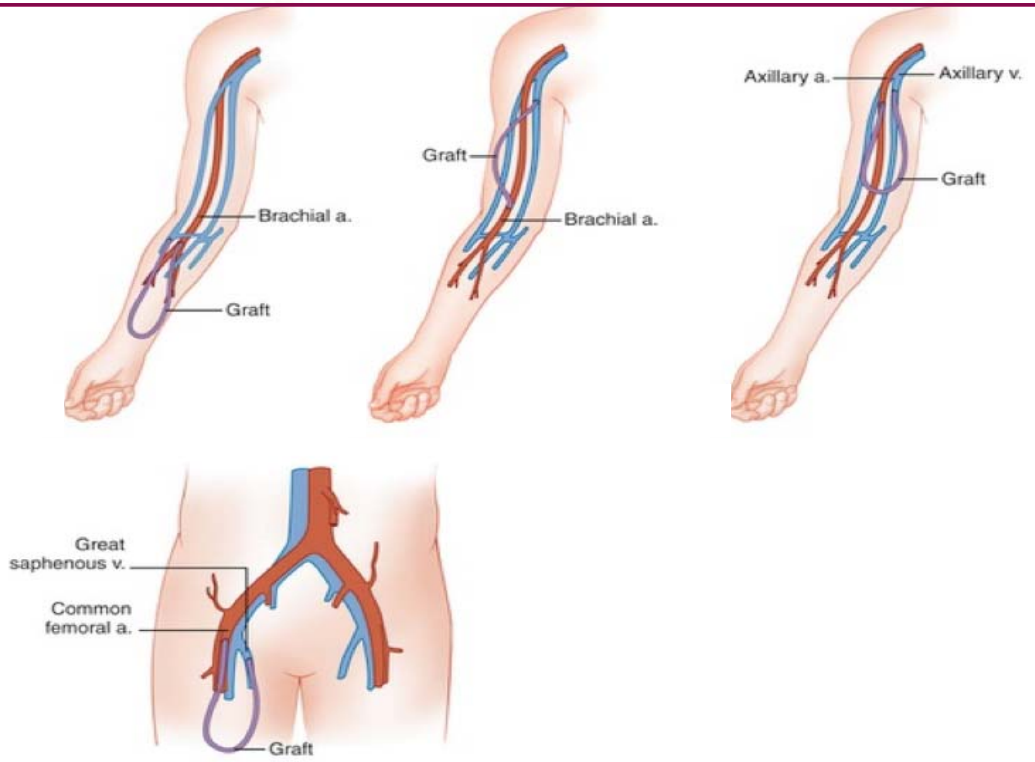

Brachial a.
Graft
Graft
Brachial a.
Axillary a.
Axillary v.
Graft
Great saphenous v.
Common femoral a.
Graft

Table 5. Secondary Endpoints

Endpoint	Stent Graft (n = 132)	PTA (n = 143)	*P* Value*
Procedure success†	128 (97.0)	137 (95.8)	–
90-d binary restenosis‡	26 (19.7)	105 (73.4)	–
ACPP (%)			
12-mo ACPP	6.2 (2.0–10.4)	1.5 (0.0–3.6)	–
Central vein	7.5	2.0	.02
Peripheral vein	5.7	1.2	.002
24-mo ACPP	0.9 (0.0–2.6)	0.8 (0.0–2.2)	–
Central vein	1.1	0.0	–
Peripheral vein	0.0	2.0	–
TAPP (%)			
12-mo TAPP	32.7 (24.2–41.2)	5.6 (1.5–9.7)	–
Central vein	30.3	4.3	< .001
Peripheral vein	31.5	5.0	< .001
24-mo TAPP	15.6 (8.6–22.7)	2.2 (0.0–5.2)	–
Central vein	13.6	4.3	< .001
Peripheral vein	16.5	1.7	< .001
IPF§			
6 mo	141.6 ± 51.2	128.8 ± 55.1	–
12 mo	165.9 ± 104.8	132.1 ± 82.8	–
24 mo	177.9 ± 152.3	143.2 ± 109.3	–
Safety endpoints through 24 mo			
Freedom from any safety event (%)			
12 mo	89.8 (84.5–95.1)	90.1 (85.0–95.3)	–
24 mo	86.0 (79.8–92.2)	84.8 (78.5–91.2)	–
All AEs‖	38	47	
Patients with any AE	27 (20.5)	38 (26.6)	–
All-cause death¶	26 (19.7)	32 (22.4)	–

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