# Lessons Learned Over 3 Decades of Dialysis Access Care

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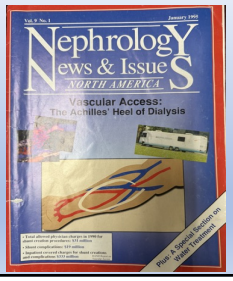
## Disclosures:

- Merit Medical: Wrapsody Stent Graft Trial
- Venture Medical: Flex Vessel Prep-AV Trial

## Altman's Experience……. Who is this Guy???

- Interventional Radiologist
- 30 Years of Focused Dialysis Access Care
  - Mobile Access Intervention 1994: PTA at Dialysis Centers, 8 States/500 centers
  - Free Standing Access Center 1998: Open Access Vascular Access Center
  - Research, Publication, New Product Development, Trials, Patents, Societies, Patient Care
- Performed over 50,000 Dialysis Access Interventions
- 7 minutes to tell you what I've learned……
- Lets Go!



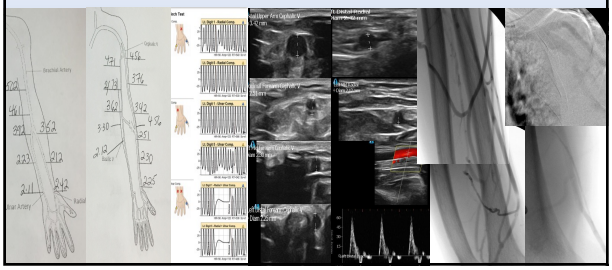

## Over 30 Years Later I Still Believe…….
## Dialysis Access is a Dis…Ease

- DisEase created by our Dis…ruption in the otherwise Ease of blood flow within the Vascular System.
  - 1.7 interventions per year required to Place and Maintain the DisEase of Vascular Access
  - High Complication Rate Associated with the DisEase of Dialysis Access
    - Ineffective Dialysis, Infection/Sepsis, Vascular Obstruction, Swelling/Disfiguration, Thromboembolism, Ischemia, Amputations, Exsanguination, Death
  - Dialysis Access Should be Managed like any other DisEase
    - Well Thought-Out
    - Well Implemented
    - Well Managed

## Fistula/Graft: Planning

- Evaluate the Patient
  - Handedness: Non-Dominate whenever possible, even if it may be more difficult to create and mature.
    - Nerve damage and significant steal do happen and can be life altering for these patients
  - Mobility:
    - For Patients s/p CVA we try and Use their Non-Functioning Extremity even though there is a greater risk of extremity swelling. Usually the swelling can be managed. The unimaginable thought of a patient having to watch an access bleed out and not be able to apply pressure we believe is worth that risk
  - Prior Central Venous Interventions: Catheters, Pacer, AICD
  - Pulses, Palmar Arch
- Image The Patient
  - Doppler US, Venography, PPG's

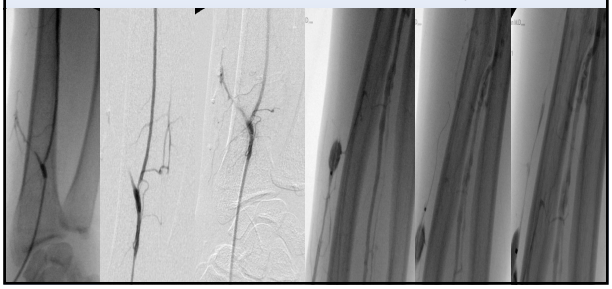
## Mapping: Best to Know the Lay of the Land!
## Doppler: Artery & Vein, PPG: Palmar Arch & Venography



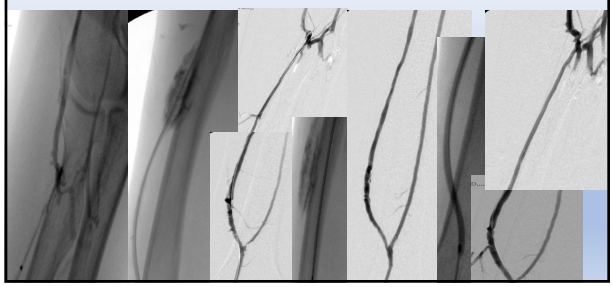
## Fistula/Graft: Maturation Evaluation & Intervention.

- Feel the fistula. Can you easily palpate it? Will the Dialysis Tech be able to stick it?
- We image the fistula with Doppler to see its depth, diameter, tortuosity and flow.
- Don't wait: If its not maturing within the first few weeks it likely will never mature properly.
- We evaluate our patients every 2-3 weeks for fistula maturation evaluation until we determine the fistula is mature and ready to be used.
- Intervention: PTA/Declot can be performed day one (if needed) and should be performed if at first evaluation 2-3 weeks post creation if the fistula is small in diameter with poor flow.
- With Regards to PTA Balloon size, Don't Go to Big to Fast as these young dilating fistula veins can rupture easily. They often will mature nicely with minimal enlargement of flow limiting stenoses.
  - Radial-Cephalic Fistula: 3-4mm balloons at AA and 4-5mm in fistula at first intervention increasing to 5-8mm on subsequent interventions if needed

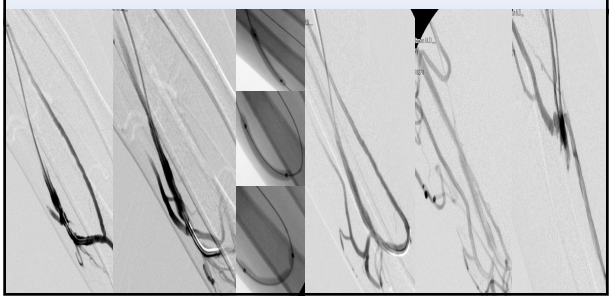
## RC fistula Created and Clotted 2 Week Follow-Up: No Fistula Vein to stick on US, Distal Radial Artery Cannulation



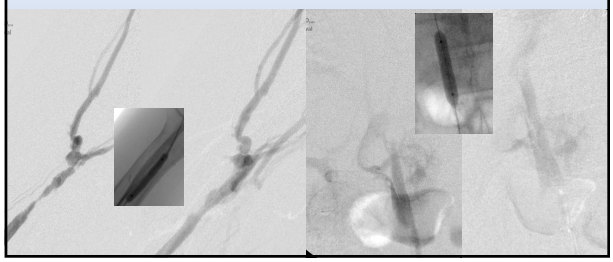
## Post Declot PTA 2 & 2.5mm Balloons Flow 62 cc/min



## 1 Month Post Declot: Fistula Still Immature PTA Now with 4mm Balloon, Increase Flow from 68 to 280 cc/min



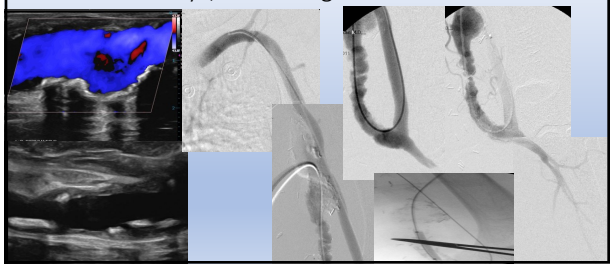
## 8 Week Post Maturation Intervention: Being used for Dialysis with Pulsatile Flow: Outflow Stenosis-PTA 6mm, Increase Flow 175 to 647 cc/min. Fem Cath Removal with IVC PTA



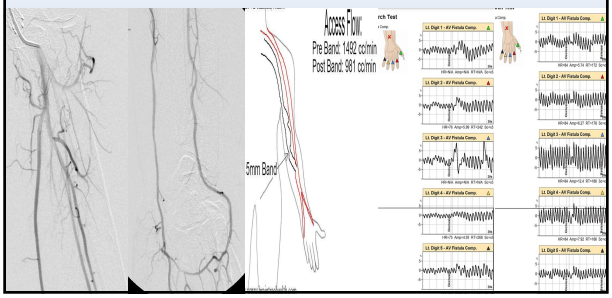
## Fistula/Graft: Care

- Pay attention to the access:
  - Remember Dialysis Access is a DisEase that needs to be managed, not a surgery that is complete once the wound has healed.
- Most fistula and grafts develop flow limiting stenoses over time.
  - In my experience restenosis rates tend to be consistent within each patient. Some re-stenosis quickly, others less so. We try to monitor our patients based on their unique rates of developing hemodynamically significant stenoses with Doppler imaging. Over time we are able to learn that Ms. Jones requires evaluation every several months while Mr. Smith only needs a check up once a year.

17 y/o Fistula Management: 36 Office Visits,13 PTA's, 2 Thrombectomys, 1 Banding *Pre Band Post*



Post Banding Run off Flow Reduction Pre PPG's Post



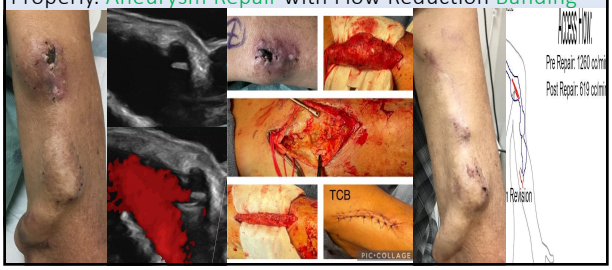

If you Cant Easily Feel It, the Person Cannulating Likely Can't Either!
Patient sent due to Difficulty Palpating and Cannulating Fistula: 6mm PTA OV: Weak Thrill Still on Palpation so Collateral Vein Ligation Performed. Increase in Flow from 441 to 1005 cc/min. Its easy to Palpate Now!

**Plan the Best Access for the Patient and Keep an Eye on It!** Started Dialysis 9 months ago. First Access Left IJ catheter?? Next, Failed Percutaneous Fistula with lots of Coils Now Living with Coil Pain?? Then Brachial-Basilic Fistula with no Follow-up for 6 months. Sent for Initial Consultation for "Failure to Mature". PTA 3,4 & 5mm balloons increasing flow from 112 to 999 cc/min. Scheduled for Mobilization

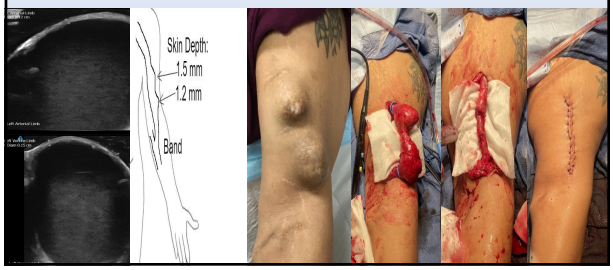
## Aneurysms: They Need to be Watched and Managed

- Large Aneurysms: Not an issue if the Overlying Skin is Intact and they are not thrombogenic
- Treat Outflow Stenosis: It will Reduce Pressure within the Fistula, the Rate of Aneurysmal Growth and Thinning of the Skin
- Band: Reducing Fistula Flow will Reduce Rate of Aneurysm Growth
- Monitor Skin Depth and Overall Appearance of Aneurysms: We find skin depth measurements to be an important tool in aneurysm monitoring. Once skin depth below 2mm we monitor a bit more frequently (every 3-6 months depending on appearance and history). Skin Depigmentation is not an absolute indicator for aneurysm repair. We have some patients' living with skin depths ranging from 1.0-2.0mm for years without issues and others that require revisions at 2mm
- Scabs: Must be evaluated for skin depth and integrity. Some may heal, others will breakdown and Rupture. Recurrent scab formation is Usually Not Good, as it is a sign of poor vascularization and oxygenation to thin skin, which over time, can lead lead to skin necrosis and aneurysmal rupture.

12 y/o BC Fistula with Recurrent Scab Cannulation Site Pseudoaneurysm. Skin Depth 2.4mm but Scab Not Healing Properly. Aneurysm Repair with Flow Reduction Banding

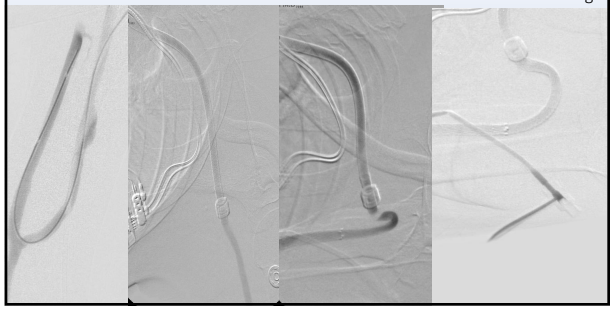


Aneurysms: 7 y/o fistula with Thinning Cannulation Site Pseudoaneurysm (1.2mm skin depth) with Increasing Flow and Worsening Steal. Aneurysm Repair and Surgical Banding. Flow 2242 to 995 cc/min Post Revision/Band




**Never Give Up!** Try and Figure Out the Problem and Fix it.
*The Access You Know is Often Better than the Access You Don't Know.*

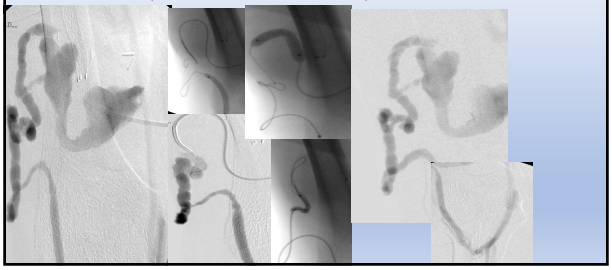
Frequent 1-2 Month Clotting of HeRO Graft: Thought to be due to Labile BP. Abduction Eval Reveals Kink which is Stented. 16 Months Without Clotting



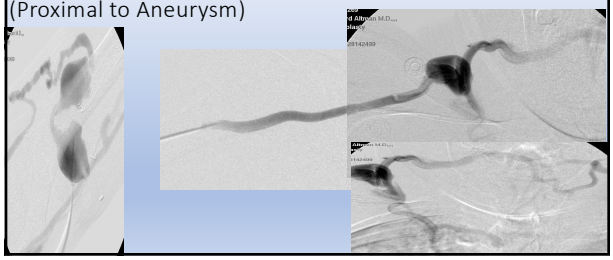
11 y/o HeRO Access Managed with Occasional Declot and PTA's. New Immediate Use Double Wall Graft Placed 4 years ago due to Aneurysms with Thinning of Skin. Clotted 4 months after Placement. Delamination of Inner Layer impeding flow treated with Stenting (x2) of Flap during Declot with third stent placed 2 weeks later due to progression of flap (best seen with US and IVUS due to CO2 limitations-Contrast allergy). Access Patent 3 years later with Stents Being Cannulated Without Issues aside from New Small Cannulation site Pseudoaneurysms. 3 PTA's over 3 years


Grafts and Fistula Can be Declotted Many Months after Clotting
Clotted BC Fistula: Failed Declot 3 Months Earlier (not by us): Sent in for Possible Declot

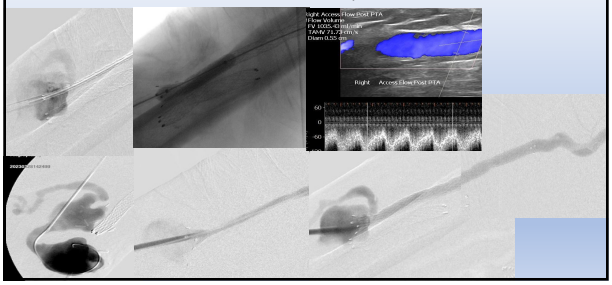
Collateral Outflow: May not Look Pretty but it Can Work-at Least for a While 8 y/o RUE Fistula with Occluded Outflow Stent-Unable to Cross, Collateral Outflow PTA, Bilateral CV Occlusions



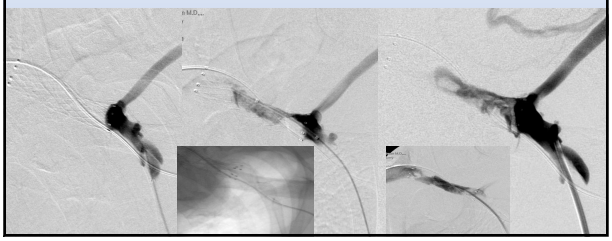
Collateral Outflow Failing after 3 years of PTA: High Venous Pressures & Low Flow Through Collateral Brachial Outflow: Cephalic Vein Patent Mid and Proximal Arm On Doppler (Proximal to Aneurysm)



Percutaneous Bypass to Cephalic Vein: Access Flow Increased from 263 to 1035 cc/min



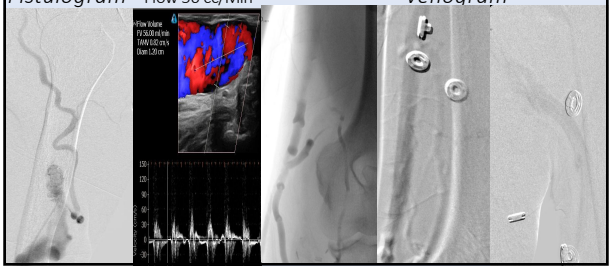
Look Out for Large Clot Burden Before Restoring Flow During a Declot. Life Threatening PE is Real! Fistula Declot: Large Clot Burden in BCV Stent treated with tPA with attempted gentle maceration and aspiration which failed to remove Clot.



13.5 x 4cm Fluency Stent Placed Trapping Clot Between Stents. Declot Successful, Patient Safe, Happy and Access Functiong without issues.

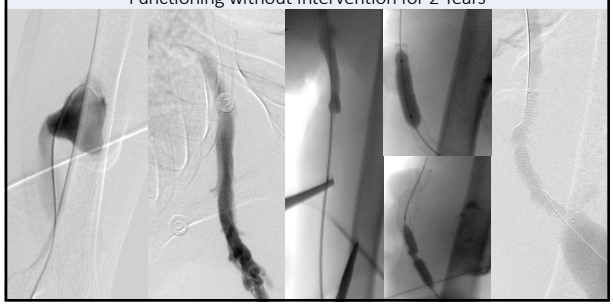
2 Y/O Fistula "Clotted" 2 Month's Prior. Sent Elsewhere, Catheter Placed. Sent for Intervention Options: Occluded Antegrade Outflow with Small Collateral Outflow. Patient does not want Right arm access and only wants Percutaneous Intervention

*Fistulogram* Flow 56 cc/Min *Venogram*



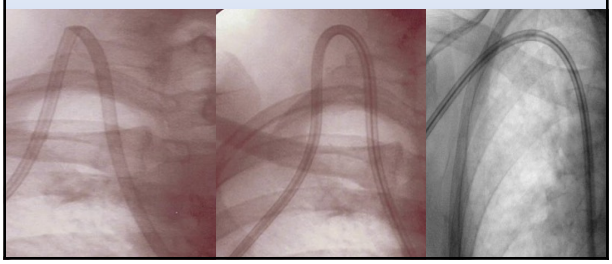
Percutaneous Bypass to Basilic Vein

Functioning without Intervention for 2 Years

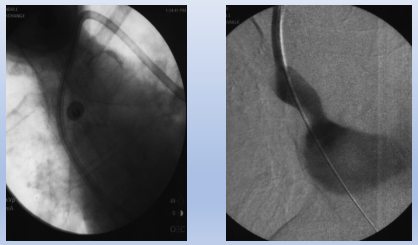


Pay Attention to Angle from Entrance Site to Tunnel Tract

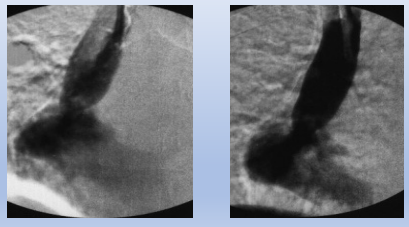
Don't Leave This | Pre-Curved Catheters Can Help | Better to Start With



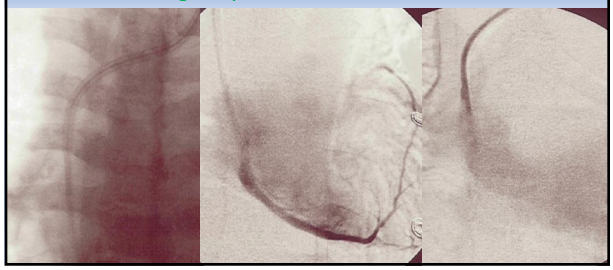
Caval-Atrial Tip Positioning



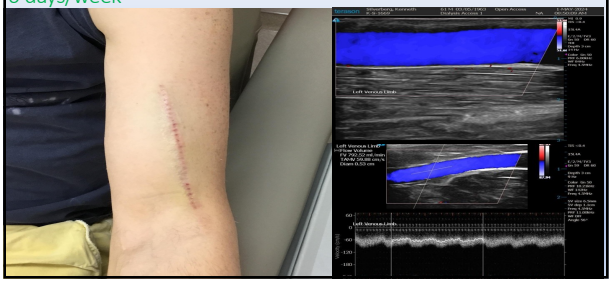
Shallow Right Atrium



Catheter Patient s/p Catheter Exchange with PTA of Fibrin Sheath 2 weeks earlier. Worked well for 1st week then High VP and Nausea During Dialysis!

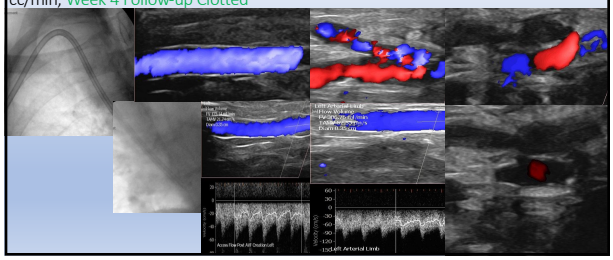


Perfect Fistula: Perfect Diameter, Depth and Flow with Perfect Patient Self-Care. 2 Y/O Fistula, Home Dialysis, Self Cannulates 5-6 days/week

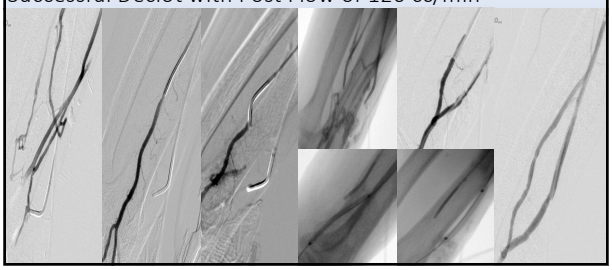


Map the Patient if you are Placing a Catheter for the Patient to Start Dialysis to Start the Fistula Creation Process ASAP

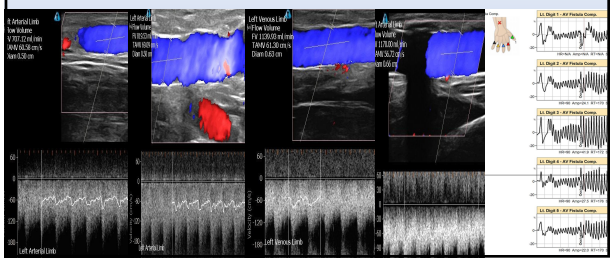
Mapping Performed at Catheter Placement, Fistula Created Following Week: Post Creation Flow 123cc/min, Week 2-Perianastomotic Stenosis with Flow of 306 cc/min, Week 4 Follow-up Clotted



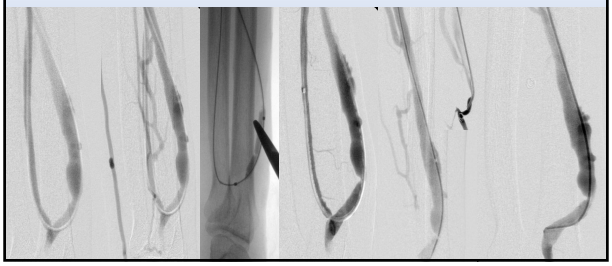
Declot: Unable to Cross AVA from Fistula Approach Requiring Brachial Artery Cannulation. Difficult, but Successful Declot with Post Flow of 126 cc/min



2 Week Post Declot: 707 cc/min, 6 Week Post Declot 819 cc/min. Ok Given to Use Fistula. Cath Removal 1 Month Later. 3 Months Post Cath Removal Flow 1170 cc/min with Steal Hand Numbness & Pain



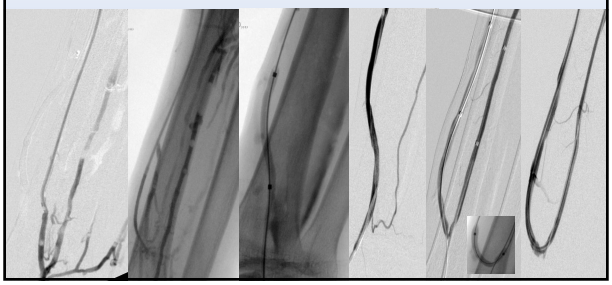
Steal Treated with Banding & Coiling: Coils/Vein Ligation helps to Reduce Fistula Flow Demands and Steal. Flow Reduced from 1170 to 584 cc/min. Steal Symptoms Resolved-Patient Grateful!



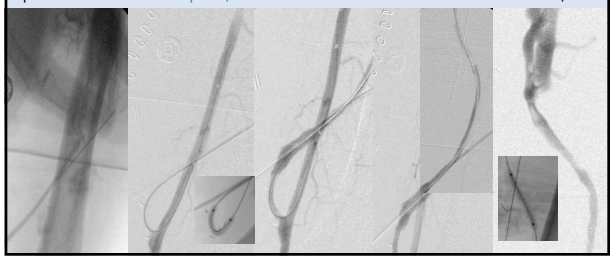
## Fistula/Graft: Creation

- Percutaneous versus Open Surgical Creation?
  - The Best physician with the Best Results is what you want for you, your loved ones, and those who place their healthcare in your hands.
    - Community with limited vascular surgical options and skilled interventionalist may be well served with percutaneous creations.
  - In our practice I Prefer an Open Surgical Creation (which I don't do… And I Love doing Interventional Cases)
    - Better anastomosis
    - Better angles
    - No need for immediate flow diverting coil placement in collateral/deep veins.

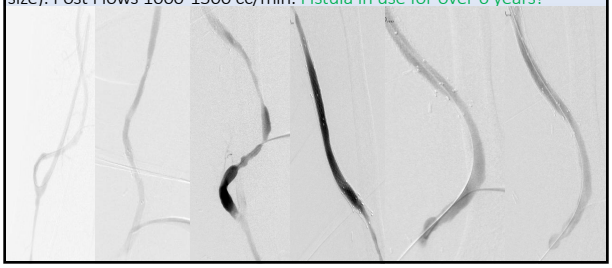
Failed LRCF, LBCF (not us): RCFF Created, Clotted Post Creation, Systolic 60's Unable to cross AV Anast from fistula, Radial Artery Cannulation, Cross & PTA



Patient Sent for Catheter Exchange. Had Small LUE BB Fistula which Clotted After Mobilization. Told by Surgeon who Created and Mobilized Immature Fistula, Vein is No Good. Can Not be Saved. No other Access Options. Declot Attempted/Performed with Post Declot Flow: 457 cc/min



Fistula Matured and Used 4 Months Post Declot. Develops Recurrent Stenoses with Diffuse Intimal Thickening. Has required 3 Declots, Outflow Stents Placed and Requires Frequent PTA's (now up to 10mm balloon size). Post Flows 1000-1300 cc/min. Fistula in use for over 6 years!



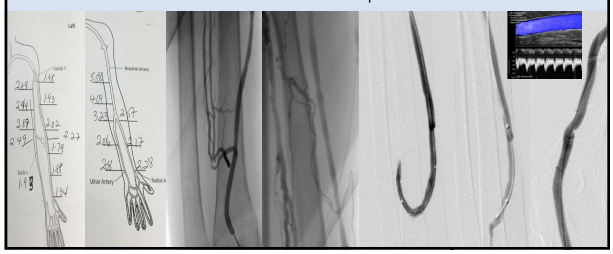
Look for the Cause of Arm Swelling after Fistula Creation and Treat it!
Arm Swelling after Left BB Fistula Creation: Patient with Occluded Right BCV & Left IJ Catheter. BCV Occlusion Crossed, Rt IJ Cath placed, Lt IJ Cath Removed, Arm Swelling Resolved, Fistula Matured

Immature Fistula: BAM…But Don't go to Big to Fast! RC Fistula: Flow 153 cc/min Post Creation, Immature 2 Weeks Post Creation- PTA 3 & 4mm flow 74 to 312 cc/min, 6 weeks later-flow 412 cc/min. OK to Use. Difficult Cannulation- Restenosis PTA 5mm 180 to 571 cc/min

Graft/Fistula Declot: Once you Restore Access flow, Check the Arterial Run-off for Clot because if you don't look, you don't know, as the Majority of time the Patient will be Asymptomatic.

8 Y/O RC Fistula with Thinning Cannulation Site Aneurysm, Glistening Skin with 1.6mm Skin Depth. Time to Repair

Sometimes Patients are Told They Don't Have Veins for a Fistula Which May Not be The Truth. Vibrant 83 y/o Sent for Access Options. Living with Right IJ Catheter After Removal of 2y/o LUE Graft for Infection. Told her veins were too small for Fistula. Beautiful Cephalic V. RC Fistula Created



Mature Fistula Sent for Catheter Removal. Patient Describes Difficult Cannulation. Doppler: Low Flow and Stenoses. PTA Fistula & Cath Removal-Imaging Reveals Fibrin Sheath