Access Flow Reduction: Endovascular vs Surgical Banding

Clinical Indications & Limitations

Lifeline Physician Operators Forum
Las Vegas, Nevada. January 27 – 29, 2017

William Jennings, MD

TULSA

Department of Surgery

DISCLOSURE POLICY

It is the policy of The University of Oklahoma Health Sciences Center College of Medicine to ensure balance, independence, objectivity and scientific rigor in all its educational programs. All faculty participating in these programs are expected to disclose to the program audiences any real or apparent conflict of interest related to the content of their presentation.

St. John Medical Center

University of Oklahoma, Tulsa

This presentation contains no conflict of interest.

William Jennings, M.D.
Speaker Disclosure

financial relationships:

- DaVita: Speaker
- Avenu Medical: Consultant

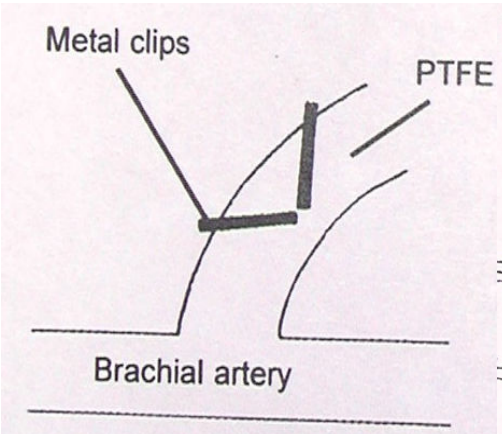
This presentation contains no conflict of interest.

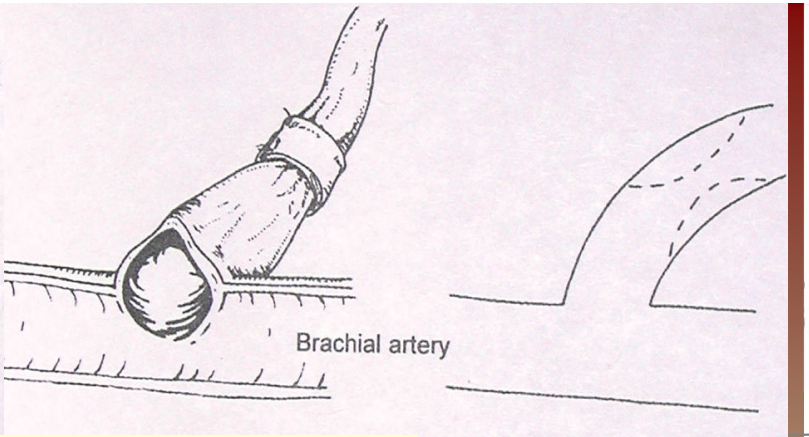
Indications for flow restriction

- High flow steal syndrome
- Symptomatic central venous stenosis or obstruction
- High access flow with unimpaired cardiac status
- Moderate flow with impaired cardiac status
- Transplantation with high or moderate flow AVF
- High flow or elevated AVF outflow pressure associated with aneurysm formation, cannulation site prolonged bleeding, other symptoms

Access banding in the past just seemed to “never work”

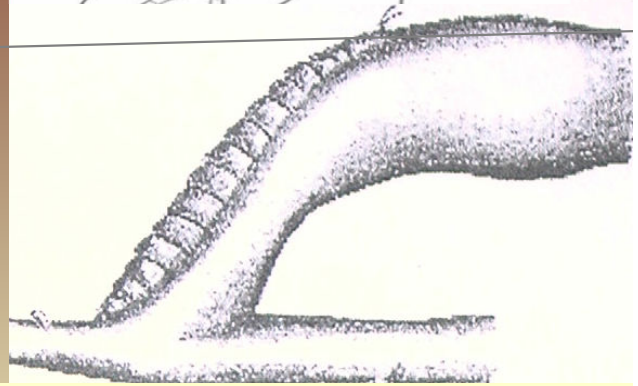
- Too tight = Thrombosis!
- Too loose = No benefit!
- Difficult to get it “Just Right”!





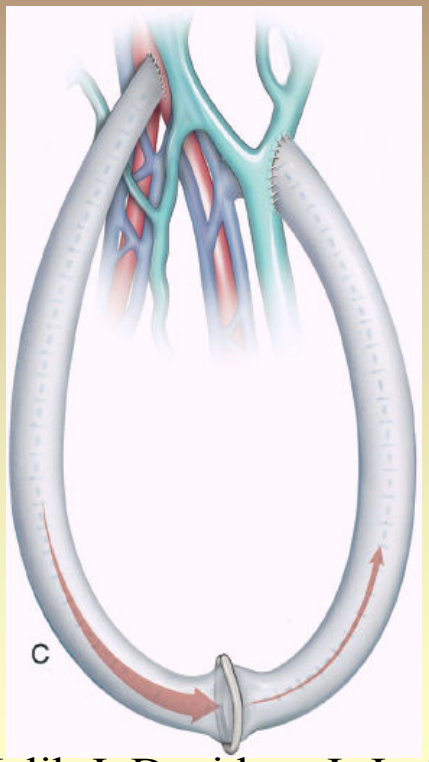
Bakran A. in Vascular Access Simplified. 2003 Trinity Press

Henriksson AE. Journal Vasc Access 2004; 5: 13-15

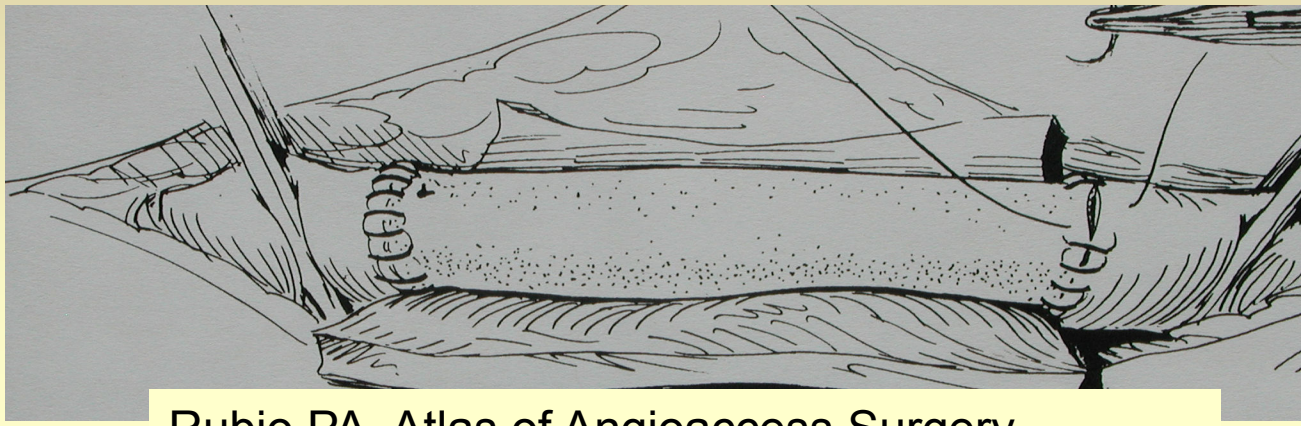


Zanow J. in Vascular Access for HD VII. 2001 Precept Press

So many options…..!



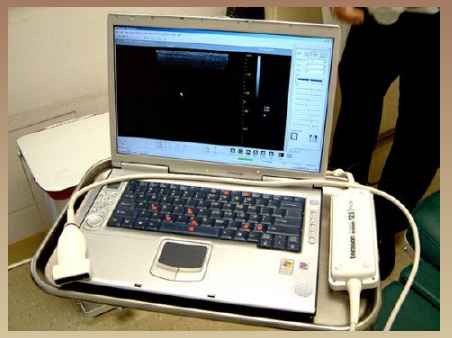
Malik J, Davidson I. J of Vasc Access 2008;9:155-1666



Rubio PA. Atlas of Angioaccess Surgery. 1983 Year Book Medical Publishers

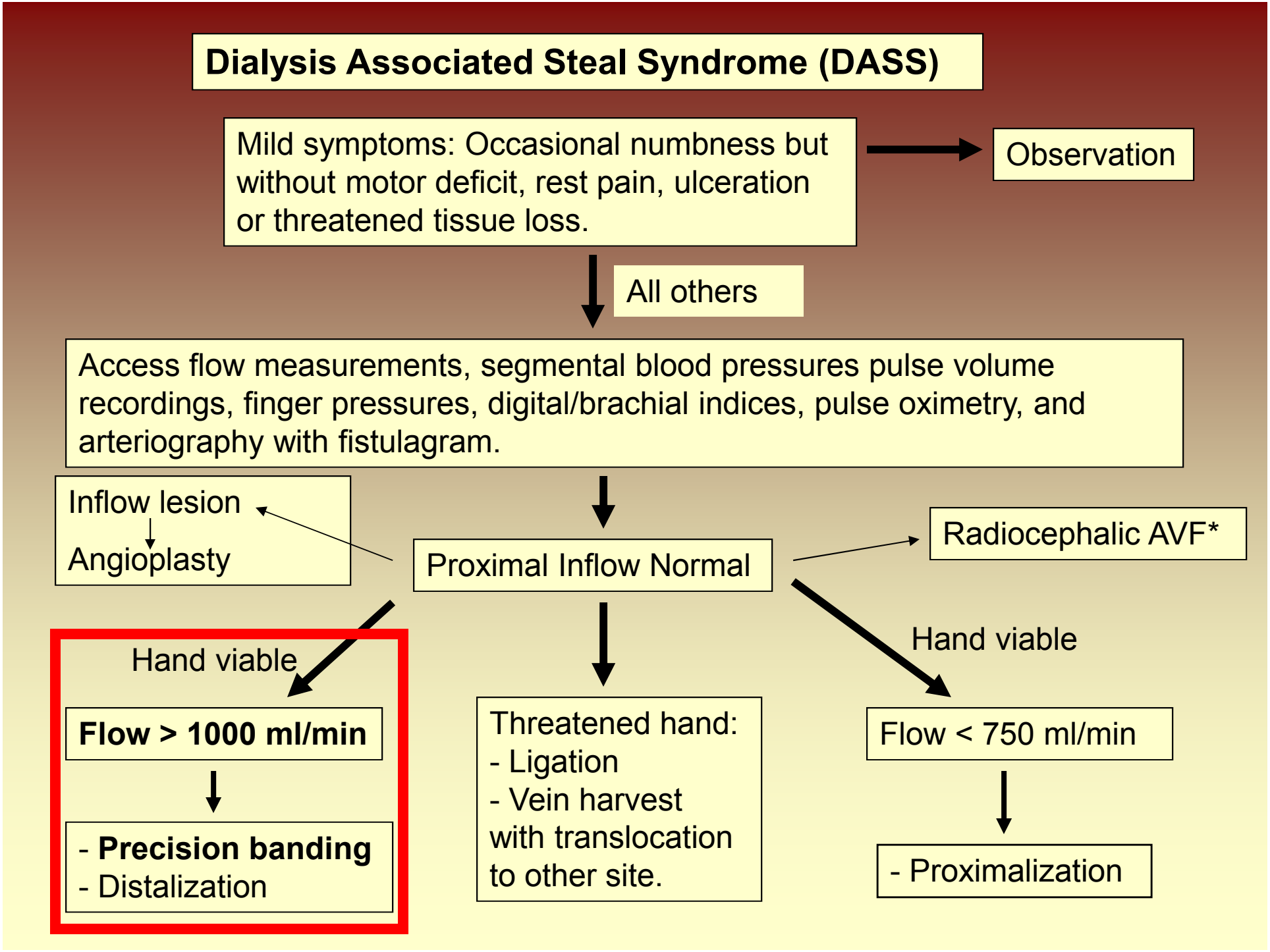
Ultrasound: A Critical Role in ***ALL*** aspects of Vascular Access

- Prior to fistula creation
- Follow-up before initial access cannulation.
- Evaluating access dysfunction
- **Real-time flow measurement during flow reduction (banding).**

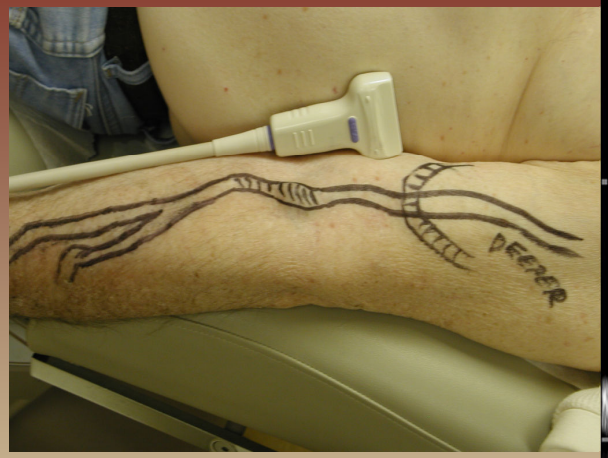


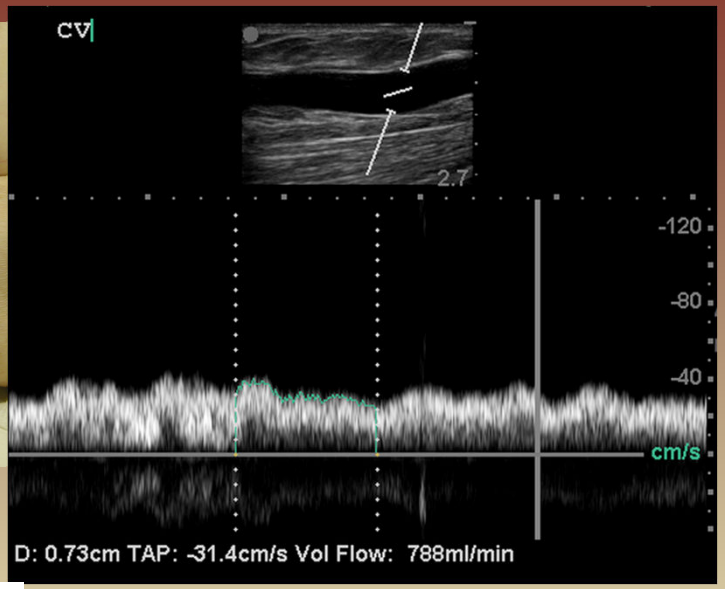
-Parmley M, Broughan TA, Jennings WC. Vascular Ultrasonography Prior to Dialysis Access Surgery. Am Journal of Surg. 184(6), December 2002, 568-572.

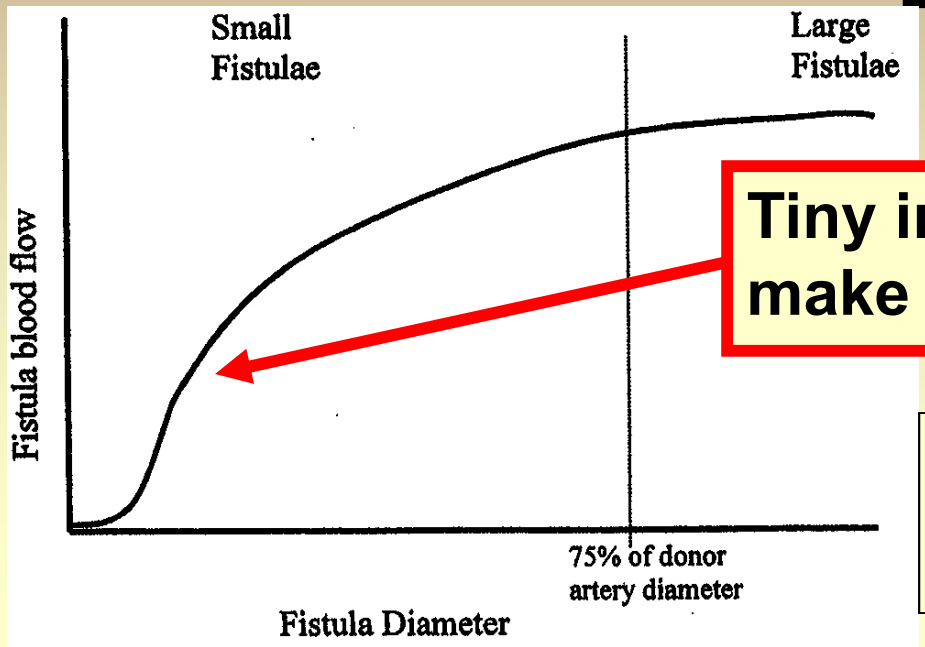
-Clinically Immature Arteriovenous Fistulas: Effect of US on Salvage. Singh P, Robbin ML, Lockhart ME, Allon M.Radiology.246(1), Jan 2008. 299-305


Dialysis Associated Steal Syndrome (DASS)
Mild symptoms: Occasional numbness but without motor deficit, rest pain, ulceration or threatened tissue loss.
Observation
All others
Access flow measurements, segmental blood pressures pulse volume recordings, finger pressures, digital/brachial indices, pulse oximetry, and arteriography with fistulagram.
Inflow lesion
Angioplasty
Proximal Inflow Normal
Radiocephalic AVF*
Hand viable
Flow > 1000 ml/min
- Precision banding
- Distalization
Threatened hand:
- Ligation
- Vein harvest with translocation to other site.
Hand viable
Flow < 750 ml/min
- Proximalization

Real time ultrasound flow replaces guess work

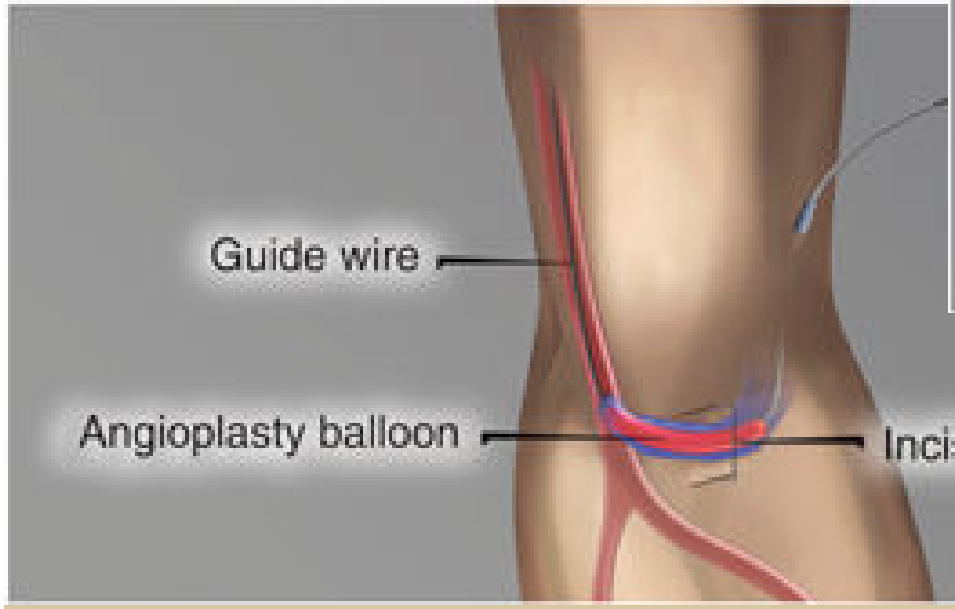


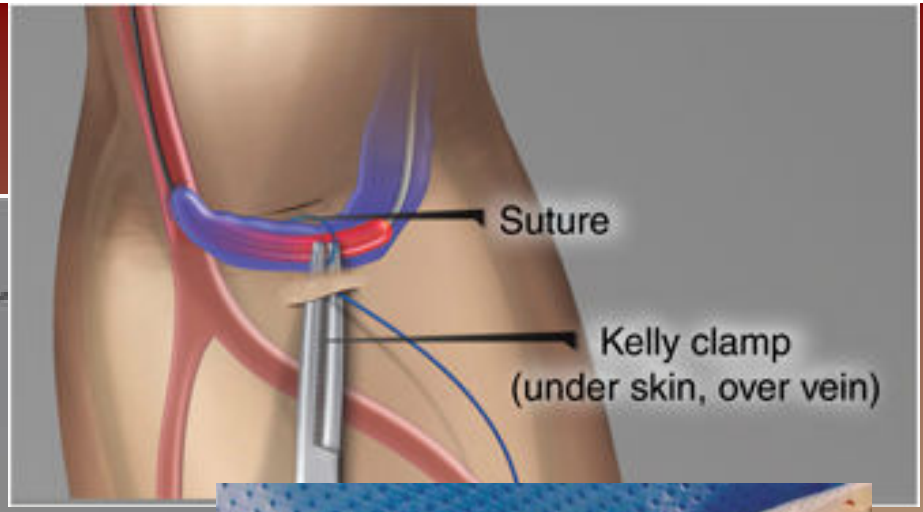


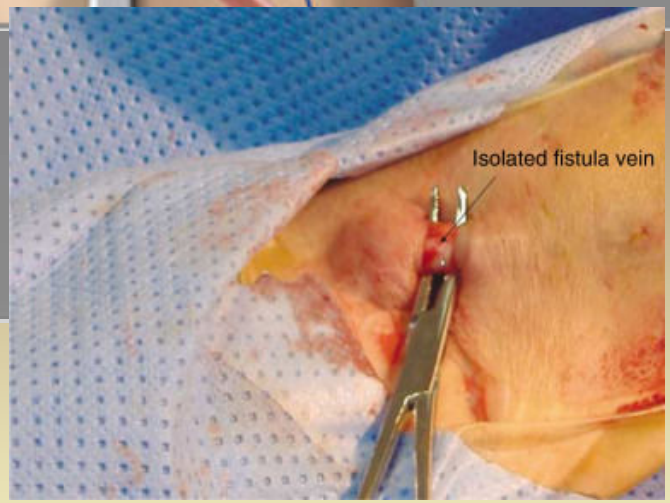


Tiny increments in AVF diameter make *major* changes in flow.

Wixon CL, Hughes JD, Mills JL. Understanding strategies for the treatment of ischemic steal syndromes after hemodialysis access. J Am Coll Surg. 2000 Sep;191(3):301-310.





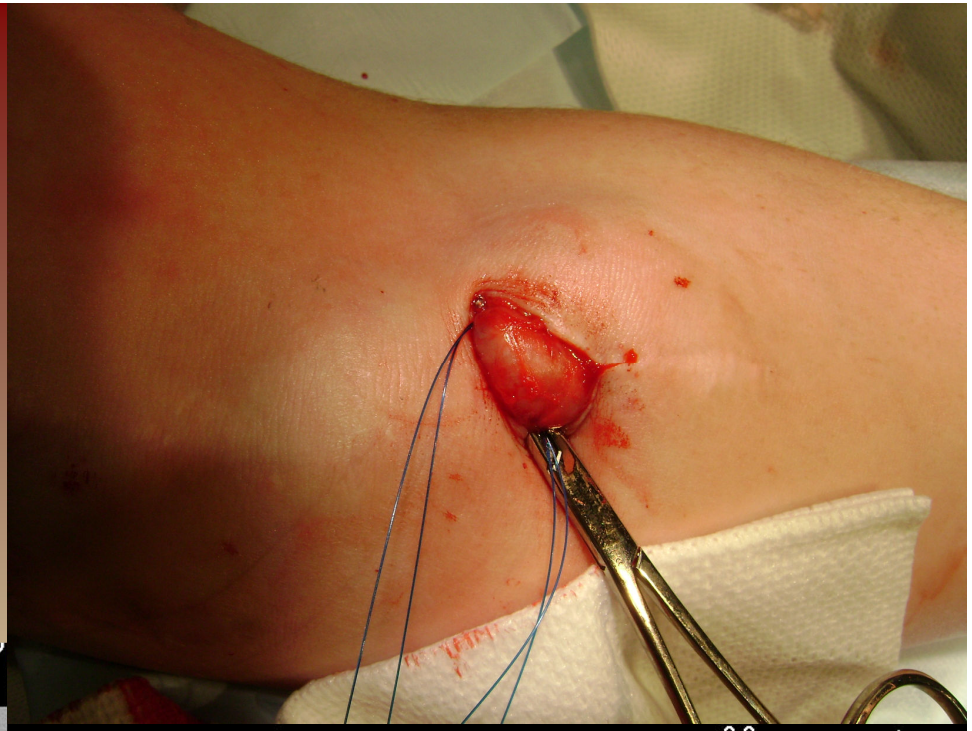


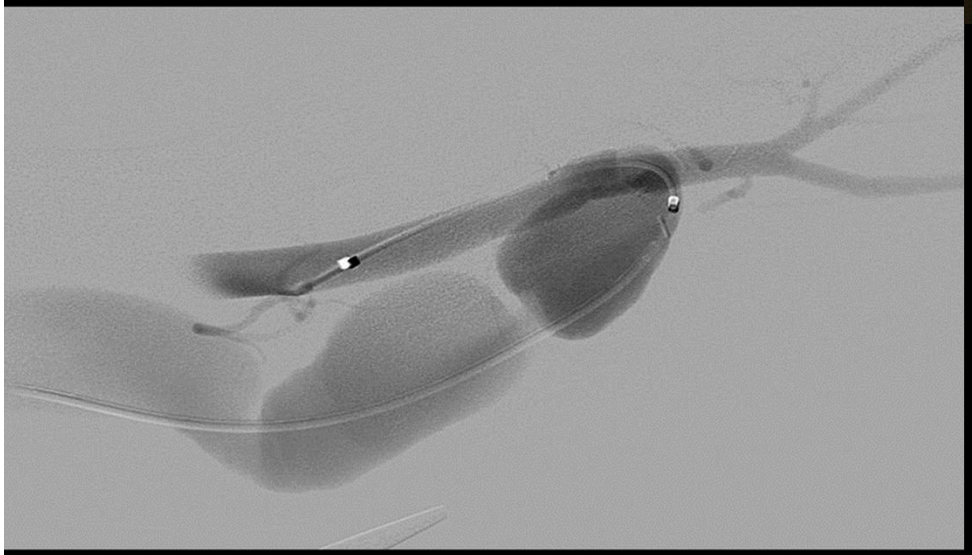
-Miller GA, Goel N, Friedman A, et al. The MILLER banding procedure is an effective method for treating dialysis associated steal syndrome. Kidney Int 2010;77:359.
-Jennings WC, Miller GA, Coburn MZ, et al. Vascular access flow reduction for arteriovenous fistula salvage in symptomatic patients with central venous occlusion. J Vasc Access 2012;13:157.

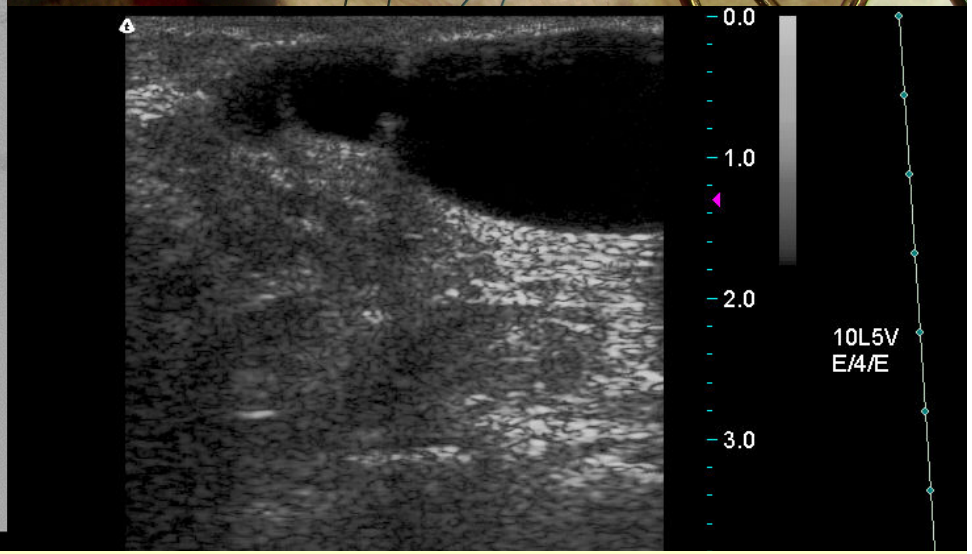
Images….https://www.google.com/search?q=Miller+access+banding&biw=1366&bih=662&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjWrcXPpvfQAhVCw1QKHTpqA4wQ_AUIBygC&dpr=1#imgrc=qrRJSXlYoOEwBM%3A

Goel N, Miller GA, Jotwani MC, et al. Minimally Invasive Limited Ligation Endoluminal-assisted Revision (MILLER) for treatment of dialysis access-associated steal syndrome. Kidney Int. Aug;70(4) 765–770. Epub June 2006

Precision banding with real-time access flow monitoring is key!

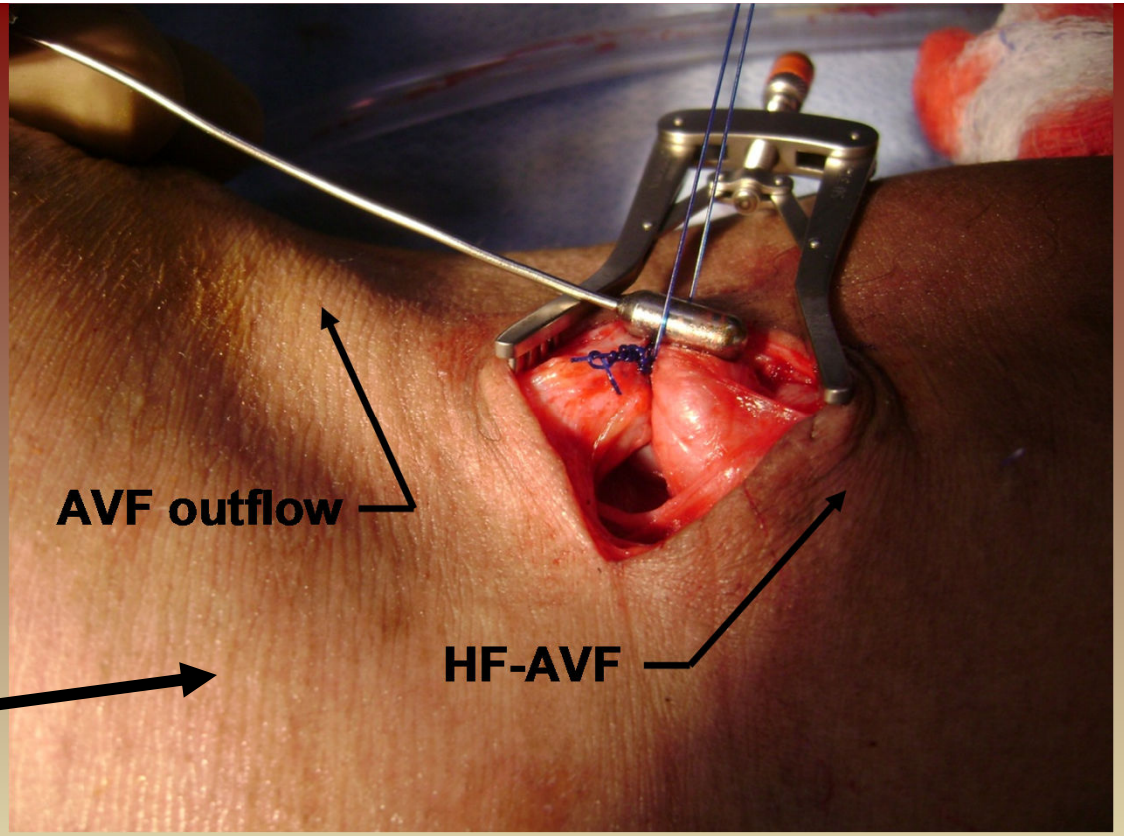






Jennings WC, Miller GA, Coburn MZ, Howard CA, Lawless MA. Vascular access flow reduction for arteriovenous fistula salvage in symptomatic patients with central venous occlusion. J Vasc Access 2012;13(2):157-162.

US calculated flow in brachial artery as a surrogate for AVF flow

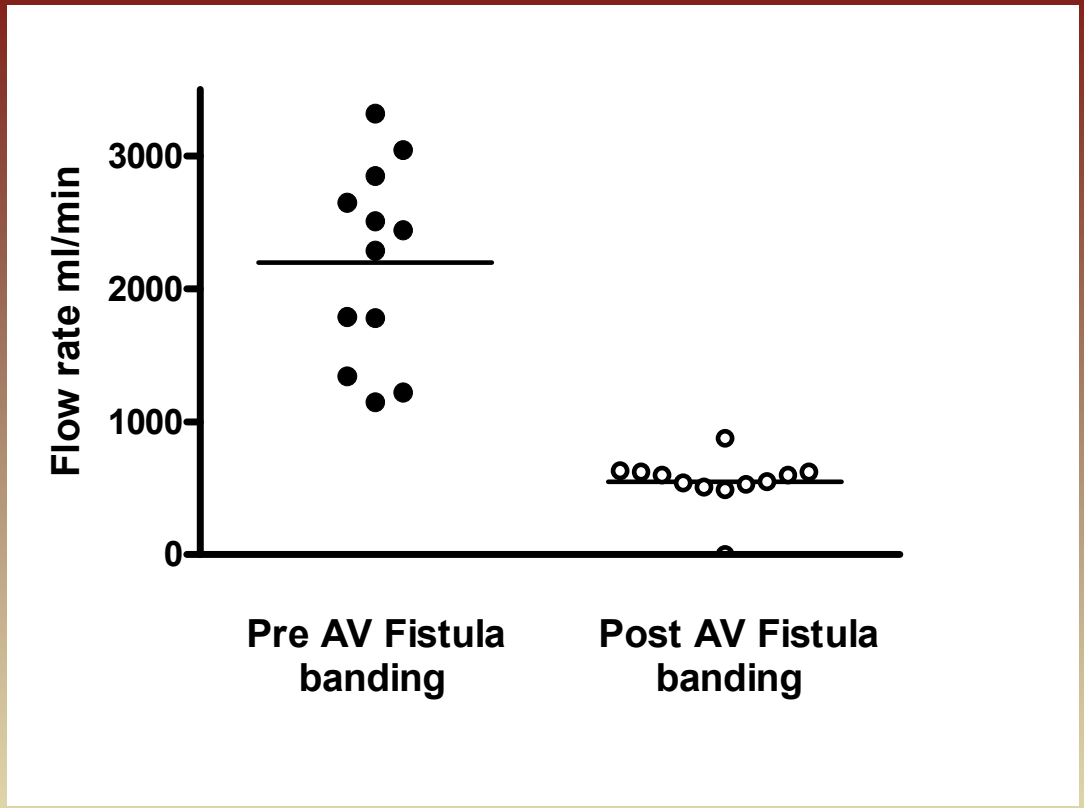


- Precision banding using a **vessel dilator as a dowel.**

-Flow restriction is created adjacent to the AVF anastomosis, using polypropylene suture and **sized in 0.5 mm diameter increments**.

-**AVF flow rates are re-measured** until the target access flow is achieved (500-800ml/min). A second suture was placed at the same site for security.

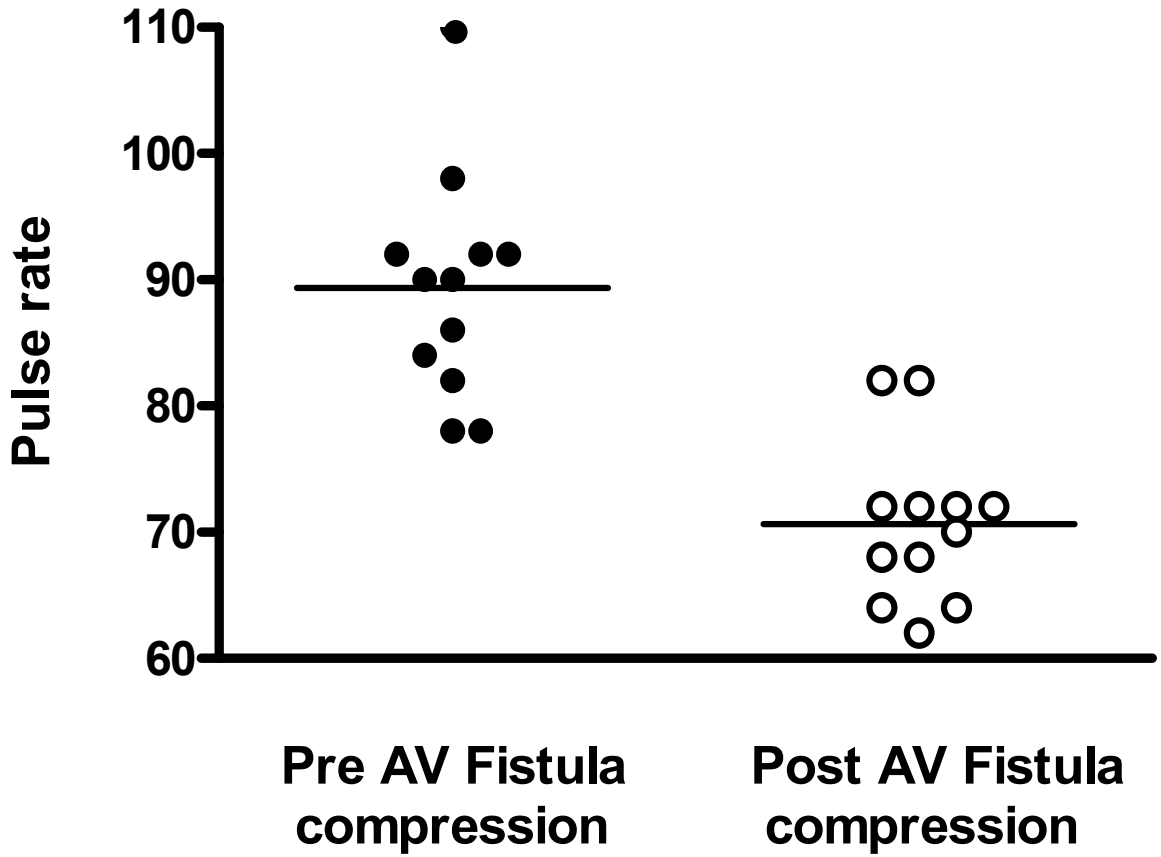
Gkotsis G, Jennings WC, Malik J, Mallios A, Taubman K. Treatment of high flow arteriovenous fistulas after successful renal transplant using a simple precision banding technique. Ann Vas Surg. 2016, Feb;31:85-90.



Mean access flow was 2280ml/min (1148-3320ml/min) before flow reduction and was 598 ml/min (481-876) after flow reduction, $p < 0.01$.

One patient with poor cardiac function underwent immediate AVF ligation.

Gkotsis G, Jennings WC, Malik J, Mallios A, Taubman K. Treatment of high flow arteriovenous fistulas after successful renal transplant using a simple precision banding technique. Ann Vas Surg. 2016, Feb;31:85-90.



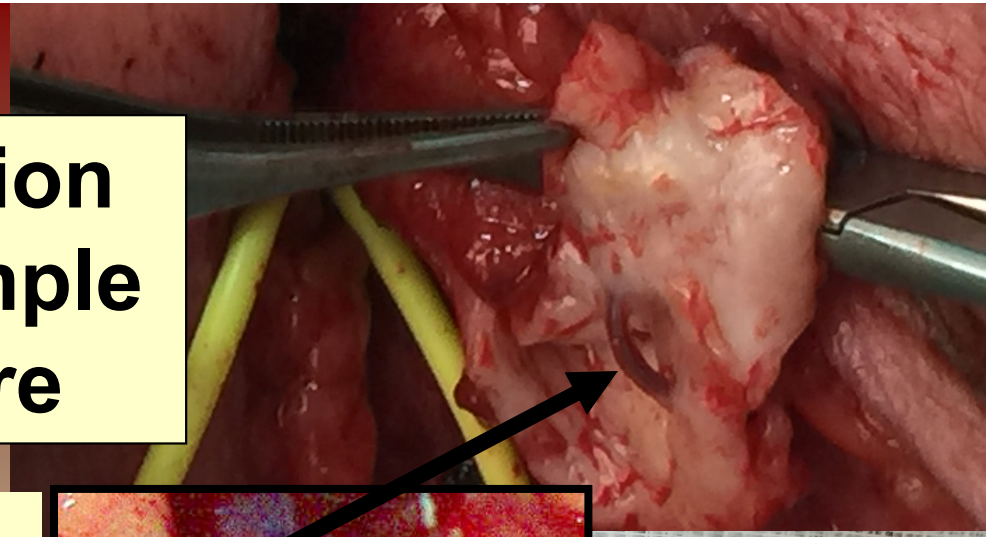
Temporary digital AVF occlusion decreased the mean pulse rate from 90/min to 72/min (range 110-78), $p < 0.05$. (Branham's sign)

Gkotsis G, Jennings WC, Malik J, Mallios A, Taubman K. Treatment of high flow arteriovenous fistulas after successful renal transplant using a simple precision banding technique. Ann Vas Surg. 2016, Feb;31:85-90.

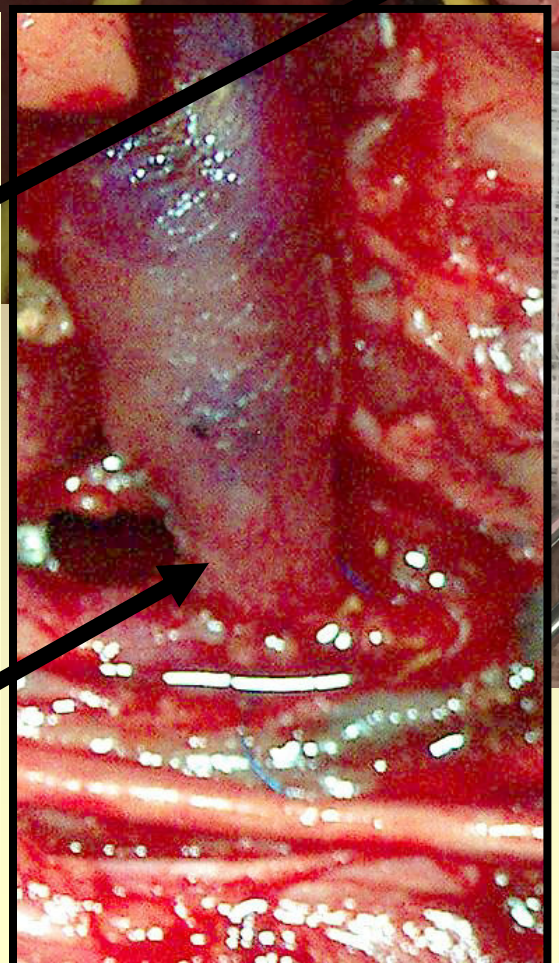
Individual patient data prebanding and postbanding of High-FlowAVFs

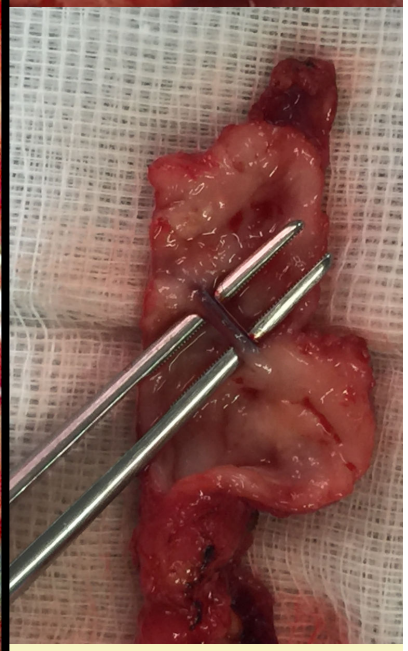
Banding Size	Access Flow (ml/min)		Pulse Rate (rate/min)		Cardiac Murmur		Dyspnea		Palpitation	
Diameter (mm)	Pre-Band	Post-Band	Pre-Band	Post-Band	Pre-Band	Post-Band	Pre-Band	Post-Band	Pre-Band	Post-Band
3	3045	622	78	68	No		No		No	
3	1789	488	90	72	Yes	Resolved	No		Yes	Resolved
3	2288	622	98	72	No		Yes	Resolved	Yes	Resolved
3.5	1780	598	82	64	Yes	Resolved	No		Yes	Resolved
3.5	1342	550	92	72	Yes	Resolved	No		No	
3.5	1148	510	84	82	No		No		No	
3.5	2850	540	110	82	No		No		Yes	Resolved
4	3320	599	78	62	Yes	Resolved	Yes	Resolved	No	
4	2650	876	92	68	Yes	Resolved	No		No	
4	2510	632	86	72	Yes	Resolved	No		No	
ligated	1220	0	92	64	No		Yes	Resolved	No	
4	2444	528	90	70	Yes	Resolved	No		No	

Consider one exception to banding with a simple polypropylene ligature



- ***Mega-fistula*** involving the AVF anastomosis (3 cases).
- Over time, **erosion of suture** into the lumen with resumption of high flow symptoms has been reported (**No bleeding or thrombosis**)
- **Surgical revision** with tapering or creation of a new anastomosis using realtime ultrasound flow measurement is recommended.





Endovascular vs surgical banding

Conclusions:

- Simple flow reduction with polypropylene suture is safe and reliable.
- Ultrasound flow measurement is the preferred guide for diameter reduction.
- Banding adjustments in 1/2mm increments are often necessary.
- Endovascular access centers or outpatient surgical centers are both appropriate procedure sites.
- An external banding dowel or angioplasty balloon are both safe and effective.
- Banding over an external dowel avoids access cannulation and balloons.