

**Highflow
vascular access
indications
and options for
Surgical therapy**

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None of the research or non FDA approved products will be discussed in this presentation

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**High flow AVF
Indications and options for surgical therapy**

Is it preventable?
Surgical options
Indications for treatment

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What is high flow?

Dialysis machine flow rate varies between 150ml/min to 500ml/min

AVF flows expected at 450 -1200ml/min
AVG flows expected at 600 - 1200 ml/min

Flows over 1500 ml/min are excessive

Wasse H. Sem Nephrol 2012; 551-57
Miller GA. Sem Nephrol 2012; 32:545-50

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Hemodynamic changes with AV access

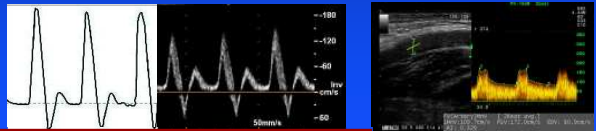
Brachial artery flow measurement prior to and after AVF creation
Flow measurements 10 - 14 days
Flow measurements 4-6 weeks

Mature access with high flows

No diastolic reversal

Triphasic

Biphasic



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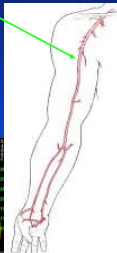
Why brachial artery flow?

Brachial/axillary is feeding artery to the limb

- Uniform diameter
- Non compressible
- Reproducible
- Sole vessel supplying the limb

Venous flow unreliable

- Variable diameter
- Non laminar flow
- Compressible



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Is high flow preventable?

AV communication leads to acute decrease in peripheral resistance

Compensatory increase in cardiac output maintains distal limb perfusion

When an AV access is created roughly 1/3 of the flow increase is seen immediately in the OR

Barring development of complications most of the flow increase is complete by 28 days

What determines the flow in access?

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AV stenosis diameters and flows with varying mean blood pressures

Stenosis diameter	1 mm		2 mm		3.5 mm	
Stenosis length (mm)	5 mm	60 mm	5 mm	60 mm	5 mm	60 mm
Pressure Mean (mmHg)	Blood flow (ml/min)					
50	117	40	626	329	2099	1338
80			896	475	3271	1888
100			1060	564	3761	2191
120			1207	642	4483	2469
160	269	117	1471	795	5103	3006

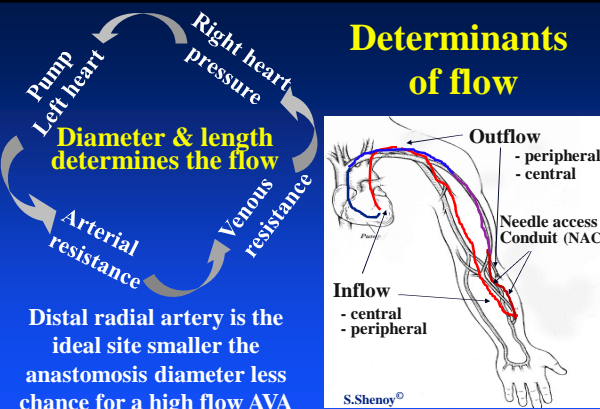
Small diameters do not permit high flows

Hoganson D. J Vasc Acc 2014;15:409

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Determinants of flow

Diameter & length determines the flow



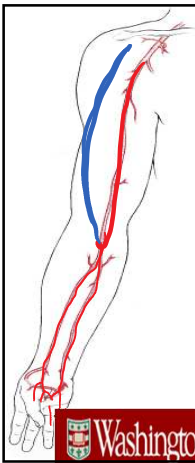
Distal radial artery is the ideal site smaller the anastomosis diameter less chance for a high flow AVA

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Adverse effects of high flow

Central effects	Peripheral	Local
↓	↓	↓
CHF	Distal ischemia	Aneurysms
↓	↓	↓
Uncommon	occasional	Common

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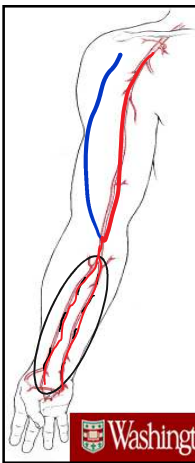


Hemodynamics of asymptomatic patients

Normal compliant vessels

High flows AVF often cause decrease in distal perfusion in less compliant distal vessels

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Hemodynamics of symptomatic patients

➤ With distal vascular disease

High flow becomes symptomatic in the presence of distal vascular disease

Valentine RJ et al. J Vasc. Surg. 2002;36:351-6
Tynan-Cuisinier GS et al. Eu J Vas Endo V Surg. 2003;37:179-84

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Aneurysms
Pathophysiology
Why fistulae dilate?

High intra access pressure

Hoop stress

Mismatch between volume flow and outflow diameter

- High flow and relatively narrow outflow
- True outflow vein stenosis
- Varicosity resulting in obstructing kinks
- Outflow vein stents

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Pathophysiology

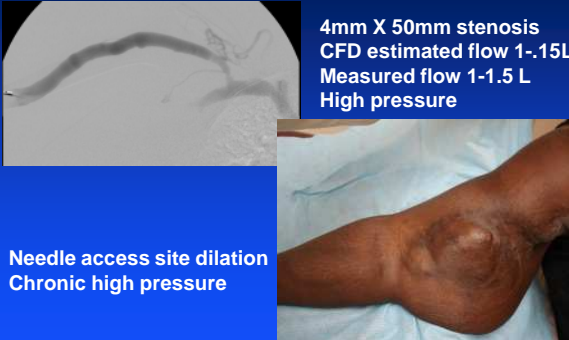
Venous aneurysms are a result of dilation of needle access segment over a period of time

Every needle access heals with a scar when the pressure in the system is high the scar tends to thin out resulting in aneurysmal dilation

..... S. Shenoy

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Chronic high pressure




4mm X 50mm stenosis
CFD estimated flow 1-.15L
Measured flow 1-1.5 L
High pressure

Needle access site dilation
Chronic high pressure

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Pathophysiology
Secondary effects of dilation, elongation




Kinks with secondary obstruction
Distal dilation → Multiple stenosis
Flow reduction → Chronic thrombus

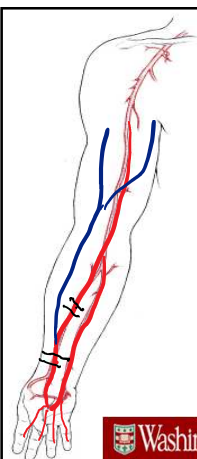
Surgical management

↓
Flow reduction

↓


Controlled Banding
Using tapered grafts
RUDI - Revascularization using distal inflow
DRAL - Distal radial artery ligation

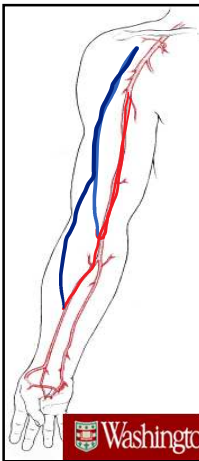




DRAL
Distal radial artery ligation

Limiting the flow by using
longer lengths of narrow
caliber
Vessels for inflow





RUDI
Revascularization using distal inflow

Narrow caliber of the radial artery acts as a flow limiting segment

Minion DJ et.al. Ann Vasc Surg 2005;19:625
Callaghan CJ et.al. J Vasc Access 2011;12:52

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Summary

High flow AVF tend to be more common with brachial/axillary artery inflow

Using small artery for inflow and keeping smaller anastomotic diameter are effective preventative strategies

Controlled banding is a simple technique that can be successfully used to reduce flows

RUDI and DRAL are other surgical options that can be used
