Autogenous Direct Access (Fistula) Creation

Transit-Time Ultrasound Intraoperative Flow Measurements

Measurement Steps

1. Identify Vessel to Be Measured

Expose and identify the venous outflow of the AVF.

2. Select Flowprobe Sizes

Measure the vein's diameter with a gauge. Select a probe so that the vein will fill between 65% - 100% of the sensor window of the probe (Fig. 1).

Probe Size	Nonrestrictive Vessel Range
3 mm	1.2 - 3.2 mm
4 mm	3.2 - 5.3 mm
6 mm	4.5 - 7.5 mm

3. Check Blood Pressure

If systolic BP is greater than 100 mmHg, continue with measurement. If systolic BP is less 100 mmHg, low AV fistula flow may be caused by low BP.[1]

4. Measure Venous Outflow

1. Select an outflow site wide enough to accommodate the probe's acoustic reflector.
2. Apply sterile gel to the Flowprobe to ensure good ultrasound coupling.
3. Apply the Flowprobe to the vein, bending the probe's flexible neck so that the entire vein lies within the sensing window of the probe and aligns at a 90º angle with the probe handle (Fig. 1).
4. Check the bucket display (Signal Quality Indicator) on the flowmeters front panel for good acoustic contact.
5. Listen to the pitch of **FlowSound.™** The higher the pitch, the greater the flow.

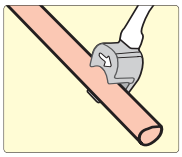

Fig. 1: Align the vessel of the probe as shown.

End-to-End or Venous End-to-Arterial Side Anastomosis: When the AVF is constructed with end-to-end or venous-end-to-arterial-side anastomoses, simply measure venous outflow distal to the venous anastomosis (Fig. 2).

Side-to-Side or Arterial End-to-Venous Side Anastomosis: If the anastomosis is constructed with a venous-side-to-arterial-side anastomosis or end-artery-to-venous-side anastomosis occlude the vein (Fig. 3) proximal to the venous anastomosis while measuring flow distal to the anastomosis. If spasm occurs, papaverin can be locally infiltrated along the artery and vein while flow is continuously monitored.

5s. Document Flows

After applying a Flowprobe to a vein, wait ~ 10-15 seconds for mean readings to stabilize. Then press the PRINT button on the flowmeter to document the phasic flow patterns for the case record. If flow is negative, press the INVERT button to change the polarity before printing the waveform.

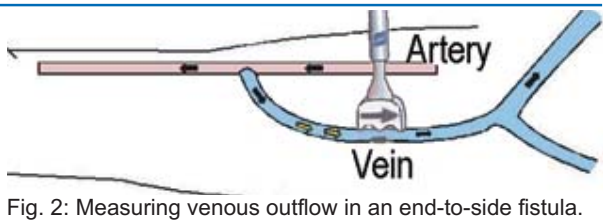

Fig. 2: Measuring venous outflow in an end-to-side fistula.

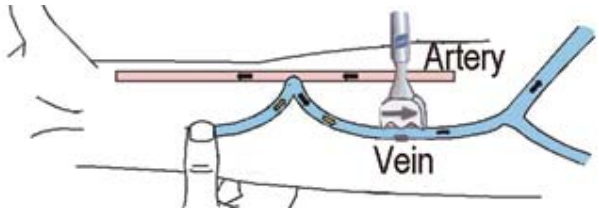

Fig. 3: Measuring venous outflow in a side-to-side fistula.

Summary: Results of Fistula Creation Study

Fistula Type	Failure within 90 days (requiring intervention)	
Radiocephalic		
Flow <170 ml/min	**56%**	*P=.001*
Flow >170 ml/min	**15%**	
Brachiocephalic		
Flow <280 ml/min	**64%**	*P=.01*
Flow >280 ml/min	**18%**	

Guidelines for AV Fistula Construction[2]

Flow Rate	Recommendation
≤ 100 ml/min	abandon site
100 -300 ml/min	at risk for early failure: observe closely allow to mature > 4-6 weeks before using
> 300 ml/min	allow to mature 4-6 weeks before use

Tables 1,2: Johnson et al reported the following AV fistula maturity results and recommendations.[2]

AV Fistula	Threshold to predict Maturation[3]
Radiocephalic	**179** ml/min
Brachiocephalic	**308** ml/min

Table 3: Blood flow rates at time of AV fistula construction to predict maturation to a functional access from Berman et al.[3]

AV Fistula	Threshold to predict Maturation[4]
Radiocephalic	**> 250-300** ml/min
Brachiocephalic	**> 400** ml/min
Basilic Transposition	**> 500** ml/min

Table 4: Blood flow rates at time of AV fistula construction to predict maturation to a functional access advised by Dr. John Ross.

References

1Eric S. Chemla, MD, Renal Transplant and Vascular Surgery, St. George's Healthcare NHS Trust, London, UK.

2Johnson, CP et al, "Prognostic Value of Intraoperative Blood Flow Measurements in Vascular Access Surgery," Surgery 1998; 124: 729-38.

3Berman, SS et al, "Predicting Arteriovenous Fistula Maturation with Intraoperative Blood Flow Measurements," Western Vascular Society 22nd Annual Meeting, Sept, 8-11, 2007, Kohala Coast, Kona, HI.

4John Ross, MD, Bamberg, SC

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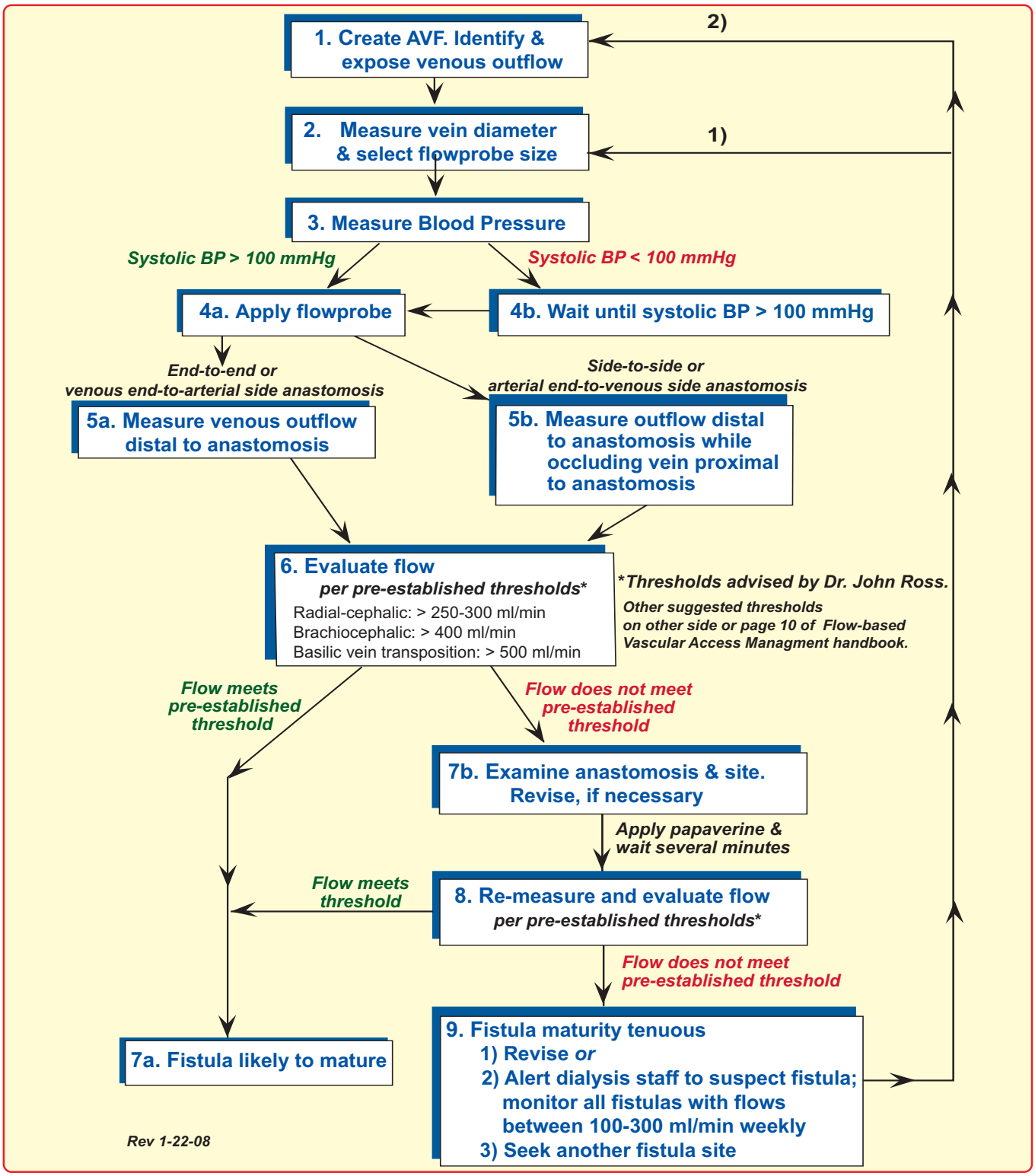

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