

Targeting a Successful Fistula: An Overview



Jamal J. Hoballah, MD, MBA, FACS
Professor and Chairman
Department of Surgery
American University of Beirut



Goal

- Functioning AV Fistula



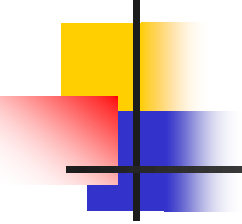
Purpose

- Identify factors affecting fistula maturation and functioning
- Select best practice approach based on available evidence or consensus



Purpose

- Identify preoperative factors affecting fistula maturation
- Discuss potential impact of such factors
- Minimize unexpected findings
- Select best approach based on preoperative assessment



Successful Fistula: Simplified Principles

- Good vein
- Good Artery
- Connect them appropriately
- Anticipate for complications



Factors for Successful Fistula:

- Anatomic variables
- Selection criteria
- Technical issues/ surgical expertise
- Handling factors
- Surveillance issues/Trouble shooting
- Management of complications



Factors for Successful Fistula:

- Anatomic variables
 - Vein diameter
 - Vein patency
 - Vein tortuosity
 - Vein thickness
 - Distance from artery
 - Artery size
 - Wall Calcifications (location; diabetes; age)



Successful Fistula: Unexpected findings

- Cannot find the vein
- The vein goes into severe spasm
- The vein is sclerotic, thick walled
- The vein has a bad segment
- The vein is far from the artery and needs significant mobilization to reach.
- The artery has a weak pulse
- The artery is calcified and cannot be clamped
- The artery goes into severe spasm



Successful Fistula: Simplified Principles Venous Assessment

- History
 - Hand dominance
 - Prior PIC lines
 - Central venous Catheters
 - Pacemakers
 - AV fistulae



Successful Fistula: Simplified Principles Venous Assessment

- Physical Exam
 - Inspection
 - Palpation
 - Venous distension with tourniquet
 - Length of continuous available palpable vein



Successful Fistula: Simplified Principles Venous Assessment

- Duplex Evaluation

- Vein Diameter
- Compressibility
- Intraluminal filling defects, sub-acute obstruction
- Thickened wall
- Change in calibers, duplicate systems
- Major branches
- Thickness of Subcutaneous tissue
- Evidence of distal obstruction



Successful Fistula: Simplified Principles Venous Assessment

- Duplex Evaluation

- Vein Diameter

- Hydration, temperature, position, tourniquet

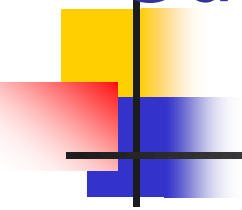
- Preferable size > 3mm

- Ideal Vein: >3mm, continuous for at least 7cm, compressible, superficial, non thickened wall, no distal obstruction.



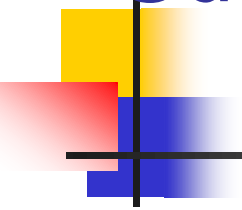
Successful Fistula: Simplified Principles Arterial Assessment

- History
 - Hand dominance
 - Prior AV fistulae
 - Prior Arterial lines
 - Diabetes
 - Vasculitis
 - Finger Ischemia



Successful Fistula: Simplified Principles Arterial Assessment

- Physical Exam
 - Inspection
 - Blood pressure in both arms
 - Palpation of pulses
 - Allen Test for Palmar arch patency
 - Distance between artery and vein



Successful Fistula: Simplified Principles Arterial Assessment

- Duplex Evaluation
 - Arterial Diameter
 - Calcification
 - Waveform Analysis
 - Finger pressures



Factors for Successful Fistula:

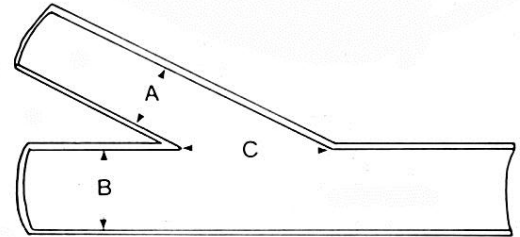
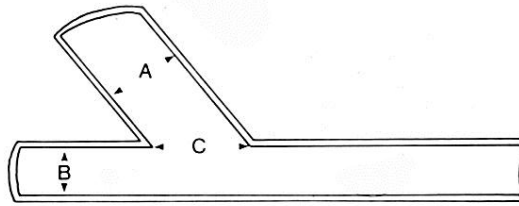
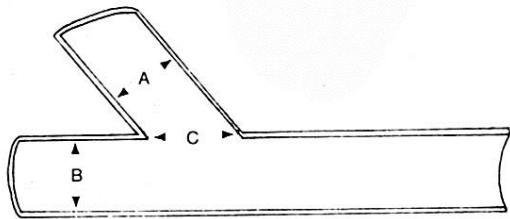
- Selection Criteria

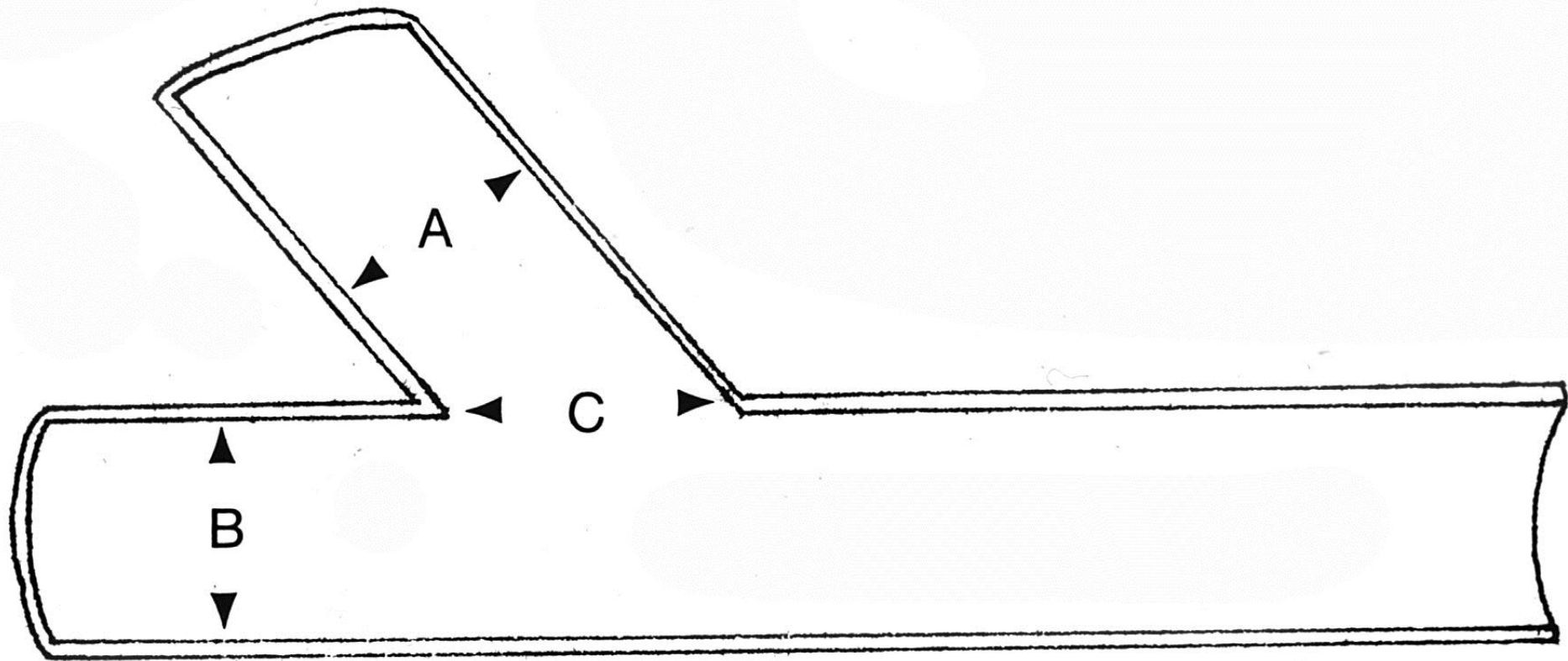
- Radiocephalic
- Brachio cephalic
- Basilic Transposition (upper arm/forearm)
- Brachial Transposition
- One stage vs Two stages



Factors for Successful Fistula:

- Technical issues
 - Surgeon's expertise
 - Anastomotic configuration:
 - End to side/vs side to side
 - Length of anastomosis
 - Lack of Technical imperfections
 - Use of Heparin
 - Handling of tissues
 - Others (use of dilators; vascular clamps; papaverine; suture material)



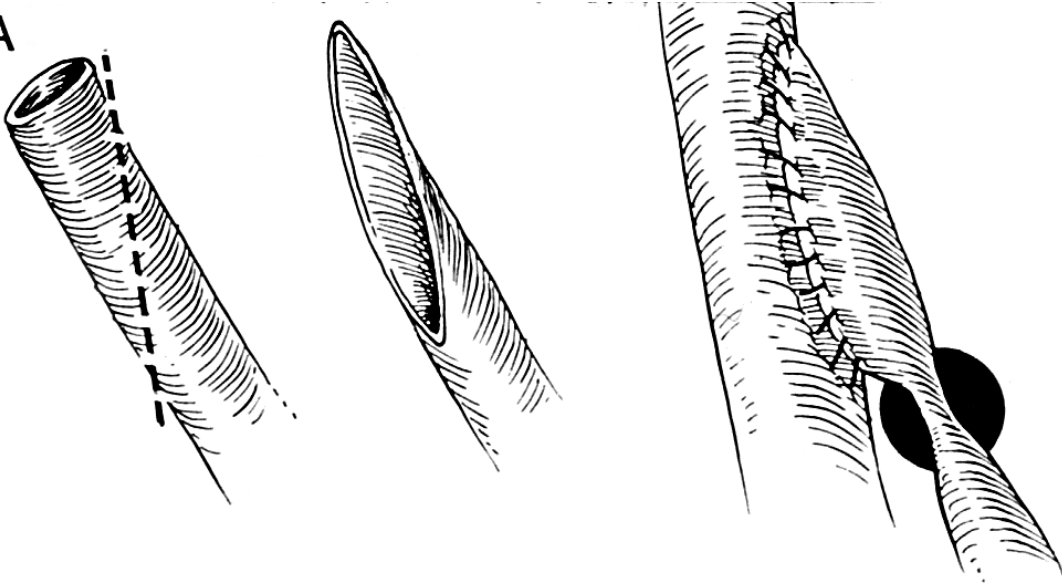




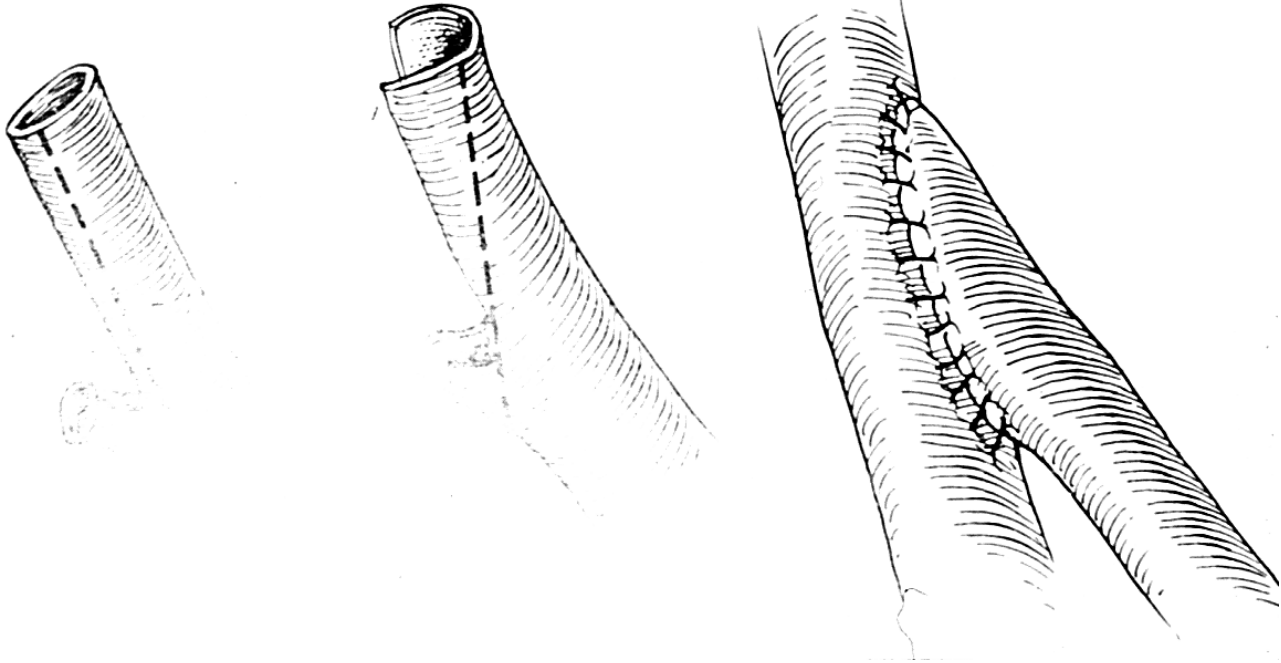
Successful Fistula: Unexpected findings

- There is a buckle in the anastomosis
- There is a kink in the vein few cms from the anastomosis
- There is no thrill
- There is a pulse in the fistula
- There is a diminished pulse in the distal vessels

A



B





Factors for Successful Fistula:

- Handling factors
 - cannulation time
 - cannulation techniques
 - Dialysis nurse expertise
 - Post fistula arm exercises
 - Thin vs obese patient



Factors for Successful Fistula:

- Surveillance issues
 - Diameter changes
 - Flow changes
 - Clinical assessment by nurses and physicians
 - Use of Protocols
 - Issues while on dialysis



Factors for Successful Fistula:

- Management of complications
 - Lack of maturation
 - Inability to cannulate
 - Inability to achieve required flow
 - Aneurysms
 - Bleeding



Successful Fistula: Simplified Principles

Anticipate Complications

- Antiplatelet Therapy: ASA/ Clopidogrel
- Diabetes Control
- Blood Pressure Control
- Hyperlipidemia Control
- Branches within 5-7 cm from anastomosis
- Distal Obstructive pathology



Non Functioning Fistulae risk factors

- Women
- Elderly
- Diabetic
- Forearm fistula
- Overweight patients



Functioning AV fistulae

- SELECTED STUDIES



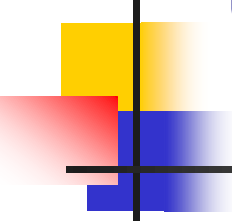
Native AV Fistula: Preoperative Evaluation

Predictor for success

N=116; 55% maturation rate

Low probabilities: Hx Stroke, TIA, Increasing age and
Dialysis dependency

High probability: Large diameter vein , use large dose
heparin MAP >85mmHG



Utility of U/S venous assessment prior to forearm AV fistula Creation

Predictor for success

N=106

Male gender

Cephalic Vein Diameter > 2.6mm



Clinical Utility of Doppler U/S prior to AV fistula Creation

Likely Failure

Cephalic vein < 1.5-2.0mm

Radial Artery < 1.5-2.0mm

Brimble et al Semin Dial 2001



Forearm Venous distensibility predicts successful AV fistula

n = 17 patients;

Strain-gauge plethysmography

Distensibility < 50cc/mmHg 100% non functional

Distensibility > 50cc/mmHg 20% non functional

No difference in Luminal diameter between functional and non functional



Preoperative radial artery diameter predicts early failure of AV fistula

n=21

11 Diameter <1.5mm	failure 45%
10 Diameter >1.5mm	failure 0%



Predictors of Successful AV fistula Maturation

	successful AVF 80%	non successful 20%
IDA	2.64mm	1.62mm
RI after Hyperemia	.50	.70
Q(A)	54.5cc/min	24.1cc/min
IDV after compression	59%	12.4%



Predictors of Successful AV fistula Maturation

N=116 80% successful AVF

Internal Diameter Artery IDA

Resistance Index RI before and after Hyperemia

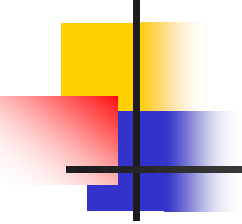
Arterial blood Flow Q(A) before and after Hyperemia

Internal Diameter of Vein

Proximal Vein Compression

Preemptive Stellate ganglion blockage increase the patency of Radiocephalic AV fistula

	n=50	
	Block	No Block
n	25	25
Thrill	25/25	13/25
Flow	201cc/min	155cc/min
Maturation	77 days	41 days
Adequate access	19/25	12/25



Radiocephalic and brachiocephalic arteriovenous fistula outcomes in the elderly.

Age did not affect usability, primary or secondary patency

Weil et al [J Vasc Surg.](#) 2008 Jan;47(1):144-50.



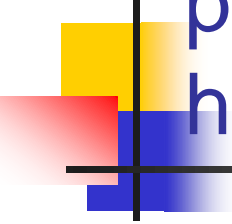
Vein diameter is the major predictor of fistula maturation

- Women
- Elderly
- Diabetic
- Vein Diameter
- Fistula type
 - [Mills et al J Vasc Surg.](#) 2009 Jun;49(6):1499-504.



Non Functioning Fistulae Etiology

- Women
- Elderly
- Diabetic
- Median Fistula flow by 6 weeks:
 - Matured: 1534 ml/ minute
 - Non matured: 245 mL/minute, ($P = .03$)



Implementation of an optimized care protocol on the outcome of arteriovenous hemodialysis access surgery.

- Higher primary and secondary patency

Flu H et al J Vasc Surg. 2008



Study Survey; Importance 1-5

Vascular mapping	1
Vascular calcification	2
Antiplatelets/anticoagulants	3
Antihypertensive meds	3
Blood pressure	3
CHF	3
Systemic vascular disease	3
Diabetes	2
Hyperlipidemia	4
Prior vascular access	1.5
Ipsilateral CVC	2



Study Survey; Practical 1-5

Vascular mapping	2
Vascular calcification	4
Antiplatelets/anticoagulants	2
Antihypertensive meds	2
Blood pressure	2.5
CHF	3.5
Systemic vascular disease	4
Diabetes	4
Hyperlipidemia	3
Prior vascular access	3.5
Ipsilateral CVC	3