

Vascular Access Monitoring

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ประธาน Service Plan สาขาโรคไต จ.เชียงใหม่

Definitions

Monitoring: the examination and evaluation of the vascular access by means of physical examination to detect physical signs that suggest the presence of dysfunction.

Surveillance: the periodic evaluation of the vascular access by using tests that may involve special instrumentation and for which an abnormal test result suggests the presence of dysfunction.

Diagnostic testing: specialized testing that is prompted by some abnormality or other medical indication and that is undertaken to diagnose the cause of the vascular access dysfunction.

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Hemodialysis Vascular Access

- Arteriovenous fistula (AVF)
- Arteriovenous graft (AVG)
- Central venous catheter
 - Cuffed: Permcath
 - Non-cuffed: Double lumen catheter

Problems of Vascular Access

AVF & AVG

- Stenosis → Thrombosis
- Infection
- Limb edema
- Limb ischemia
- Aneurysm
- High flow related CHF

HD Catheter

- ↓ Blood flow: Thrombosis, Fibrin, Malposition
- Infection
- Central venous stenosis

Problems of Vascular Access

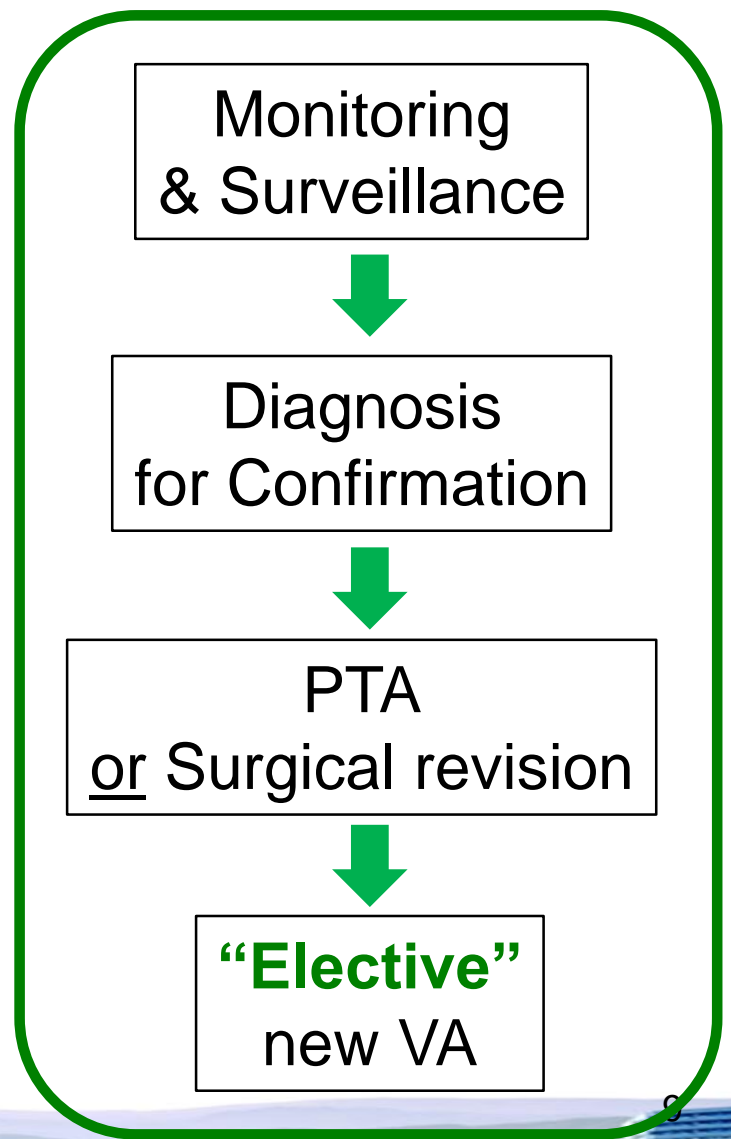
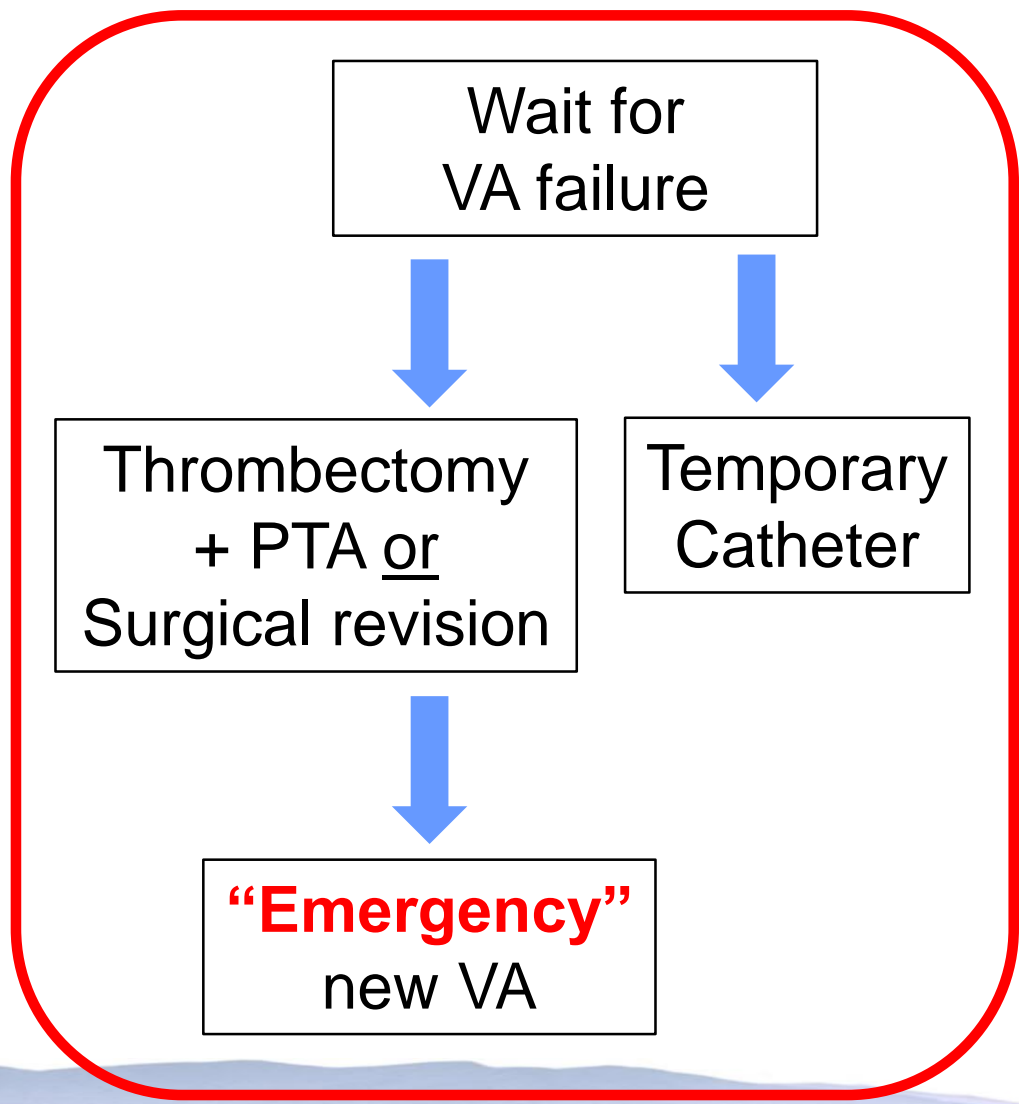
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Monitoring Choices for VA Stenosis



Benefits of Preventing Access Thrombosis

- Reduce risks of patients
 - Unrecognized access recirculation
 - Missed dialysis
 - Central venous catheter
 - Access surgery
 - Loss of the access (prolong access life & preserves access sites)

- Reduce cost of dialysis care

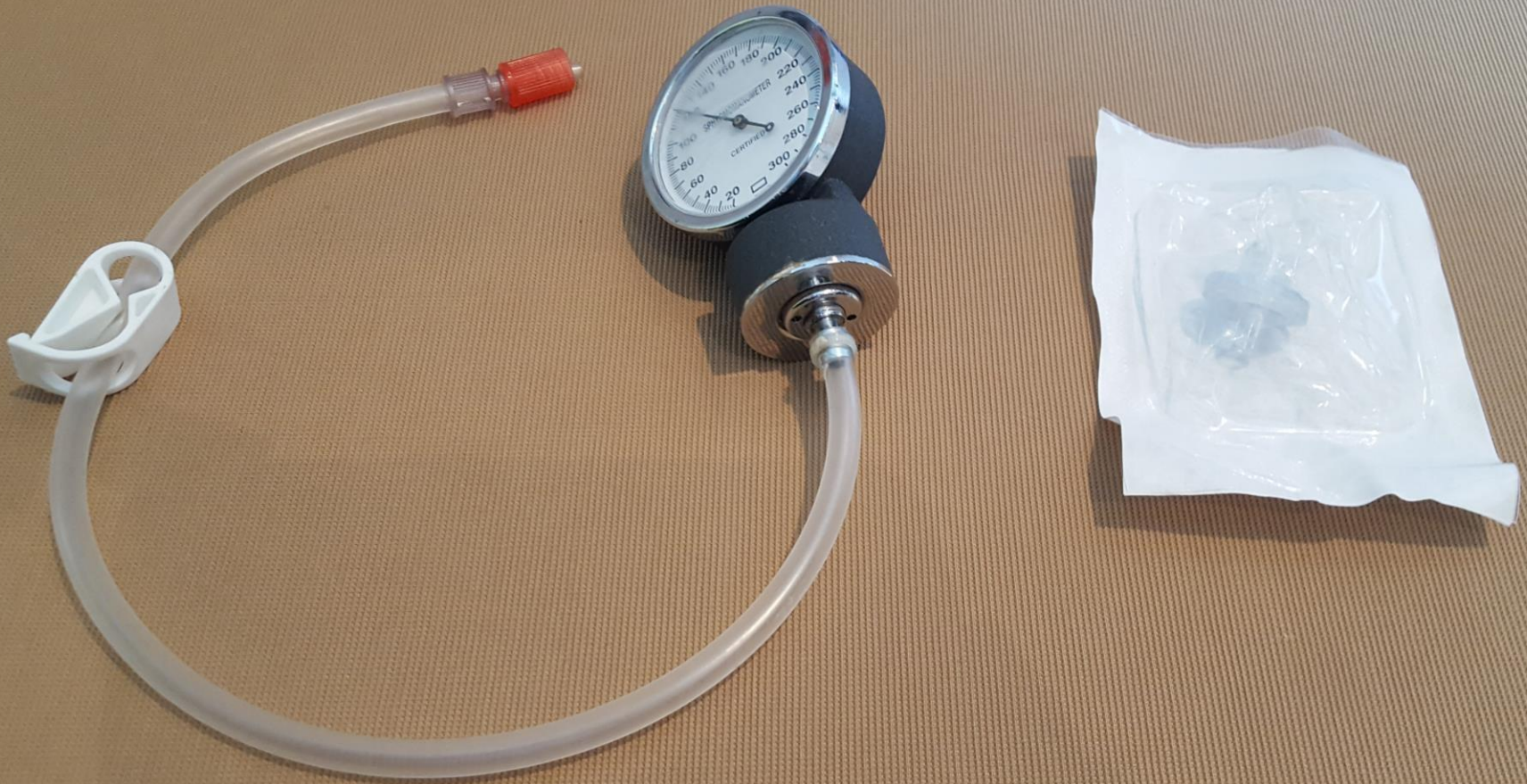
KDOQI 2006 Guidelines

	AVF	AVG
Clinical Monitoring		
● Signs & Symptoms	Preferred	Accept
Surveillance		
● Intra-access pressure		
◇ Static	Accept	Preferred
◇ Dynamic	X	X
● Intra-access flow	Preferred	Preferred
● Recirculation	Accept	X

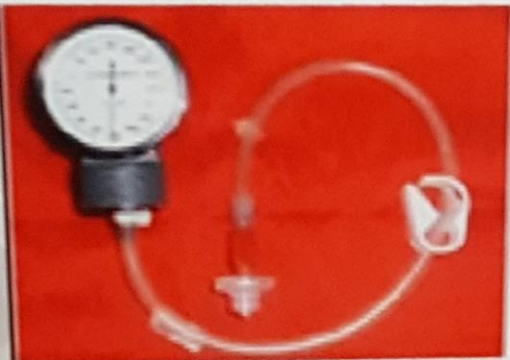
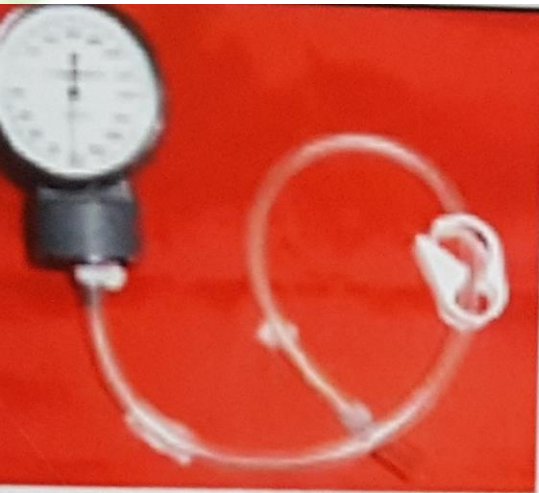




Static Intra-Access Pressure



Static Intra-Access Pressure





Example:

□ $S-AP = 60 \text{ mmHg}$

$V-AP = 40 \text{ mmHg}$

□ Blood Pressure = 140/80 mmHg

Mean Arterial Pressure (MAP) =
 $80 + ((140 - 80) / 3) = 100 \text{ mmHg}$

□ Normalized S-AP = $60 / 100 = 0.60$

Normalized S-VP = $40 / 100 = 0.40$

Clinical Signs & Symptoms

Stenotic site	Access blood flow (Qa)	Intra-access pressure (IAP)		Clinical Signs & Symptoms
		A	V	
None	↔	↔	↔	
Inflow	↓	↓	↓	<ul style="list-style-type: none"> • ↓ Blood pump flow • Unexplained dialysis inadequacy
Intra-access	↓	↑	↓	<ul style="list-style-type: none"> • Difficult to cannulation • Aspiration of clots
Outflow	↓	↑	↑	<ul style="list-style-type: none"> • ↑ Venous pressure • Prolonged bleeding after needle withdrawal • Persistent arm edema (→ Central vein stenosis)

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Outflow + collateral v.	↓	↔	↔	
Inflow + Outflow	↓	↔	↔	

Physical Examinations

- ❑ Physical examination should be used to detect dysfunction in fistulae and grafts **at least monthly** by a qualified individual.
- ❑ AVF abnormality – more easily detectable than AVG
- ❑ Anastomosis site → Inflow → Body → Outflow

Physical Examinations

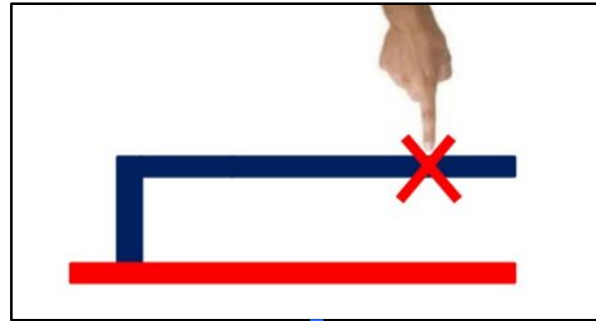
❑ Arm elevation

- Collapsed → good **outflow**
- Dilated → Stenosis at collapsed/non-collapsed junction

❑ Pulse augmentation

- ↑ Strong pulse → good **inflow**
- No change → stenosis at proximal site (common: juxta anastomosis vein) or → collateral vein

Pulse augmentation test



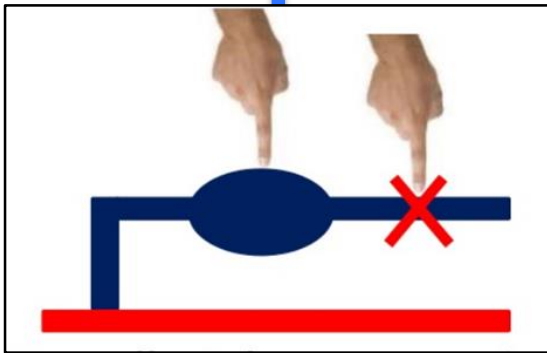
Yes

No

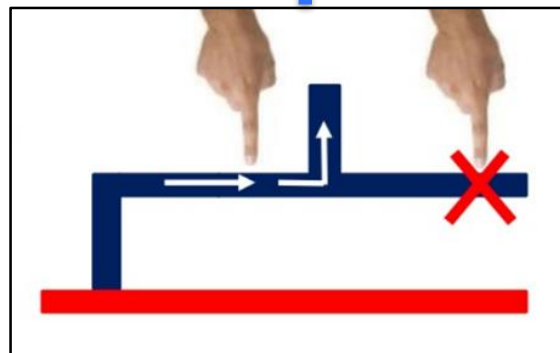
Thrill

Yes

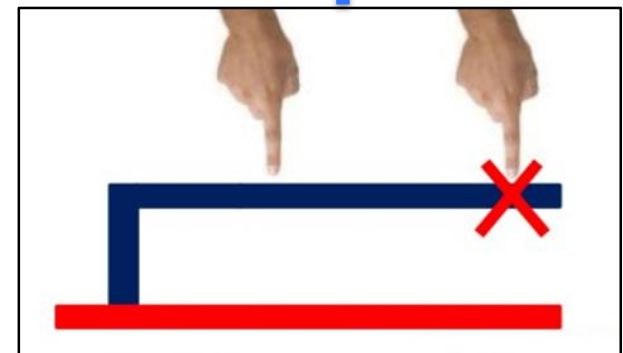
No



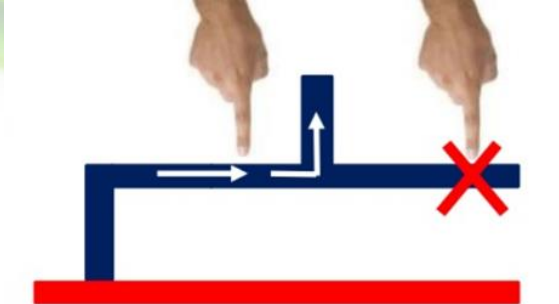
Normal



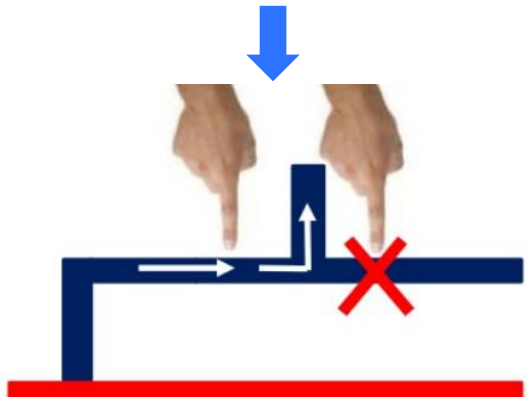
Collateral vein



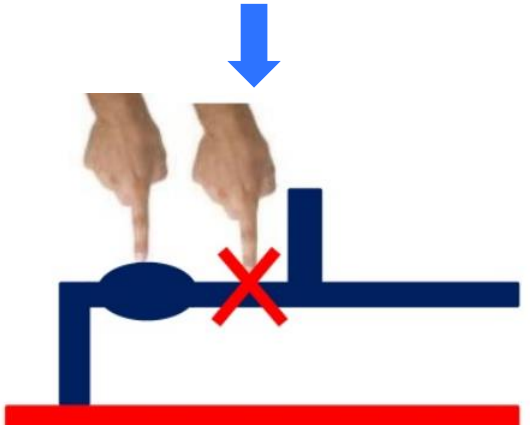
Inflow stenosis



No pulse augmentation,
normal thrill



Still no pulse augmentation,
normal thrill



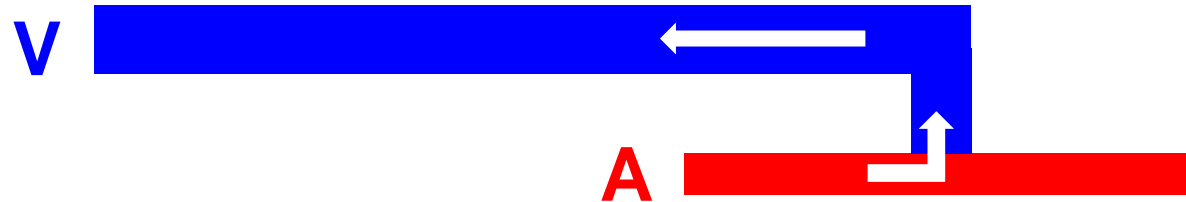
Pulse augmentation,
no thrill

**Collateral
vein
level**

Physical Examinations

- ❑ Thrill (Bruit)
 - Thrill is good / Pulse is bad
 - Good AVF: strong thrill at anastomosis, gradually ↓ along distal, continuous pattern, soft pulse
 - Record thrill (site, intensity, quality) from Anastomosis site → Inflow → Body → Outflow
 - Stenosis:
 - ❖ Mild:
 - Anastomosis: ↓ continuous thrill, ↑ pulse
 - Stenotic point: continuous thrill
 - ❖ Severe:
 - Anastomosis: systolic thrill, ↑ ↑ pulse
 - Stenotic point: absent thrill

Normal AVF



■ Arm elevation

■ Pulse augmentation

■ Configuration

■ Pulse

■ Thrill (Bruit) max. intensity

← Collapsed →

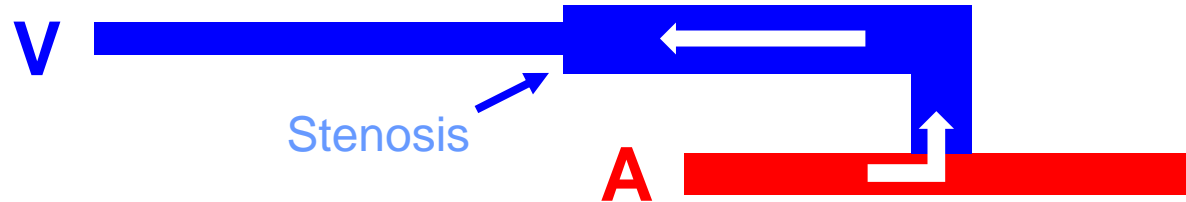
Strong

Uniform

Soft

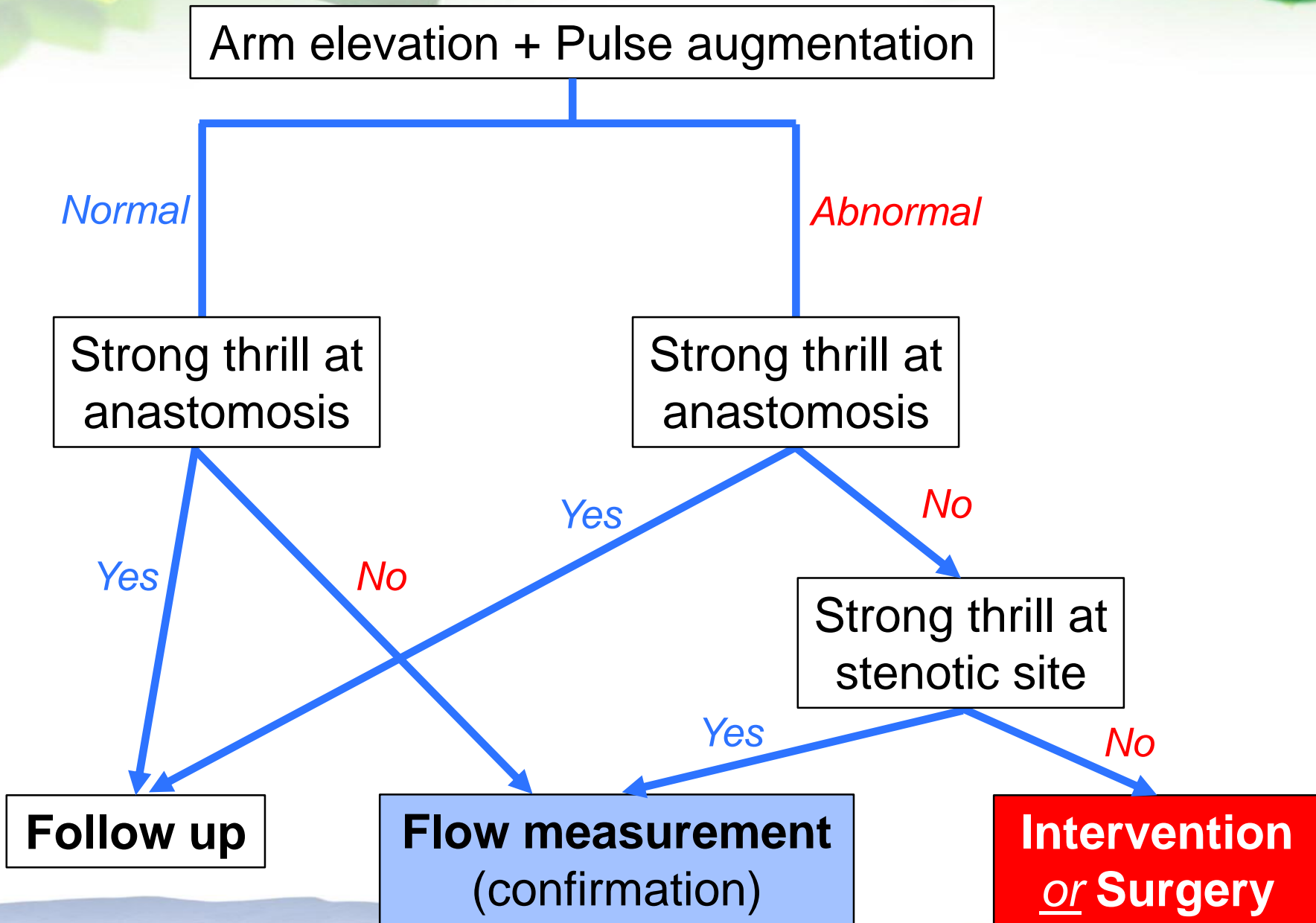


AVF (mid) Stenosis



- Arm elevation ← Collapsed →
- Pulse Strong
- Augmentation
- Configuration ← Collapsed → ← Dilated →
- Pulse ← Absent → ← Strong →
- Thrill (Bruit) max. intensity ↑ ↑ / ↔





When to refer for evaluation (diagnosis) and treatment:

- ❑ Prospective **trend analysis** of the test parameter has greater power to detect dysfunction than isolated values alone.
- ❑ **Persistent** abnormalities in any of the monitoring or surveillance parameters should prompt referral for access imaging.
- ❑ Routine monitoring & surveillance (at least)
 - ❖ Physical examination: 1 month
 - ❖ Flow measurement: AVG - 1 month
AVF - 3 month

When to refer for evaluation (diagnosis) and treatment:

Clinical	Hemodynamic
<ul style="list-style-type: none"> • Arm swelling • Difficult cannulation • Loss of continuous bruit • Prolonged bleeding • ↓ URR, Kt/V > 10% x 2 • Recurrent clotting > 2 /month • Dialyzer clotting <u>or</u> poor reuse • Recirculation <ul style="list-style-type: none"> - > 10 % (urea based) - > 0-5 % (other) 	<ul style="list-style-type: none"> <input type="checkbox"/> Access flow rate <ul style="list-style-type: none"> - AVG: < 600 mL/min - AVF: < 400 - 500 mL/min <input type="checkbox"/> Venous segment static pressure (mean pressures) ratio > 0.5 (AVG & AVF) <input type="checkbox"/> Arterial segment static pressure ratio > 0.75 (AVG) <i>(KDOQI 2006)</i> <input type="checkbox"/> Access flow rate <ul style="list-style-type: none"> - AVF: < 500 mL/min <p><i>(Eur Vasc Surg 2018)</i></p>



ขอบคุณ & สวัสดีครับ