Monitoring of Vascular Access

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ประธาน Service Plan สาขาโรคไต จ.เชียงใหม่

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

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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

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.

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

Clinical Signs & Symptoms

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

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

Physical Examinations

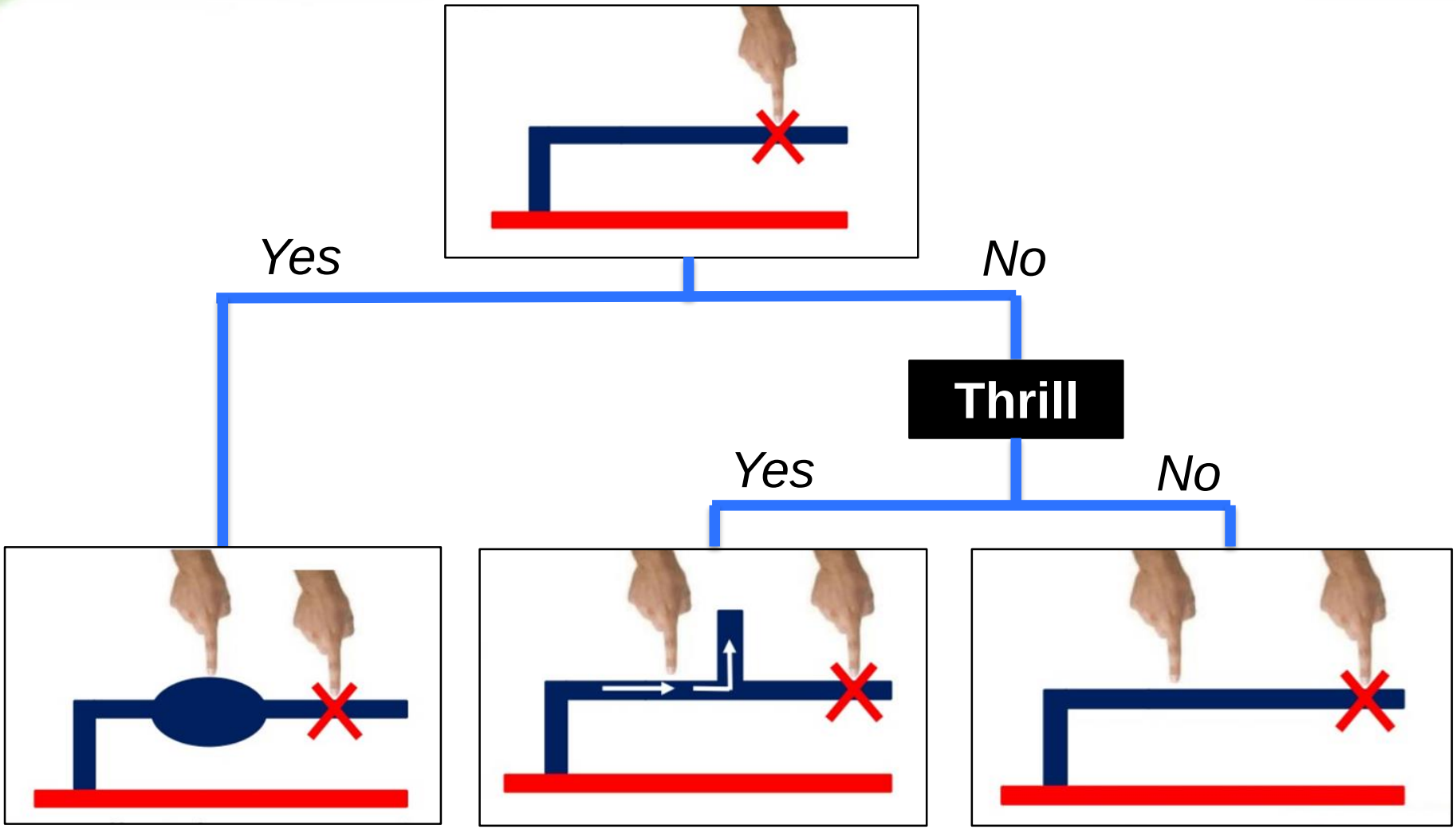
- Physical examination should be used to detect dysfunction in fistulae and grafts at least monthly by a qualified individual.
- AVF abnormality – more easily detectable than AVG
- Anastomosis site → Inflow → Body → Outflow

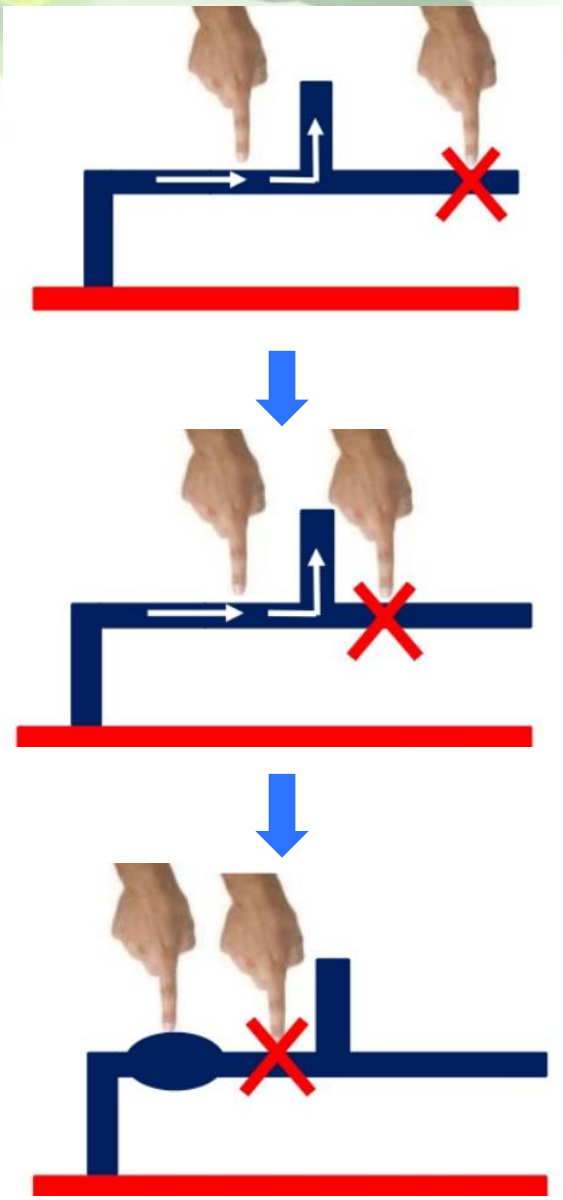
Physical Examinations

- 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





No pulse augmentation,
normal thrill

Still no pulse augmentation,
normal thrill

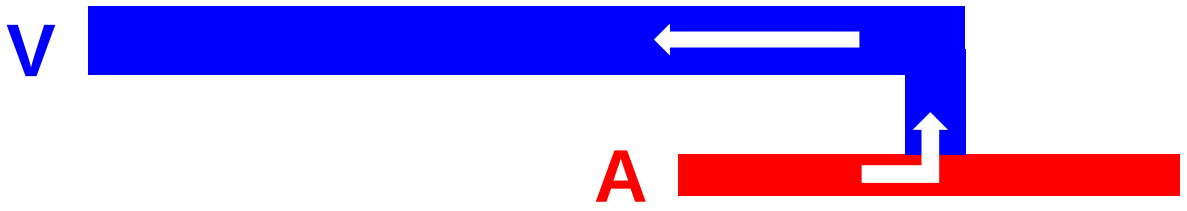
Pulse augmentation,
no thrill

Collateral vein level

Physical Examinations

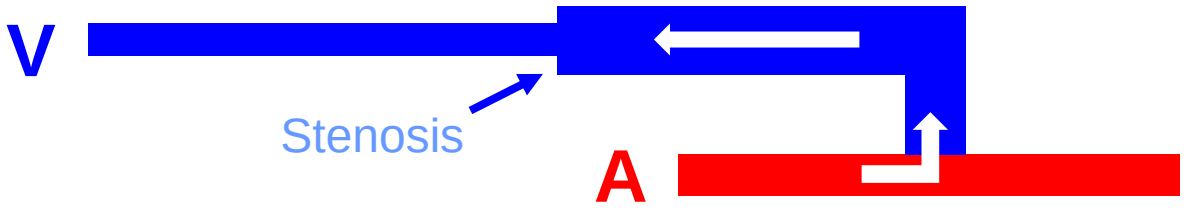
- Thrill (Bruit)
  - Thrill is good / Pulse is bad
  - Good AVF: strong thrill at anastomosis, gradually ↓ along distal, continuous pattern, soft pulse
  - Record thrill (site, intensity, quality) from Anastomosis site → Inflow → Body → Outflow
  - Stenosis:
    - Mild:
      - Anastomosis: ↓ continuous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

Normal AVF

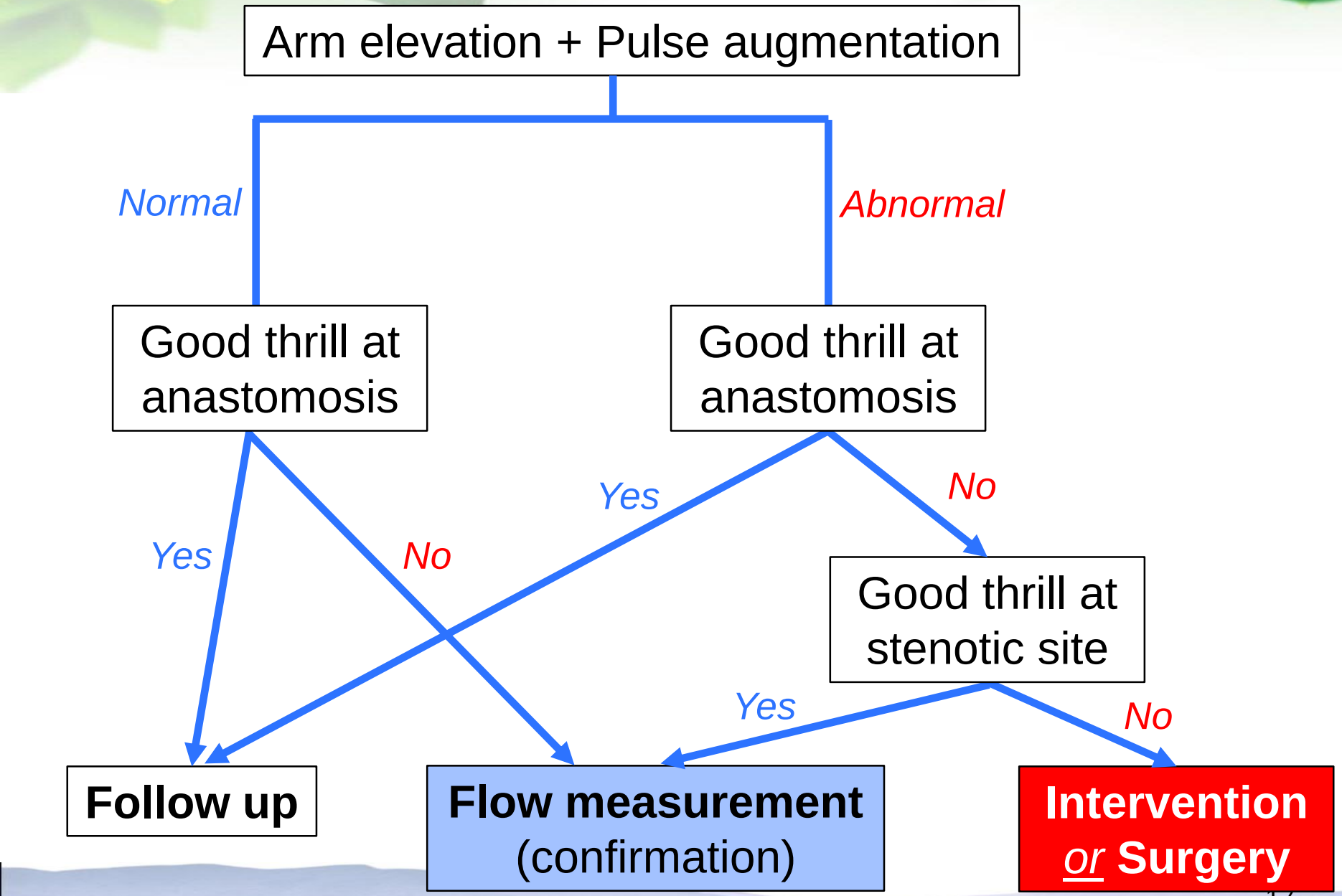


- Arm elevation ← Collapsed →
- Pulse augmentation — Strong
- Configuration — Uniform
- Pulse — Soft
- Thrill (Bruit) max. intensity ↑

AVF (mid) Stenosis



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


Arm elevation + Pulse augmentation
Normal
Abnormal
Good thrill at anastomosis
Good thrill at anastomosis
Yes
No
Yes
No
Good thrill at stenotic site
Yes
No
Follow up
Flow measurement (confirmation)
Intervention or Surgery

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.
- Access flow rate - AVG: < 600 mL/min
  - AVF: < 400 - 500 mL/min
- Venous segment static pressure (mean pressures) ratio > 0.5 (AVG & AVF)
- Arterial segment static pressure ratio > 0.75 (AVG)

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