

North American Society of Cardiovascular Imaging
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*Tips and Tricks in Vascular Imaging
Lower Extremity CTA*

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Tips and Tricks in Vascular Imaging
LOWER EXTREMITY CTA

- Clinical context
- Scanning and Contrast Technique
- Postprocessing
- Interpretation & Reporting



Tip 1: Clinical Context
Role of Imaging in PAD*

*Peripheral Artery Disease

Peripheral Artery Disease (PAD)

- manifestation of atherosclerosis in arteries supplying blood to lower extremities

Clinical Symptoms:

- at 'stress': intermittent claudication
perfusion pressure (ABI<0.8) can't keep up with increased demand when walking;
ischemic tissue is muscle
- at 'rest': critical limb ischemia
perfusion pressure<baseline demand;
ischemic tissue is skin, nerve- connective tissue



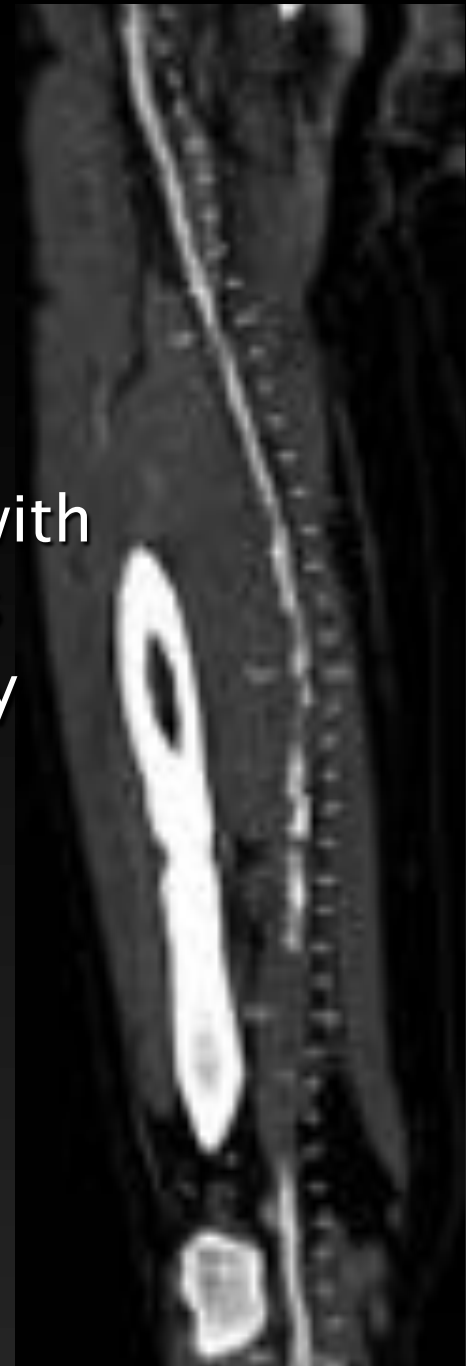
Diagnosis and Staging of PAD

- symptoms +
- ankle-brachial-index

- poor correlation of symptoms and ABI with number, location and severity of lesions
→ i.e. calf claudication can be caused by isolated vs a combination of iliac or femoropopliteal lesions

Role of Imaging NOT diagnosis / staging

- mapping of lesions to symptoms for treatment planning



16 x .75mm
2.0mm/1.0mm

MIP

multipath
CPR

73 year old woman with
intermittent claudication
bilaterally

post
PTA /
stent

post
PTA

TASC II Criteria

Transatlantic Society Consensus (2007)

Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II)

J. Wegera,¹ W.A. Stess,² L.A. Stensrud,³ R.R. Smith,⁴ S.A. Boman,⁵ and T.A.K. Sorensen⁶ on behalf of the TASC II Writing Group. *Arterioscler Thromb Vasc Biol* 2007;27:1676-1684

INTRODUCTION

The Transatlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II) was published in January 2007¹ as a result of cooperative efforts between vascular medical and surgical specialists, interventional radiologists, and vascular biologists in Europe and North America. This consensus document had a major impact on vascular care practice worldwide. In subsequent years, the TASC II program was the primary focus of the TASC II "Workshop" and the American College of Cardiology's "Consensus Document" published by the American College of Cardiology for the Management of Peripheral Arterial Disease.² Among its numerous clinical and laboratory research questions, the document is precise, facile, and offers the patient with peripheral arterial disease (PAD), whether common or severe, the best medical therapy. The document also has been widely used by clinicians with a broader interventional approach, including Europe, North America, Asia, Africa, and Australia, and with a much larger distribution and dissemination of the information. The goals of the consensus are to provide an evidence-based approach

Overview

Recommendations of various scientific fields (angiography, medicine, interventional radiology, and surgery) were shared with these specialists, assessed, and their efforts together in 2006 to form the new Writing Group. Specialists in health economics, health education, and evidence-based medicine were also invited to discuss the document for the following project: "Consensus guidelines for the management of peripheral arterial disease: clinical application, clinical trial delivery, quality indicators, and interventional consensus recommendations for all therapies."

The Writing Group received the consensus and the guidelines developed by interventional physicians and other clinicians with deep involvement from the European Association of Percutaneous Cardiovascular Interventions and consensus on this joint consensus document. The latter provides these guidelines that were then sent back to the Writing Group, where all of the specialists, authors, and consensus organizers met and ultimately agreed that document, which had been developed by the

TASC II Criteria

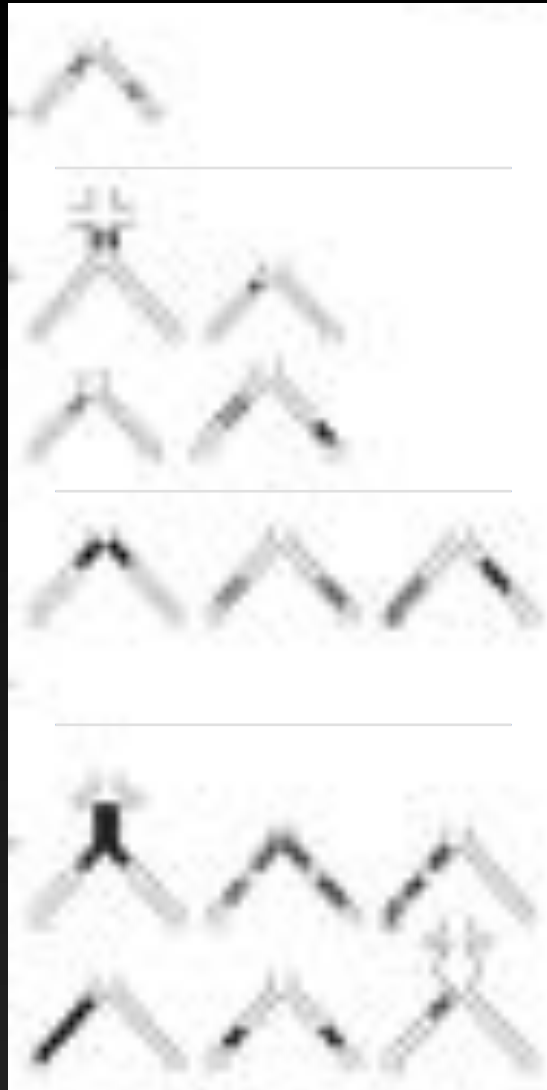
Transatlantic Society Consensus (2007)

Type A
endovascular

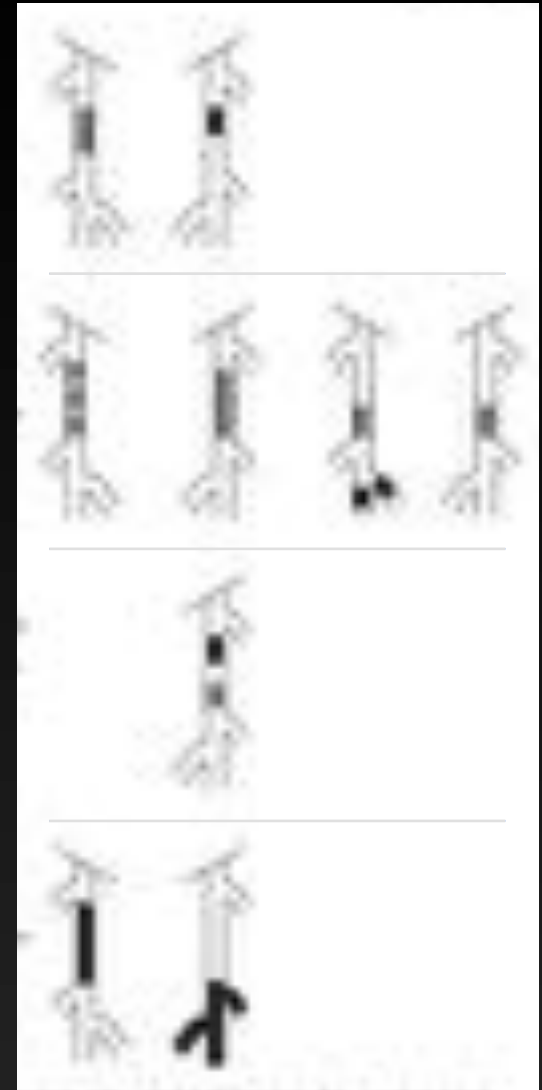
Type B

Type C

Type D
surgical



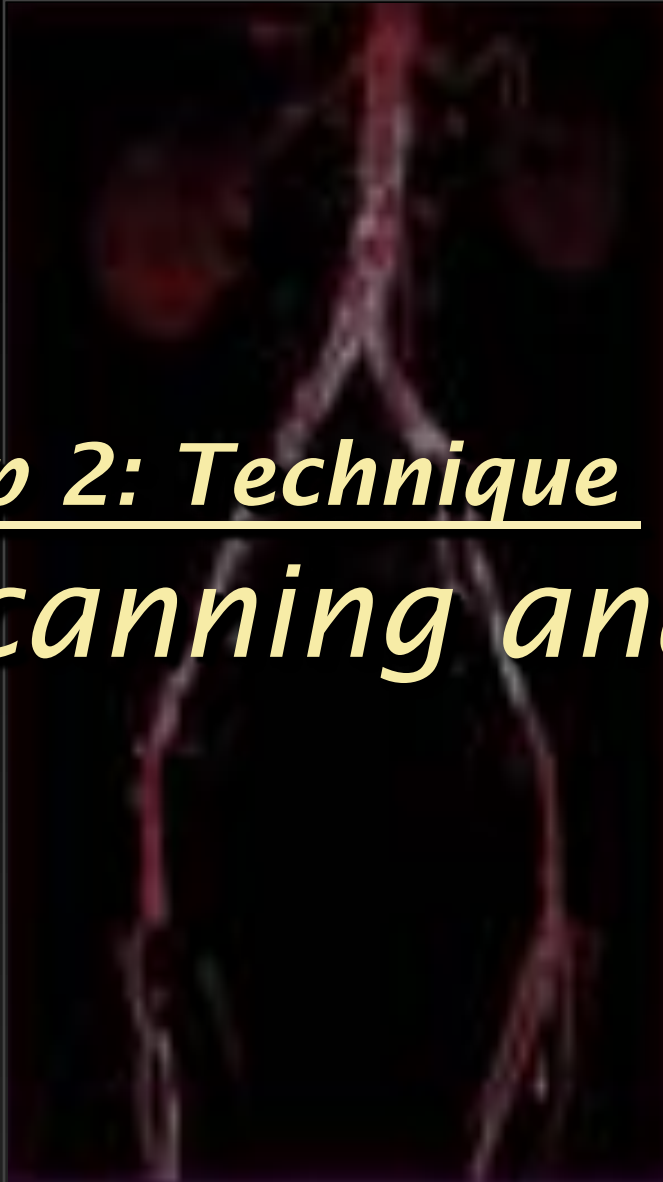
aortoiliac



femoropopliteal

Tip 2: Technique

Scanning and CM Injection



Scanning and CM Injection

- no fancy scanner needed: any CT scanner with ~ 1 mm thickness (≥ 16 -slice MDCT);
- ideally isotropic resolution (sub-millimeter)

Account for slow bolus transit in diseased arteries:

- long injection (~ 35 s)
- scan slow (40s)
- add delayed acquisition, if needed

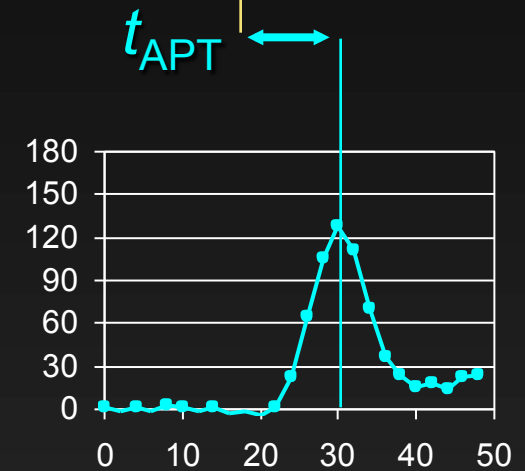
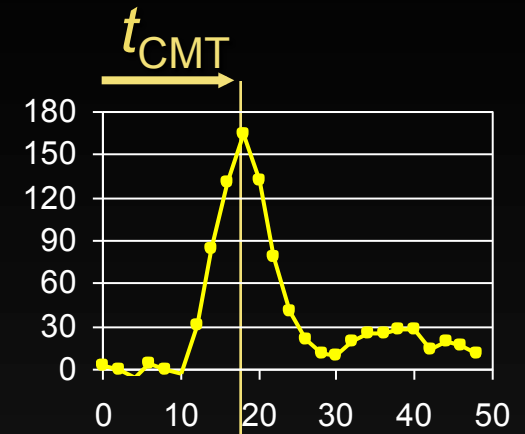
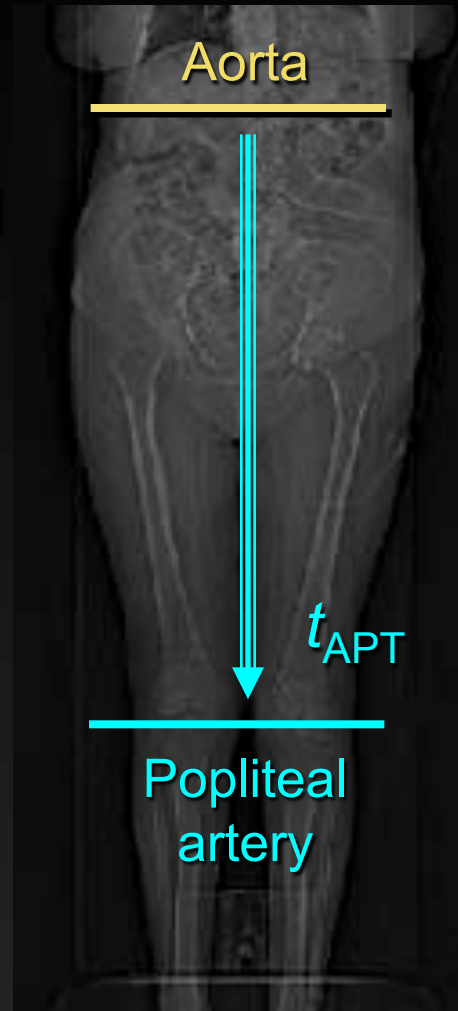
Peripheral Arterial Enhancement

(20 patients with PAOD)

Aorto-popliteal ..

Transit time Transit speed

mean: 10 s	65 mm/s
min: 4 s	177 mm/s
max: 24 s	30 mm/s



t_{APT} = aorto-popliteal transit time
 t_{CMT} = contrast medium transit time



64 - channel Lower Extremities

Scantime: 40s for ALL patients (pitch variable)
(automated tube current modulation)

Inj.duration: 35s for ALL patients

Delay: bolus triggering

weight

Biphasic Injection

<55kg 20 mL (4.0mL/s) + 96 mL (3.2mL/s)

<65kg 23 mL (4.5mL/s) + 108 mL (3.6mL/s)

75kg 25 mL (5.0mL/s) + 120 mL (4.0mL/s)

>85kg 28 mL (5.5mL/s) + 132 mL (4.4mL/s)

>95kg 30 mL (6.0mL/s) + 144 mL (4.8mL/s)

82 y.o. woman

bilateral claudication re>lt

Scanner: 64 × 0.6mm

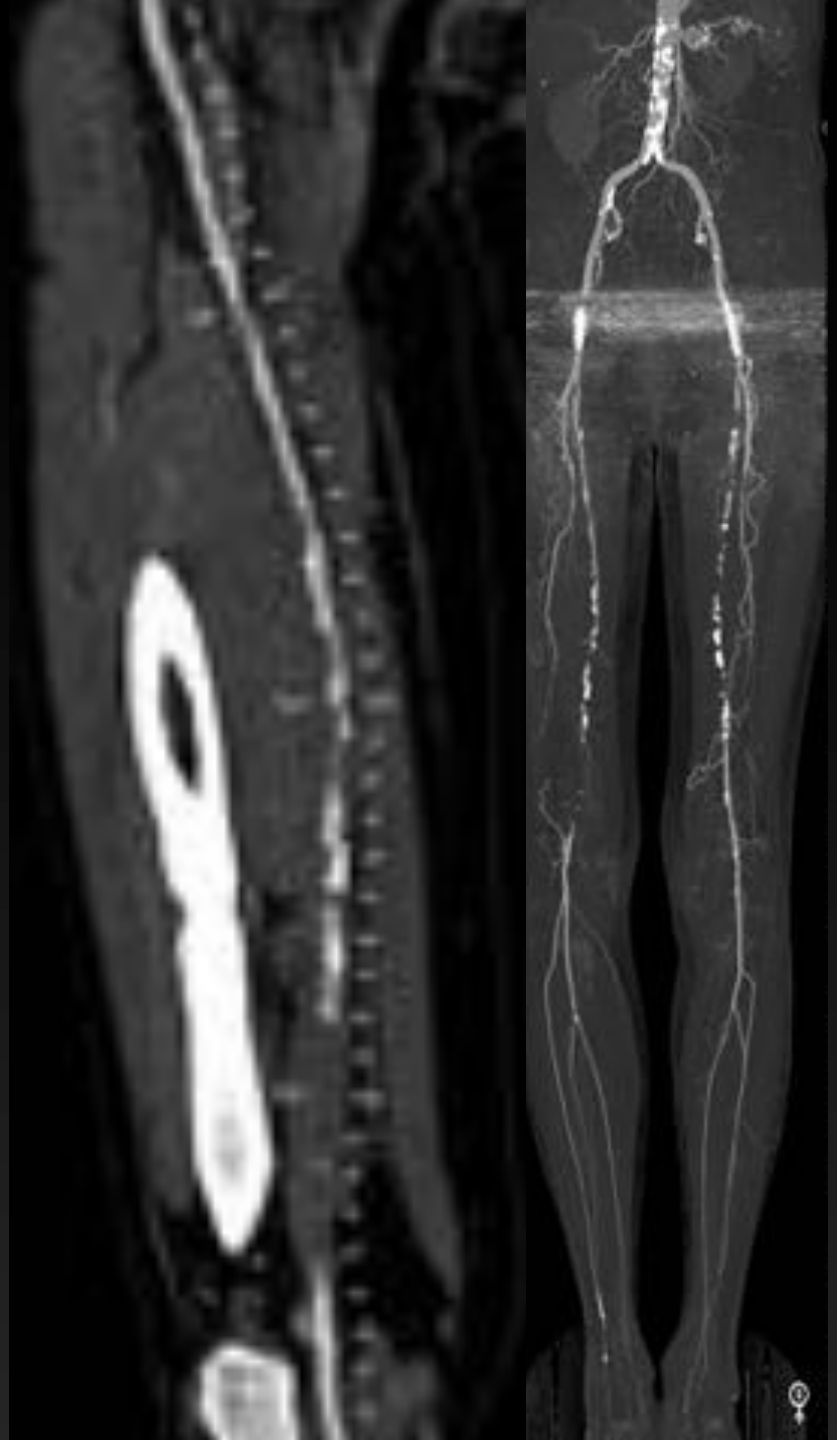
Scantime: 40 s

Injection

(biphasic): 35 s

20mL (4 mL/s) +
95mL (3.2 mL/s)

Delay: 'CareBolus'



Peripheral CTA Scanning Range

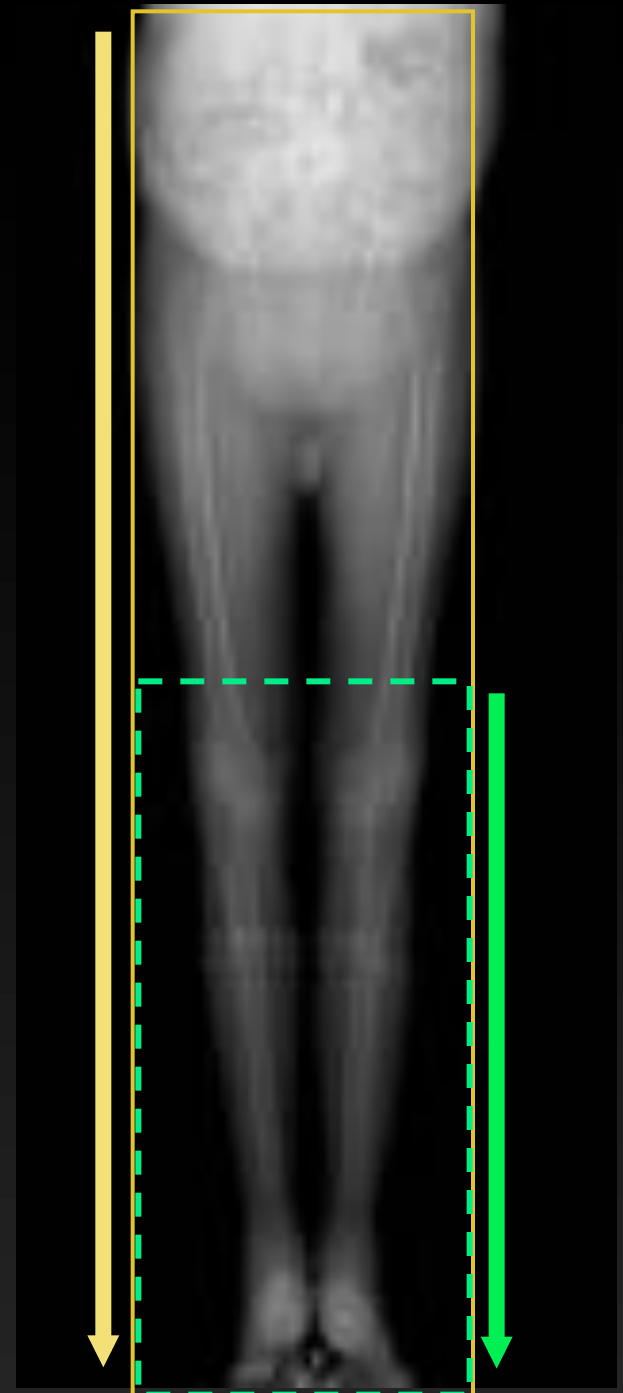
Scanning Range 1

celiac artery (Th12) → toes
(105 – 130 cm)

Optional Additional Scanning Range 2

above the knees → toes

Always pre-programmed, but
only initiated by technologist if
no contrast in crural vessels

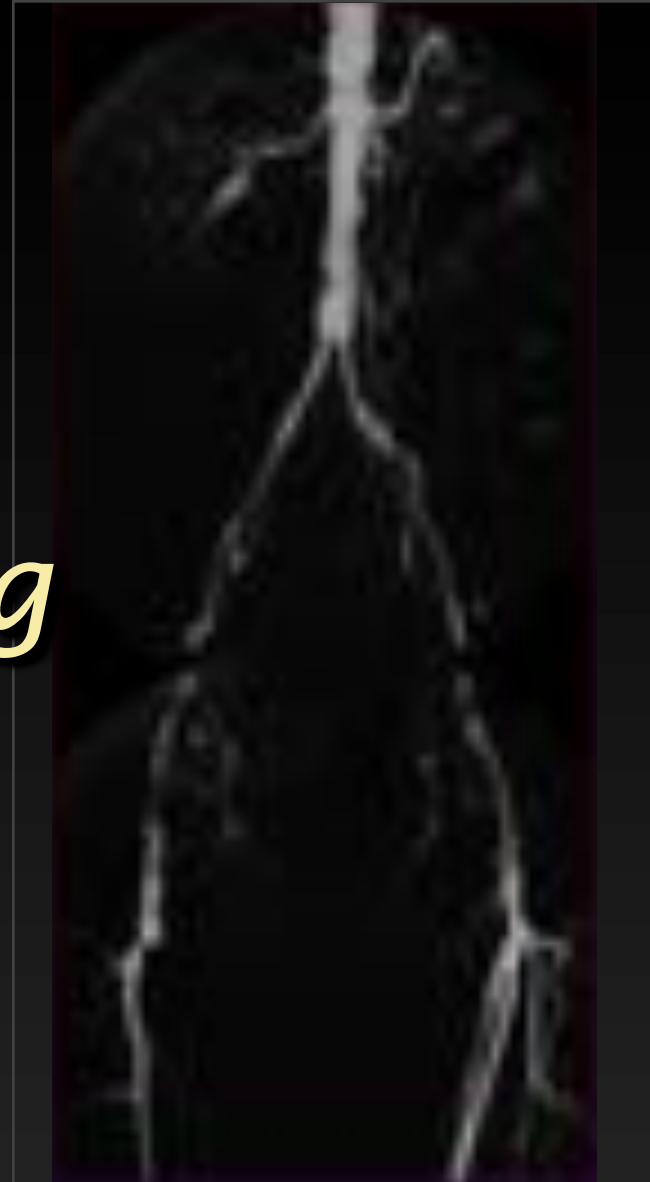
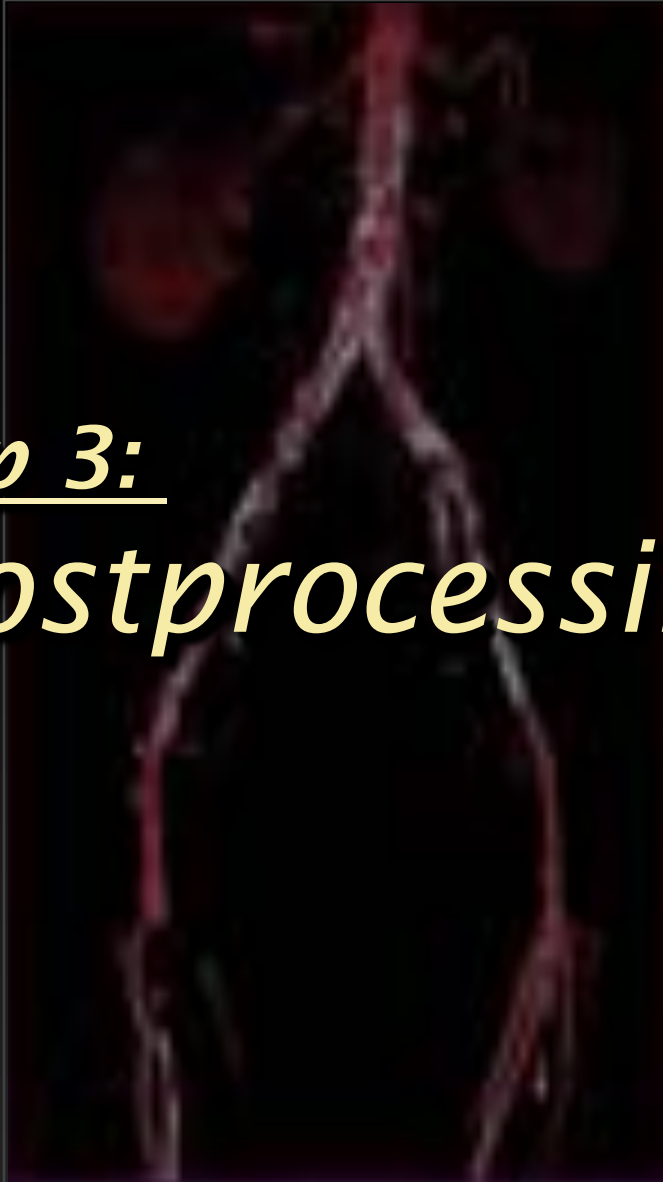


Arteriomegaly

preprogrammed,
optional 2nd acquisition



Tip 3:
Postprocessing



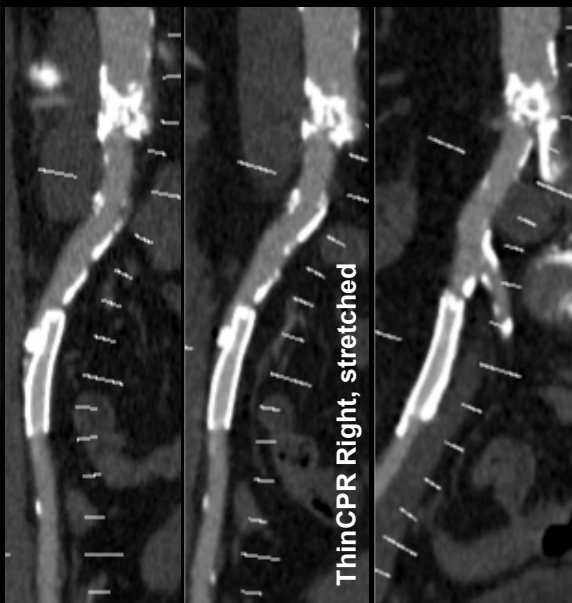
Tips and Tricks for Lower Extremity CTA Postprocessing

- greatest challenge in lower extremity CTA: difference between quick read vs. painful (literally) scrolling through images
- axial (transverse) images inadequate, except in acute ischemia (i.e. thromboembolic)
- need longitudinal cross sections (MPR/CPR)
- ideally, mapping of lesions needs a 'map': 'multipath curved planar reformations'
- try to delegate (3D-Lab, trained technologist) if routinely performing runoff CTAs

MIP



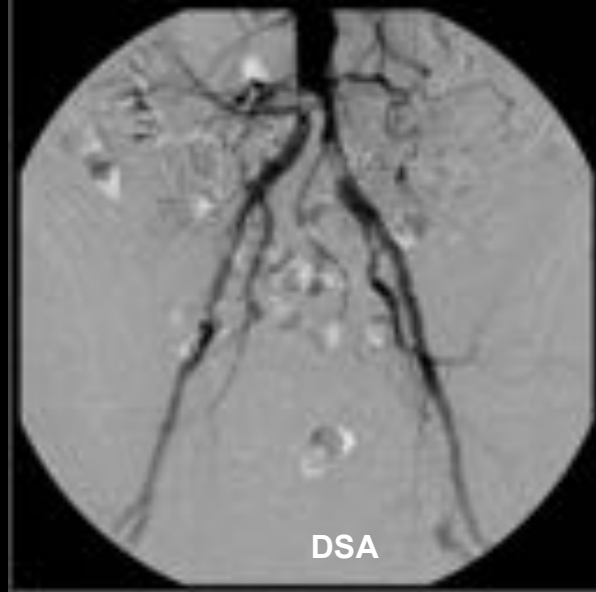
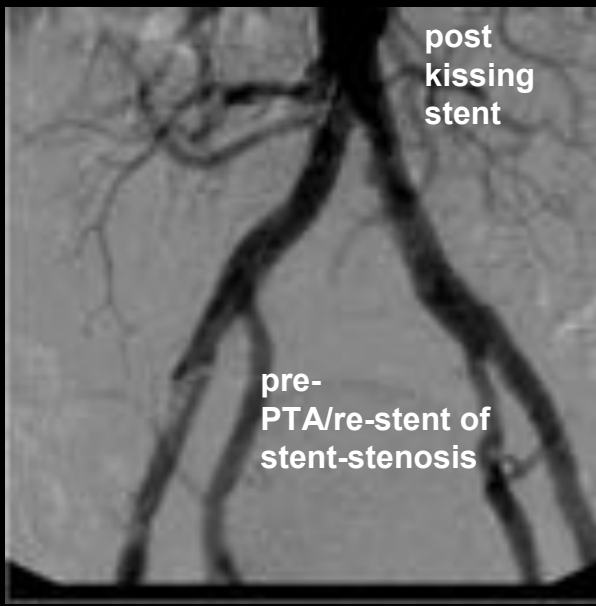
CPRs



MultiPath-CPR; thin, stretched, close-up



DSA



DSA

post kissing stent

pre-PTA/re-stent of stent-stenosis

Display on PACS



MIP

Multi-Path CPR

single CPR

Tip 4:

Interpretation & Reporting



'Surgical (endovascular) Segments'

- aorto-iliac = 'suprainguinal' = 'inflow'
- common fem. a. important landmark;
[deep fem.a.] bypass target/source
[important collateral if SFA occluded; post amput.]
- femoropoplital a. 'infra-inguinal' = 'runoff'
(pop.: P1, P2, P3) reconstitution of pop. a.
above (P1) or below (P3) knee
- below knee aa. only relevant in CLI,
can ignore in claudicants
- pedal arteries only CLI, bypass targets

Systematic Approach to Reading Lower Extremity CTA

answer clinical questions rather than listing lesions

- intermittent claudication?
critical limb ischemia ?
-- determines how you read scan
- organize first by leg, and then by station

Right/left lower extremity

- **aortoiliac** (inflow disease [above inguinal lig.])
- (common fem a.); - (deep femoral artery)
- **femoropopliteal** artery; SFA, P1, P2, P3
- **below knee** (infrapop.) runoff: 2 vessels cross ankle)
- (pedal)

Tips and Tricks in Vascular Imaging
LOWER EXTREMITY CTA: SUMMARY

- Clinical context
 - goal is to map lesions to clinical symptoms
 - 'stress' (claudication) vs. 'resting' (CLI) ischemia
- Scanning and Contrast Technique
 - inject long, and scan slow
- Postprocessing
 - curved planar reformats
- Interpretation & Reporting
 - don't read study without knowing symptoms
 - answer clinical question rather listing lesions

SAM Question

Which of the following statements regarding lower extremity CTA is correct ?

- A. the diagnosis of peripheral artery disease is fundamentally based on imaging
- B. symptoms and ankle-pressure-index (ABI) not only establish the diagnosis of peripheral artery disease, but also accurately localize the anatomic level of obstruction
- C. the role of imaging in peripheral artery disease is not making the diagnosis, but to map (localize) obstructive lesions for treatment planning
- D. in patients with calf claudication, evaluation of the distal below-knee arteries is important for treatment planning

SAM Question **ANSWER**

Which of the following statements regarding lower extremity CTA is correct ?

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- B. symptoms and ankle-pressure-index (ABI) not only establish the diagnosis of peripheral artery disease, but also accurately localize the anatomic level of obstruction
- C. **the role of imaging in peripheral artery disease is not making the diagnosis, but to map (localize) obstructive lesions for treatment planning**
- D. in patients with calf claudication, evaluation of the distal below-knee arteries is important for treatment planning

Reference: Fleischmann D, Hallett RL, Rubin GD. CT angiography of peripheral arterial disease. J Vasc Interv Radiol. 2006;17:3-26

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Thank you...



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