Noninvasive Vascular Imaging

CTA runoffs for the General Radiologist

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Objectives

- Describe standard anatomy seen on CTA runoff examination
- Review common pathologies
- Describe standards for measurements

Background

- Peripheral artery disease is the third most common vascular disease after coronary artery heart disease and stroke. As of 2010, 22 million world-wide.

- Peripheral artery disease (PAD) is a manifestation of systemic atherosclerosis affecting 14% of the population

- Computed Tomography Angiography (CTA) and magnetic resonance angiography (MRA) are the most common advanced imaging modalities used for diagnosis, disease monitoring and procedure planning.
  - Discuss the role of imaging before and after peripheral artery intervention and how it may improve intervention outcomes
  - What I wont be talking about are ABI/TBI, Arterial Duplex and Intravascular Ultrasound

DIAGNOSIS AND STAGING PAD

- **Diagnosis of PAD = Symptoms + ABI**
  - Poor correlation of symptoms and ABI with number and location and severity of lesions
  - *Example: calf claudication can be caused by isolated disease or combination of iliac and/or femoropopliteal disease*
- ***Role of CTA is NOT diagnosis/staging***
- ***CTA role is to MAP lesions to the patients symptoms for treatment planning***

- 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**

Why Are CTAs So Good?

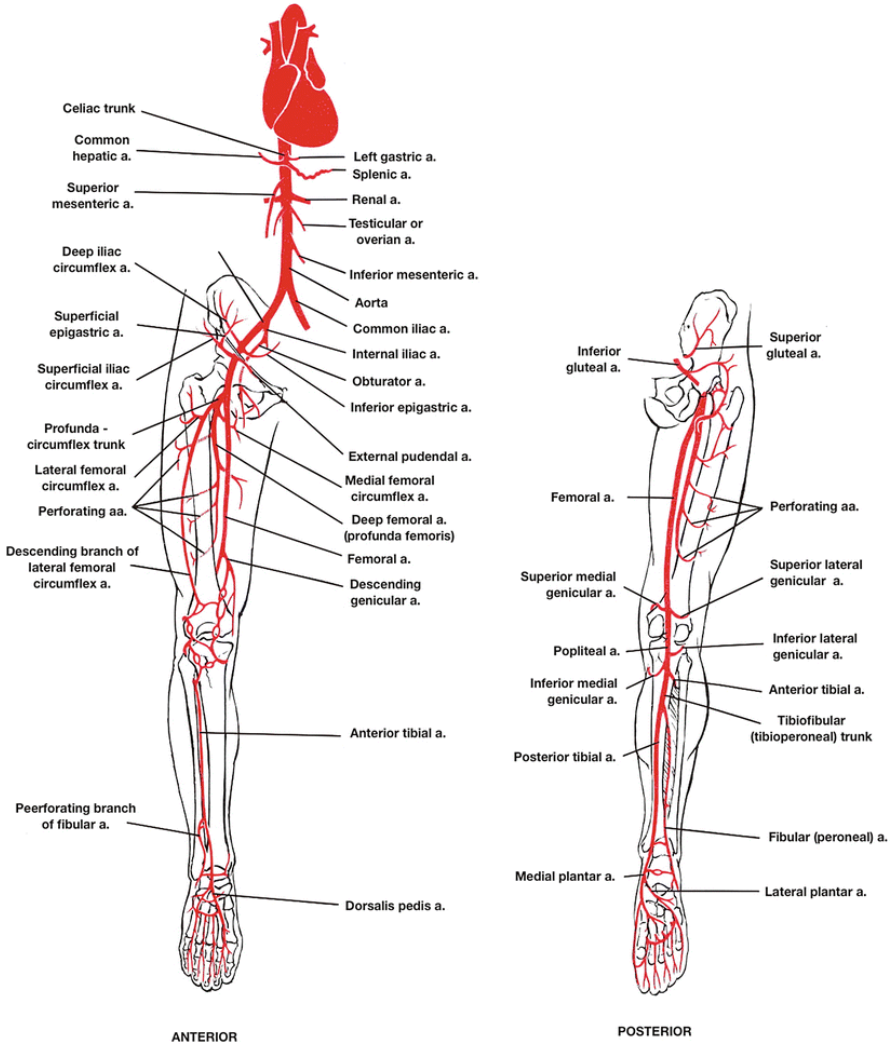
- Evaluation of vessel size, character of wall: calcification, plaque, wall thickening, wall enhancement (in aortitis or vasculitis) and thrombus.

- Treatment planning by identifying the levels of disease, amount of calcification, the length of disease, presence of occlusion, the native vessel diameter, the status of the common femoral arteries access and morphology of the aortic bifurcation

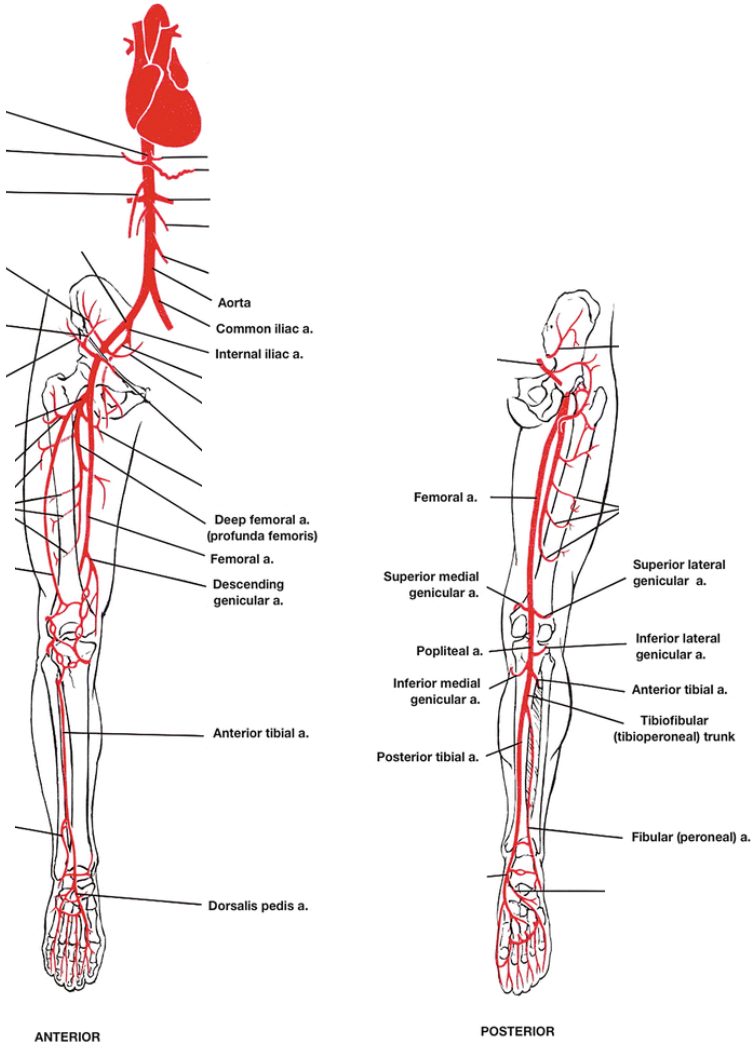
- Provides crucial diagnosis value in assessing emergent conditions: **acute limb ischemia.**

- **Digital Subtraction Angiography vs Dual Energy CTA for advanced imaging**

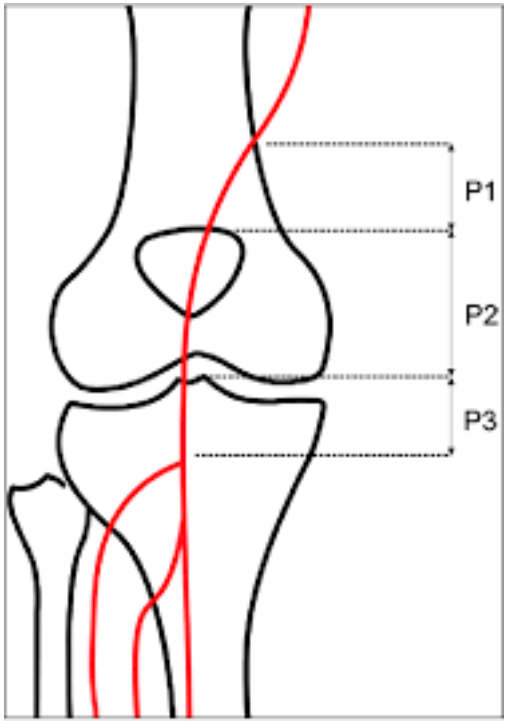
Anatomy


Celiac trunk
Common hepatic a.
Superior mesenteric a.
Deep iliac circumflex a.
Superficial epigastric a.
Superficial iliac circumflex a.
Profunda - circumflex trunk
Lateral femoral circumflex a.
Perforating aa.
Descending branch of lateral femoral circumflex a.
Peerforating branch of fibular a.
Left gastric a.
Splenic a.
Renal a.
Testicular or overian a.
Inferior mesenteric a.
Aorta
Common iliac a.
Internal iliac a.
Obturator a.
Inferior epigastric a.
External pudendal a.
Medial femoral circumflex a.
Deep femoral a. (profunda femoris)
Femoral a.
Descending genicular a.
Anterior tibial a.
Dorsalis pedis a.
ANTERIOR
Inferior gluteal a.
Superior gluteal a.
Femoral a.
Perforating aa.
Superior medial genicular a.
Superior lateral genicular a.
Popliteal a.
Inferior lateral genicular a.
Inferior medial genicular a.
Anterior tibial a.
Tibiofibular (tibioperoneal) trunk
Posterior tibial a.
Fibular (peroneal) a.
Medial plantar a.
Lateral plantar a.
POSTERIOR

Anatomy


Aorta
Common iliac a.
Internal iliac a.
Deep femoral a.
(profunda femoris)
Femoral a.
Descending
genicular a.
Anterior tibial a.
Dorsalis pedis a.
ANTERIOR
Femoral a.
Superior medial
genicular a.
Superior lateral
genicular a.
Popliteal a.
Inferior lateral
genicular a.
Inferior medial
genicular a.
Anterior tibial a.
Tibiofibular
(tibioperoneal) trunk
Posterior tibial a.
Fibular (peroneal) a.
POSTERIOR

Anatomy



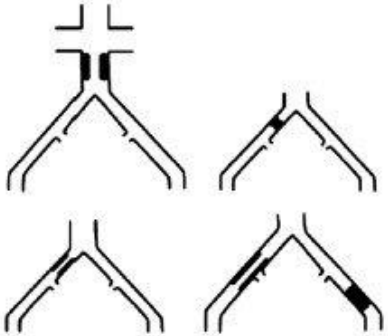
TASC

Type A lesions

- Unilateral or bilateral stenoses of CIA
- Unilateral or bilateral single short (≤3 cm) stenosis of EIA

Type B lesions:

- Short (≤3cm) stenosis of infrarenal aorta
- Unilateral CIA occlusion
- Single or multiple stenosis totaling 3–10 cm involving the EIA not extending into the CFA
- Unilateral EIA occlusion not involving the origins of internal iliac or CFA

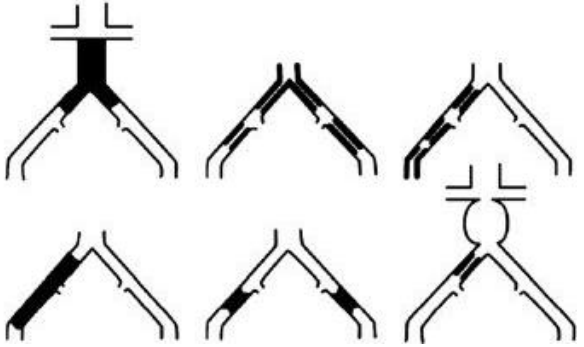


Type C lesions

- Bilateral CIA occlusions
- Bilateral EIA stenoses 3–10 cm long not extending into the CFA
- Unilateral EIA stenosis extending into the CFA
- Unilateral EIA occlusion that involves the origins of internal iliac and/or CFA
- Heavily calcified unilateral EIA occlusion with or without involvement of origins of internal iliac and/or CFA

Type D lesions

- Infra-renal aortoiliac occlusion
- Diffuse disease involving the aorta and both iliac arteries requiring treatment
- Diffuse multiple stenoses involving the unilateral CIA, EIA, and CFA
- Unilateral occlusions of both CIA and EIA
- Bilateral occlusions of EIA
- Iliac stenoses in patients with AAA requiring treatment and not amenable to endograft placement or other lesions requiring open aortic or iliac surgery



Anatomy

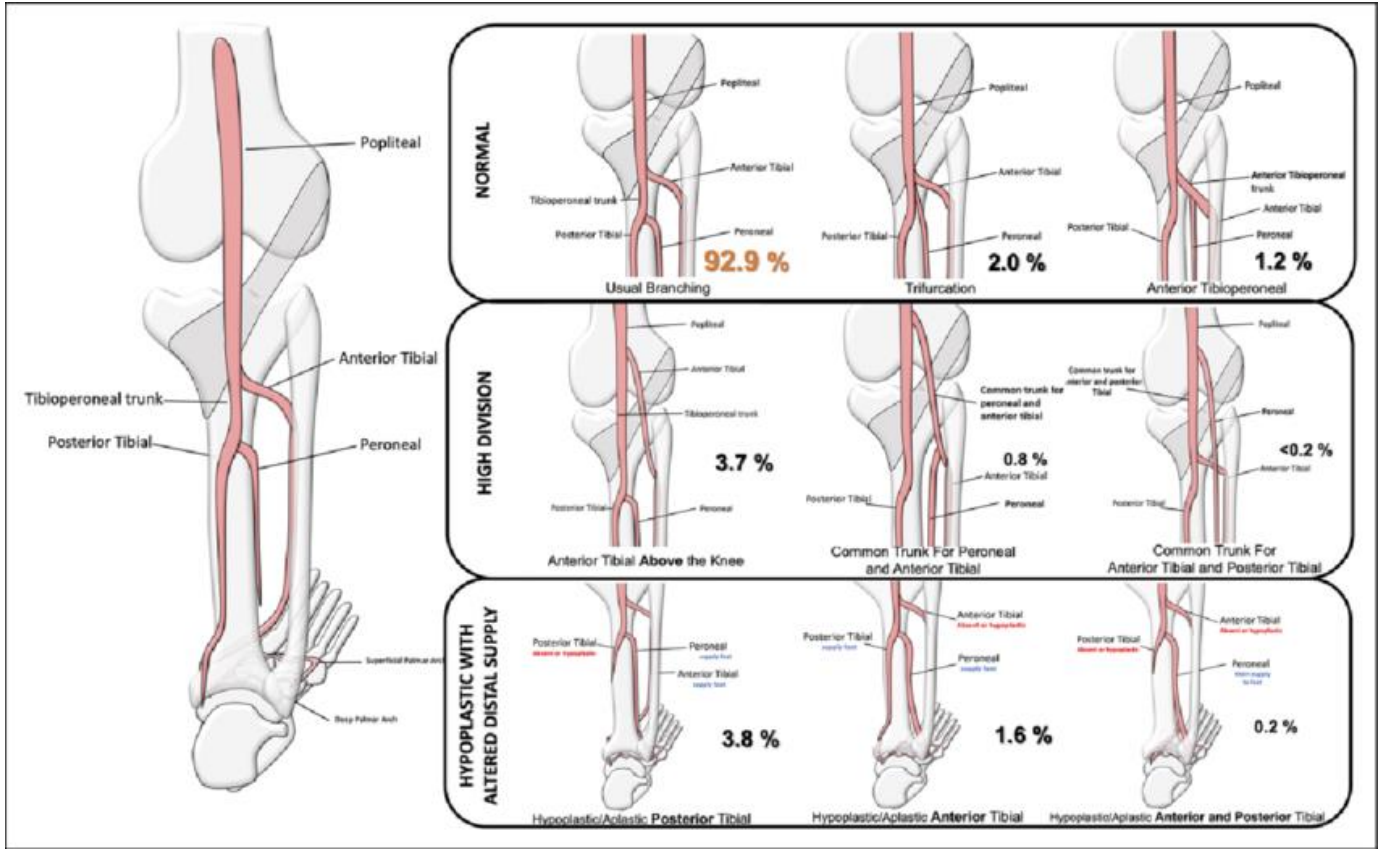
Legend	
1	Common femoral artery
2	Profunda femoris artery
3	Superficial femoral artery
4	Popliteal artery

Legend	
1	Popliteal artery
2	Tibioperoneal trunk
3	Anterior tibial artery
4	Posterior tibial artery
5	Peroneal artery

Anatomy Variants

- Persistent sciatic artery
- Corona mortis
- Popliteal artery entrapment
- High takeoffs and congenital hypo-/a-plasia of runoff vessels

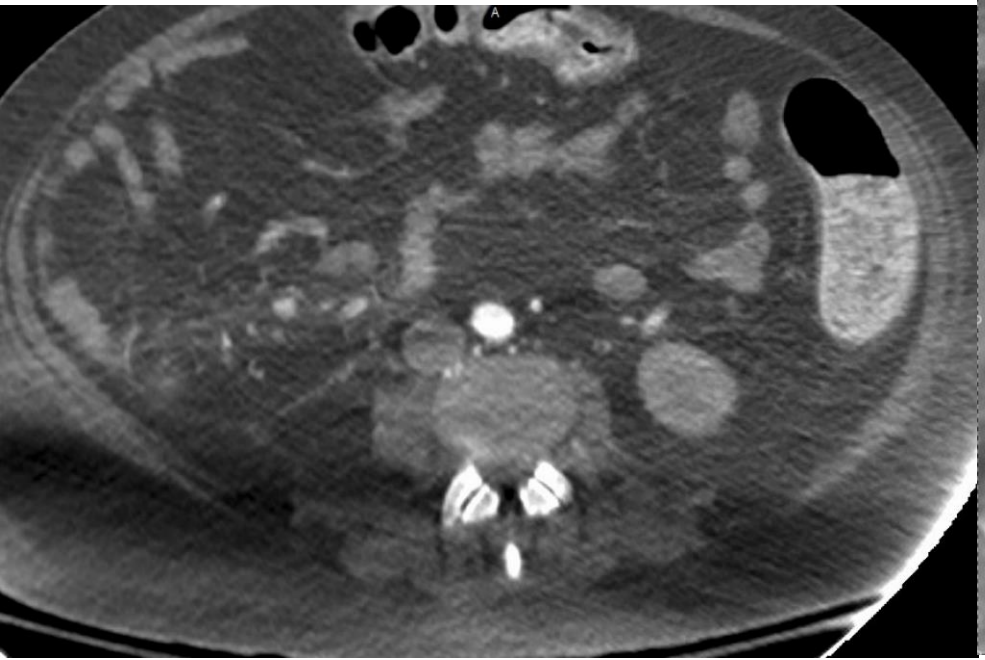
High takeoffs and congenital hypo-/a-plasia of runoff vessels



High takeoffs and congenital hypo-/a-plasia of runoff vessels

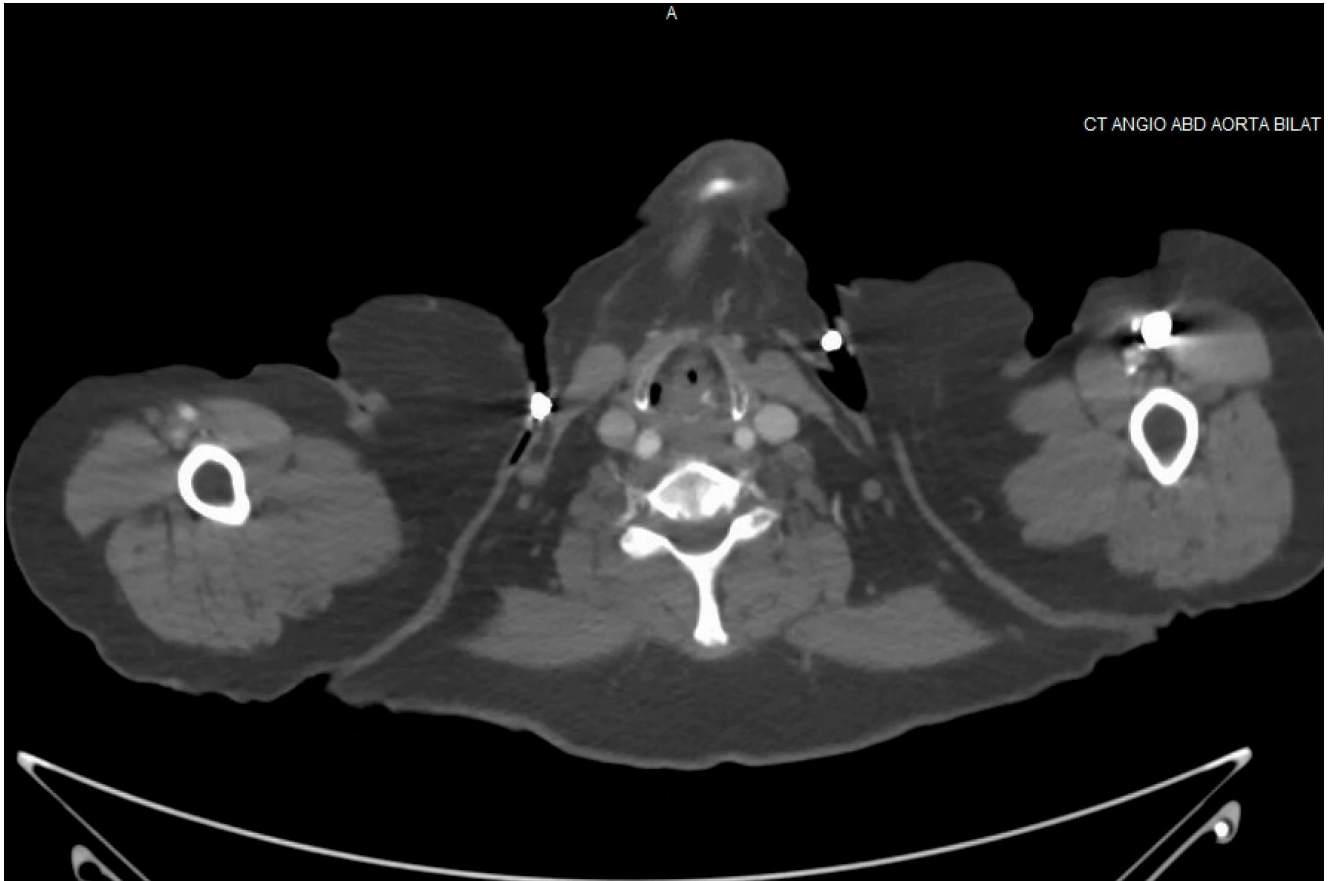
Popliteal Artery Entrapment

Corona Mortis



Persistent Sciatic Artery

Bypass Grafts



Aneurysms

- Popliteal artery aneurysms
  - 50-70% Bilateral
  - 40% associated with AAA
  - 90% Male
  - Big risk is distal thrombosis, rupture uncommon
- Iliofemoral aneurysms much less common than aortic and popliteal

Aneurysms

Systemic Approach to Reading Lower Extremity CTA

- ANSWER CLINICAL QUESTIONS RATHER THAN LISTING LESIONS: *determines how you read the exam*
  - Intermittent claudication?
  - Critical limb ischemia?

- Organize first by leg, then by station
- Right/Left Lower Extremity
  - **Aortoiliac** (inflow disease- above inguinal ligament)
  - **Common femoral artery/Deep Femoral Artery**
  - **Femoropopliteal Artery**; SFA, then above/at/below knee
  - **Below Knee**: Infrapop runoff; 2 vessel cross ankle.

Systemic Approach to Reading Lower Extremity CTA

- Describe character of lesion
  - Soft plaque
  - Calcified
  - Mixed
- Length
  - Focal
  - Short segment 1-2 cm
  - Long segment 5 cm +
- Can lump things together if multiple lesions in a segment
  - Ex. Multifocal 50% stenosis right SFA with focal proximal 70% stenosis

- Which of the following statements regarding interpretation of CTA is TRUE

A. Performed to diagnose PAD

B. Symptoms and ABI alone are enough to localize lesions for treatment planning

C. Role is to map lesions for treatment after diagnosis is made

D. In patients with calf claudication, imaging of the infrapopliteal vessels is important for treatment planning

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- The corona mortis can produce life threatening hemorrhage in pelvic fracture. This is a variant anastomosis or origin of what artery/arteries?

A. Superior epigastric artery

B. Internal Pudendal

C. Obturator artery

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