Imaging of Aortic Dissection Extending to the Common Carotids

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Agenda

- Clinical Case
- Pathophysiology
- Diagnostic features by modality
- Treatment
- Follow-up of the patient
- Discussion
Patient’s History

- 43 yo M presents to ED w/ chest pressure during vigorous bicycle riding two hrs prior
- H/o hypercholesterolemia and HTN
- No prior history of chest discomfort
- Physical exam: NAD, no bruits, CTAB, RRR and no murmurs
Patient’s Frontal CXR

- Heart size in upper limit of normal w/ left ventricular configuration
- Hilar and mediastinal contours are within normal limits
- No pleural effusion
Differential Diagnosis

- Myocardial ischemia w/ or w/o ST elevation
- Pericarditis
- Pulmonary embolus
- Aortic dissection
- Musculoskeletal pain
- Peptic ulcer disease
Intimal flap originating in the aortic root
dilatation of the ascending aorta (5.5 cm)
Patient’s Chest CTA

Intimal flap extending into the aortic arch, involving the origins of the major aortic branches
Patient’s Cervical CTA

Intimal flap extending into left and right common carotid arteries, with thrombi in the false lumens partially occluding flow of contrast.
Pt’s Cervical CTA

Axial C+ CT (C6)
PACS, BIDMC

Reconstituted Right and left common carotid arteries just before carotid bifurcation

Axial C+ CT (C4)
PACS, BIDMC

Reconstituted right and left ICA and ECAs

Axial C+ CT (C2)
PACS, BIDMC

Right (partially occluded) and left (reconstituted) common carotid arteries
Pt’s Carotid CTA (volume-rendering)

Right CCA stenosis

Left CCA stenosis
Pathophysiology of Aortic Dissection

- Tear in the aortic intima with hemorrhage into the media, creating a false lumen
- Risk factors
  - Hypertension
  - Cystic medial degeneration
  - Infection
  - Trauma
Classification of Aortic Dissection

- Type A originates in ascending aorta and is treated surgically
- Type B originates distal to the LSA and is usually treated medically
- Our patient’s diagnosis is a type A dissection extending to the LSA

Cotran RS, Kumar V, Robbins SL. Robbin’s Pathologic Basis of Disease, 7th ed.
Companion Pt 1: Dissection on CXR

- LOW sensitivity (86%) and specificity (86%)\(^5\)
- Widening of the aorta and mediastinum shadow
- “Ring sign”
  - Displacement of intimal calcification
- Pleural effusion
Menu of Tests for Imaging Aortic Dissection

Most patients (98%) receive additional studies after initial CXR:\(^4\):

- 61% **computed tomography** (CT)
  - Noninvasive, quick and available
- 33% **echocardiography** (TEE)
  - Portable, operator-dependent
- 4% **aortography**
  - Invasive, rarely performed today
- 2% **MRI**
  - No IV contrast or radiation, expensive
Aortic Dissection on CTA

- Sensitivity 98%, specificity 100%²
- Commonly used in emergencies
- Intravenous iodinated contrast

Features:
- Intimal flap separating true and false lumens
- Aneurysmal dilatation of aorta
- Hemopericardium, hemomediastinum, and hemothorax
Companion Pt 2: Dissection on CTA

Multiplanar reformatted oblique sagittal of chest

• **Intimal flap** originating in the descending aorta
• Consistent with a type B aortic dissection

Companion Pt 3: True and False Lumen on CTA

- Cobweb in the false lumen (small arrows)
- **Beak** sign
  - acute angle between the dissection flap and the outer wall
- Hematoma in the false lumen (arrow heads)
- Delayed contrast in the false lumen compared to the true lumen

Aortic Dissection on Ultrasound

- **Transthoracic (TTE)**
  - Limited utility in diagnosis but useful in assessment of cardiac complications

- **Transesophageal (TEE)**
  - High sensitivity (97-99%) but lower specificity (77-85%)²
  - Identify intimal flap, entry site, valvular function, pericardial effusions
  - Portable procedure, although requires esophageal intubation and sedation
Companion Pt 4: Dissection on TEE

- Mobile density consistent with intimal flap
- Doppler identifies flow in true lumen (TL)

Manning W.J. et al. Clinical manifestations and diagnosis of aortic dissection. UpToDate version 16.1
Companion Pt 5: Dissection on MRI

- Sensitivity: 98%
- Specificity: 98%
- Spiraling double barrel appearance with intimal flap
- Widening of the aorta
- Good for identifying entry point and for long term follow up

Complications of Aortic Dissection

- Pericardial tamponade
- Hemomediastinum/ hemothorax
- Aortic regurgitation
- Occlusion or compromise of aortic branch vessels
  - Coronary: myocardial infarction
  - Carotid: stroke
  - Superior mesenteric: bowel ischemia
  - Renal: acute renal failure
Surgical Treatment of Aortic Dissection

- Resection of the affected ascending aorta
- Resuspension of the aortic valve
- Placement of a graft (28 mm Dacron gel weave in our pt)
- Reimplantation of the supra-aortic trunks
- Long term survival 50%

Garcia, A. et al. Radiographics 2006;26:981-992
Our Pt’s Post-graft Frontal CXR

Decreased inflation of the lungs

Significant pleural effusion bilaterally
Out Pt’s Follow-up

- Patient developed pupillary asymmetry two days post bypass.
- Carotid ultrasound ordered to investigate carotid and vertebral artery flow:
  - Abnormal flow in CCAs, especially on the right.
- Head CTA ordered to rule out stroke:
  - No evidence of stroke.
  - Pupillary abnormality hypothesized to be from TIA or ischemia of cervical sympathetic chain, later resolved spontaneously.
Our Pt’s Head CTA (recon) and CT Perfusion

Intracranial carotid and vertebral arteries and branches are patent with no evidence of stenosis or aneurysm.

- No evidence of reduced blood flow
- Normal mean transit time and cerebral blood volume (not shown)
Patient Follow-up

- Imaging
  - Standard follow-up is every 3-6 month for the first two years then annually
- Treatment of carotid dissection
  - Anticoagulation: heparin followed by warfarin
  - Stenting: rarely indicated because stenosis usually open over time
Discussion

- The patient presented with acute chest pain not radiating to the back
- Chest x-ray was not diagnostic
- CTA revealed type A aortic dissection extending to bilateral common carotids
- Patient underwent aortic graft, with no treatment of carotid dissection
- New onset of neurological abnormality
  - CTA performed to r/o stroke
Conclusions

- Imaging is crucial for early diagnosis, treatment planning and follow up
- Aortic dissection can present with atypical symptoms and no CXR abnormalities
- CT is the test of choice in emergency situations
- Imaging is also important to rule out vital organ involvement
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