

# Diagnostic imaging in the evaluation of suspected aortic dissection

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AOD ; life-threatening condition

prompt Dx; essential(Death ; 1%/hr if untreated )

\* Stanford classification

Type A: involvement of ascending Aorta

(=Debakey type I & II ; proximal dissection)

→ urgent surgical treatment

Type B: (=Debakey type III ; distal dissection)

→ medical treatment alone if uncomplicated

\* cf) optimal care

1) Prompt Dx

2) Site of origin

3) Extent

cf) Thrombolytic therapy

Crucial role in acute MI contraindication to aortic dissection

\* Diagnostic procedures

Aortography; -only acute method for suspected dissection

CT -but challenged high sensitivity, specificity and practical advantage

Echocardiography(especially by TEE )

MRI

\* Strengths, Weakness, and relative merits 4 imaging technique;

1) Aortography

- Study of choice ; available since 1949

- Levophase or aortic imaging after injection

into pulmonary artery

- Retrograde catheter aortography through the femoral artery (1953)

; Risk of proximal propagation of the dissection by the advancement of the catheter into the false lumen

- Finding

Direct sign ; Diagnostic

- Visualization of double lumen or an intimal flap

Indirect sign ; Suggestive

- Compression of true aortic lumen by false lumen thickening of aortic wall

Aortic insufficiency

Ulcer-like projection along the aortic wall

Abnormalities of branch vessels

Abnormal position of the catheter in the aorta

Report of Earnest : 52 pts

- false lumen visualized(87%)

intimal flap(70%)

site of intimal tear(56%)

advantage of aortography; to detect the complication of aortic insufficiency, involvement of branch vessels, thrombus in the false lumen, involvement of proximal coronary arteries

Accuracy

- Sensitivity

range from 81 to 91%

- Erbel Report ; 126 cases  
Sensitivity ; 88% and specificity ; 94%
- False negative; thrombosis of false lumen equal and simultaneous opacification of both the true and false lumen unusual intimal tears positioned proximal to the tip when intimal flap is not tangential to the x-ray beam
- Disadvantages  
risk inherent in the use of IV contrast agents (1mg/Kg)  
risk associated with any invasive procedure

### [CT scanning]

- Advantage
  - non invasive
  - identifying causes of aortic widening other than dissection, such as presence of abnormal layers of fat periaortic hematomas, or adjacent tumors
  - DDX intraluminal thrombus
  - Identifying the presence of pericardial effusion
- Findings
  - 2 distinct lumens with visible flap
  - Indirect sign  
compression of the true lumen by lumen spiraling of a thrombosed false lumen, displaced intimal calcification, widening of aortic lumen ulcer-like projection of contrast media
  - accuracy  
sensitivity of 83 to 100%  
specificity of 90 to 100%
  - ultrafast CT ; superior spatial resolution
  - disadvantage
    - intimal flap identified in only 63 to 70%
    - site of entry rarely identified
    - not reliable in identifying aortic insufficiency, involvement of branch vessels, or delineate the coronary arteries
    - risk of IV contrast media

- noninvasive and no use of contrast media, and no risk of ionizing radiation
- high-quality image in the transverse, coronary, sagittal, and oblique plane
  - Dx of dissection, location, extent, involvement of arch vessels
- well suited for the evaluation of pt with pre-existing complicated aortic disease, such as an aortic aneurysm or previous aortic-graft repair
- with the use of spin-echo imaging
  - rapidly flowing blood; no intraluminal signal
  - slowly flowing blood ; increased intraluminal signal
  - dissection best seen when there is rapid blood flow in both the true and false lumen
- slow flow in the false lumen ; mimic thrombus
- use of gated MRI ; DDX the true from false lumen in the presence of slowly flowing
- Findings
  - double lumen with intimal flap
  - indirect signs; widening of the aortic, thickening of the aortic wall, thrombosis of a false lumen, spiraling of thrombosed false lumen
  - pitfall of MRI ; when the false lumen is thrombosed, it may be difficult to distinguish the dissection from aortic aneurysm with mural thrombus
- cine-MRI : designed to study dynamic cardiac function such as valvular regurgitation
- accuracy : sensitivity of 90 to 100%  
sensitivity of 100% for aortic dissection  
sensitivity of 85% for aortic insufficiency  
sensitivity of 100%
- short-comings
  - not safe in pt with pacemaker, certain types of aneurysm clips, metallic ocular implants, certain types of metallic heart-valve

### [Echocardiography]

- widely available, non invasive, easily performed at the bed side, quick, no contrast media, no ionizing radiation
- findings

### [ MRI ]

- used since 1983

- undulating intimal flap central displacement of intimal calcification
- Accuracy
  - sensitivity of 59 to 85%
  - specificity of 63 to 96% of aortic Dissection
  - sensitivity of 78 to 100% of ascending aorta
  - sensitivity of 31 to 55% of descending aorta
- pitfall
  - poor image in obesity, emphysema mechanical ventilation, chest wall deformity small intercostal space
- Limitation
  - difficulty of fully capturing the upper portion of the ascending aorta and proximal aortic arch because of the interposition of the air-filled trachea and left main bronchus
- Contraindicated in esophageal disease(varix, stricture, tumors )
- Problems related to procedures (less than 1%)
  - not tolerated in up to 3% of pts
  - bradycardia, A-V Block, hypertension, esophageal perforation, bronchospasm
- Sensitivity for intimal flap ; 97-100%  
Sensitivity for site of entry ; 77-87%
- False positive test ; result of reverberation from atherosclerotic vessel, sclerotic aortic root, calcific aortic disease mimicking intimal flap
  - minimized by biplane TEE or more than one view
- Useful for abnormality of LV wall motion, pericardial effusion, signs of pericardial tamponade, valvular vegetation, aortic stenosis

Table 1. Diagnostic Information Sought in Patients with Aortic Dissection.

Presence of aortic dissection
Involvement of the ascending aorta
Extent of dissection
Sites of entry and reentry
Thrombus in the false lumen
Branch-vessel involvement
Aortic insufficiency
Pericardial effusion
Coronary-artery involvement

Table 2. Summary of the Diagnostic Performance of the Four Imaging Techniques in the Evaluation of Suspected Aortic Dissection.\*

Variable	Aortography	CT	MRI	TEE
Sensitivity	++	++	+++	+++
Specificity	+++	+++	+++	++/+++
Site of intimal tear	++	+	+++	++
Presence of thrombus	+++	++	+++	+
Presence of aortic insufficiency	+++	-	+	+++
Pericardial effusion	-	++	+++	+++
Branch-vessel involvement	+++	+	++	+
Coronary-artery involvement	++	-	-	++

\*TEE denotes transesophageal echocardiograph, +++ denotes excellent results, ++ good results, + fair results, and - not detected.

- key sign: flap of intima and media within the lumen of the aorta
- sensitivity of 14 to 100%

[CT]

- good quality, high density image that not show a flap imply that dissection is extremely unlikely
- poor quality image with inadequate opacification and movement and streak artefact not uncommon
- no information on LV function or aortic regurgitation

[TEE]

- unlike TTE, not affected by structure of

[Selecting a method of imaging]

- \* Diagnostic information(Table 1)
- \* Summary of the Diagnostic performance(Table 2)
- \* Practical Assessment of 4 Diagnostic Technique (Table 3)

[Diagnostic imaging in the evaluation of suspected aortic dissection]

[TTE]

- advantage : speed and relative ease in a hemodynamically compromised host

Table 3. Practical Assessment of the Four Diagnostic Techniques.\*

Advantage	Aortography	CT	MRI	TEE
Readily available	Fairly	Quite	Fairly	Very
Rapid	Fairly	Quite	Fairly	Very
Performed at				
patient's bedside	No	No	No	yes
Noninvasive	No	Yes	Yes	Yes
Does not use	No	No	yes	Yes
intravenous				
contrast agent				
Costn	High	Reasonable	Moderate	Reasonable

thoracic cage or by respiratory movements  
 → high quality image

[IVDSA]

- quick, easy to perform and only minimally invasive

- sensitivity & specificity; equal with aortography

[MRI]

- 100% specificity & sensitivity
- imaging better than TEE

Aortography

sensitivity between 90% and 98%

Information on the presence and severity of associated aortic regurgitation

Coronary Angiography

no reason to perform coronary angiography routinely in pt with dissection