Cardiac, Myocardial and Extracardiac Abnormalities
Advantages of CT over Echo and MRI

• CT may be performed much faster in patients who are hemodynamically unstable.
• CT may be performed in patients with poor echocardiographic windows.
• CT may be performed in patients with pacemakers or other implanted metallic devices in which MRI is contraindicated.
• CT provides a more detailed evaluation of the lungs and mediastinal structures.
• CT provides true three- and four-dimensional imaging in complex pathologies.
Disadvantages of CT over Echo and MRI

• CT may miss or incompletely characterize small mobile masses such as valvular vegetations because of its lower temporal resolution
• CT cannot visualize flow through intracardiac shunts or valvular
• CT requires radiation exposure
• CT requires use of intravenous contrast with possible allergic reactions and nephrotoxicity
Myocardial Abnormalities
LV Apical hypertrophic cardiomyopathy (Yamaguchi disease)

Severe hypertrophy of the left ventricle (*arrows*), mostly localized to the apical segments

A form of hypertrophic cardiomyopathy, which does not have left ventricular outflow obstruction but may have heart failure symptoms and increased risk of sudden cardiac death.
LV Apical diverticulum

Apical diverticulum (arrow), incidentally found during a CT coronary angiogram.

Left ventricle diverticula are benign anomalies that are usually smaller than true aneurysms and are not associated with coronary artery disease.
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Thinning and hypo-enhancement of LV wall segments

Patient with ischemic cardiomyopathy. There is dilatation of all four cardiac chambers. There also is thinning and hypo-enhancement of the septal and apical left ventricle segments.

Hypo-enhanced apex (88 HU) is compared with the normally enhanced lateral wall (180 HU). A defibrillator lead is seen in the right atrium (arrow). A mitral annuloplasty ring also is noted (arrowheads).
Typical CT attenuation of tissues and other structures

Typical radiograph attenuation of tissues and other structures in CT

<table>
<thead>
<tr>
<th>Structure</th>
<th>Hounsfield Units</th>
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<tr>
<td>Air</td>
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<td>Water</td>
<td>0</td>
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<tr>
<td>Fat</td>
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<td>Nonfatty soft tissue</td>
<td>20-80</td>
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<tr>
<td>Contrast-enhanced myocardium</td>
<td>100-200</td>
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<tr>
<td>Thrombus</td>
<td>20-120</td>
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<tr>
<td>Bone</td>
<td>600-800</td>
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Thinning and hypo-enhancement of LV wall segments

Thinning and subendocardial hypo-enhancement in the mid and distal lateral segments of the left ventricle (arrows), consistent with an occluded circumflex marginal branch.

An automated implantable cardioverter defibrillator lead is seen in the apex of the right ventricle (arrowhead).
Thinning and hypo-enhancement of LV wall segments

Thinning and bulging of the apical myocardium.

The patient had a history of myocardial infarction. The study was performed for evaluation of an ascending aortic aneurysm, also shown in the image.
Large posterior LV wall aneurysm

Large posterior wall aneurysm (arrows)

Left ventricular aneurysms are most commonly seen at the apex, secondary to occlusion of the left anterior descending artery; or at the basal septal, inferior, posterior or lateral walls, after occlusion of the right or circumflex coronary arteries.

In left ventricular aneurysms, the neck is typically narrow and the epicardium is preserved. In pseudoaneurysms, the neck is typically wide and there is a disruption of the epicardial layer.
Patch repair of LV wall aneurysm

Patch repair at the apex of a patient with ischemic cardiomyopathy (*arrows*).

There is a left internal mammary artery bypass graft to the left anterior descending coronary artery.

The patch repair was done for resection of a left ventricle aneurysm.
Apical LV wall aneurysm

Patient with heart failure symptoms

CT demonstrates a dilated left ventricle with apical ballooning (arrows). There are no features supporting an ischemic aneurysm, such as thinning and hypoperfusion of the apex. The patient had normal coronary anatomy by CT.
LV Wall Noncompaction

Also called *spongiform cardiomyopathy*

An anomaly characterized by a pattern of prominent trabecular meshwork and deep intertrabecular recesses communicating with the left ventricle cavity.

Etiology is unknown, but it is felt to be related to a congenital endoderm malformation. Left ventricular function varies from completely normal to severely reduced ejection fraction.

When present, left ventricular dysfunction is usually not confined to the noncompacted zones. Management is similar to that of other dilated cardiomyopathies. The clinical course is usually progressive and malignant ventricular arrhythmias tend to be common.
Kawasaki disease

Image obtained from a patient with an acute myocardial infarction caused by thrombosis of a right coronary artery Kawasaki aneurysm (arrow).

Results from a mucocutaneous viral infection acquired during childhood. Typically, multiple aneurysms may develop in the coronaries and in other systemic vessels. Thrombosis of these aneurysms may occur later in life.
Apical RV wall aneurysm

Apical RV myocardial infarction from thrombosis of right coronary artery Kawasaki aneurysm

Demonstrates dilation of the right ventricle secondary to myocardial infarction (arrows). Notice the thinning and hypoperfusion of the apical right ventricle wall.
Question: What is the diagnosis?

Long-axis-oriented image obtained from a patient with recurrent ventricular tachycardia with left bundle branch block.

What is the diagnosis?

A. Spongiform cardiomyopathy
B. Kawasaki’s disease
C. Apical RV wall infarction
D. Infiltrative angiosarcoma
E. RV dysplasia
Long-axis-oriented image obtained from a patient with recurrent ventricular tachycardia with left bundle branch block.
What is the diagnosis?

A. Spongiform cardiomyopathy
B. Kawasaki’s disease
C. Apical RV wall infarction
D. Infiltrative angiosarcoma
E. **RV dysplasia**
RV dysplasia

Long-axis-oriented image obtained from a patient with recurrent ventricular tachycardia with left bundle branch block.

There is evidence of fatty replacement of the right ventricle (RV) free wall, shown as regions of reduced attenuation (-98 HU) (arrows).
Question: RV dysplasia

The classical imaging criteria for the diagnosis of RV dysplasia include all of the following except ?

A. RV systolic dysfunction

B. Evidence of regional aneurysmal dilatation,

C. Fibrofatty infiltration

D. All of the above

E. None of the above
Answer: RV dysplasia  D

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A. RV systolic dysfunction
B. Evidence of regional aneurysmal dilatation,
C. Fibrofatty infiltration
D. All of the above
E. None of the above
The classical imaging criteria for the diagnosis of RV dysplasia include:

- RV systolic dysfunction,
- evidence of regional aneurysmal dilatation, and
- fibrofatty infiltration.

- CT may be used as an alternative or complementary to MRI.
- CT has the advantage of higher spatial resolution, and
- may also provide tissue characterization and
- functional analysis (four-dimensional cine-CT).
Hepatic cyst

Axial image obtained from a patient presenting with ascites and edema.

• There is external compression of the right atrium and right ventricle by a giant hepatic cyst (arrows).

• External compression of the heart by intraabdominal or intrathoracic structures may resemble the signs and symptoms of constrictive pericardial disease.
Azygous Vein
Bronchial arteries

Hypertrophied bronchial artery in cystic fibrosis

- Cardiac CTA three-dimensional volume-rendering technique image showing the common trunk (CT) of the bronchial artery arising from the proximal descending aorta and bifurcating into the left bronchial artery (LBA) and the right bronchial artery (RBA).

A 23-year-old female with cystic fibrosis complained for the first time of profound weakness and fatigue. She previously had sinus symptoms and bronchiectasis, which had remained stable over the years, and never had hemoptysis. Transthoracic echocardiogram done in work-up showed normal cardiac function but did show a continuous flow in the descending aorta, suggesting a possible patent ductus arteriosus. For clarification of this finding, a retrospectively gated, contrast-enhanced 64-slice cardiac computed tomography angiography (CTA) was performed. Multiplanar postprocessing, including three-dimensional volume-rendering technique, after data acquisition was done. CTA showed no evidence of a patent ductus arteriosus but did show a hypertrophied, tortuous bronchial artery arising from the proximal descending thoracic aorta (Fig. 1). The artery, measuring 4 mm, was a common trunk that bifurcated into tortuous left and right bronchial arteries (Fig. 1). Lung parenchyma showed severe diffuse bronchiectasis but no pulmonary hemorrhage (Fig. 2).

Bronchial arteries vascularize bronchi and peribronchial connective tissue and are associated with life-threatening hemoptysis in patients with cystic fibrosis. Their weakened walls may lead to episodic or persistent bleeding into bronchial lumen, causing obstruction of the airway or hypotension. The use of embolizing agents to the bronchial arteries has been an accepted method of controlling hemoptysis. Accurate CTA identification of the vessel's location guide monitoring and therapies for this condition. Because this patient had no evidence of pulmonary hemorrhage and remained clinically stable, it was decided to follow her at the cystic fibrosis clinic without further interventions.

References
Cardiac CTA axial image reformatted to include fullfield of view with lung windows showing severe diffuse bronchiectasis bilaterally.
Pulmonary Embolus
Pulmonary Hypertension

pulm htn - reflux into azygous veins of contrast
Pulmonary Hypertension

pulm htn - reflux into azygous veins of contrast2
Pulmonary Hypertension

pulm htn - thickened outflow
Pulmonary Hypertension

pulm htn - thickened outflow2
Pulmonary Hypertension

pulm htn - thickened subvalvular apparatus
VSD
Ventricular Septal Defect
LV Apical Thrombus