Supplements

1. Summary of Guidelines

Table 1. Appropriate Indications (Median Score 7-9)

			Appropriateness Criteria (Median Score)	Level of Evidence	Key References
Non-acute Chest Pain Patients Suspected of Ischemic Chest Pain					
1	ECG interpretable and capable of exercise	Intermediate	A (7)	A	(11, 13)
2	ECG uninterpretable or unable to exercise	Low	A (7)	A	(11, 13)
		Intermediate	A (8)	A	(11, 13)
Acute Chest Pain Patients Suspected of ACS					
5	Acute chest pain of uncertain cause (differential diagnosis includes pulmonary embolism, aortic dissection, and ACS ["triple rule out"])		A (7)	B	(25, 31)
6	Normal ECG and cardiac biomarkers	Low	A (7)	A	(18, 22, 23)
		Intermediate	A (7)	A	(18, 22, 23)
		High	A (7)	A	(18, 22)
7	ECG uninterpretable	Low	A (7)	A	(18, 21, 23)
		Intermediate	A (7)	A	(18, 21, 23)
8	Nondiagnostic ECG or equivocal cardiac biomarkers	Low	A (7)	A	(18, 23)
		Intermediate	A (7)	A	(18, 23)
Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD **Noncontrast CT for CCS**					
9	Family history of premature CHD	Low global CHD risk estimates	A (7)	A	(37, 38)
10	Asymptomatic No known CAD	Intermediate global CHD risk estimates	A (7)	A	(45-48, 50, 52)
Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD **Coronary CTA**					
11	Asymptomatic No known CAD	High global CHD risk estimates	A (7)	C	(56, 57, 61, 62)
12	Routine evaluation of coronary arteries following heart transplantation		A (7)	A	(63)
Detection of CAD in Patients with Newly Developed or Newly Diagnosed HF and No History of CAD					
13	Reduced left ventricular ejection fraction	Low	A (7)	A	(73)
		Intermediate	A (7)	A	(73)
Detection of CAD for Preoperative Coronary Assessment Prior to Non-coronary cardiac Surgery					

15	Coronary evaluation before non-coronary cardiac surgery	Low		A (7)	A	(77, 78, 80)
		Intermediate		A (7)	A	
		High		A (7)	A	
Before PCI						
20	Evaluation of complex lesions before PCI (i.e., chronic total occlusions, bifurcation lesions)			A (8)	B	(94, 98, 104)
Use of CTA in the Setting of Prior Exercise ECG						
21	Prior normal exercise ECG, continued symptoms			A (7)	A	(13, 14, 107, 110, 111, 113)
22	Prior exercise ECG results	Duke Treadmill Score	Intermediate	A (7)	B	(14, 107) (112, 114)
Sequential Testing After Stress Imaging Procedures						
23	Discordant ECG exercise and imaging results			A (8)	B	(107, 110, 126)
24	Prior stress imaging results	Equivocal		A (8)	B	(112, 118, 125)
		Mild		A (7)	B	
Use of CTA in the Setting of Prior Coronary Calcium Scoring						
27	Diagnostic impact of coronary calcium on the decision to perform coronary CT angiography in symptomatic patients	CAC <100		A (8)	A	(14, 16, 44, 139, 140),
		CAC 100-400		A (8)	A	
Evaluation of New or Worsening Symptoms in the Setting of Past Stress Imaging Study						
30	Evaluation of new or worsening symptoms	Previous stress imaging : Normal		A (8)	C	NA
Post revascularization (PCI or CABG): Symptomatic (Suspected of Ischemic Chest Pain)						
40	Evaluation of graft patency after CABG			A (9)	A	(157, 160)
41	Prior coronary stent with stent diameter ≧3 mm			A (7)	A	(161, 162)
Asymptomatic CABG patients						
43	Prior CABG	Time since CABG	≧5 y ago	A (7)	A	(157, 160)
Asymptomatic Patients with Coronary Artery Stents						
44	Prior left main coronary stent with stent diameter ≧3 mm			A (7)	A	(161, 162, 177, 178)
Congenital Heart Disease in Adults						
47	Assessment of anomalies of coronary arterial and other thoracic vasculatures			A (9)	A	(179, 183, 187)
48	Assessment of complex adult congenital heart disease			A (9)	A	(193, 198, 199)
Evaluation of Ventricular Structure and Systolic Function						

50	Evaluation of LV function, following acute MI or in HF patients, Inadequate images from other noninvasive methods	A (7)	A	(203, 205)
51	Quantitative evaluation of RV function	A (7)	A	(211-213)
52	Assessment of RV morphology, suspected arrhythmogenic RV dysplasia	A (7)	A	(214, 215)
55	Serving as an 'one-stop shop' for ischemic heart disease in diagnosis, comprehensive evaluation and treatment strategy planning in difficult cases	A (8)	C	(222)
Evaluation of Intra- and Extracardiac Structures				
56	Characterization of native cardiac valves, Suspected clinically significant valvular dysfunction, Inadequate images from other noninvasive methods	A (8)	A	(225, 228)
57	Characterization of prosthetic cardiac valves, suspected clinically significant valvular dysfunction, inadequate images from other noninvasive methods	A (8)	A	(228, 237-239)
60	Evaluation of cardiac mass (suspected tumor or thrombus), inadequate images from other noninvasive methods	A (8)	A	(246, 248)
61	Evaluation of pericardial anatomy	A (8)	A	(243, 244)
62	Evaluation of pulmonary vein anatomy, prior to radiofrequency ablation for atrial fibrillation	A (8)	A	(253-255)
63	Localization of coronary bypass grafts and other retrosternal anatomy, prior to reoperative chest or cardiac surgery	A (8)	A	(258, 259)
64	Anatomic assessment before percutaneous device closure of ASD or VSD or percutaneous aortic valve replacement	A (8)	B	(231-233, 260)
Morphologic Study of Congenital Heart disease				
65	Assessment of complex congenital heart disease including anomalies of coronary circulation, great vessels, and cardiac chambers and valves	A (8)	B	(261, 263, 266)
66	Assessment of post-operative congenital heart disease, such as residual pulmonary stenosis, ventricular septal defect and patency check for Blalock-Taussig shunt	A (8)	C	(199)
Coronary CT Angiography in Kawasaki Disease Patients				
68	Asymptomatic, Previous tests (invasive angiography, CMR or CCT) documented coronary aneurysm/stenosis, for follow up	A (7)	C	(276, 277)
69	Symptomatic, No previous definite test available	A (7)	C	NA
70	Symptomatic, Previous tests (angiography, CMR or CCT) documented coronary aneurysm/stenosis, for follow up	A (8)	C	(276, 277)

Table 2. Uncertain Indications (Median Score 4-6)

			Appropriateness Criteria (Median Score)	Level of Evidence	Key References
Non-acute Chest Pain Patients Suspected of Ischemic Chest Pain
1	Interpretable ECG and capable of exercise	Low	U (5)	A	(11, 13)
2	Uninterpretable ECG or unable to exercise	High	U (5)	B	(16)
Acute Chest Pain Patients Suspected of ACS
4	Persistent ECG ST-segment elevation following exclusion of MI		U (6)	B	(18)
7	Uninterpretable ECG	High	U (5)	B	(18)
8	Nondiagnostic ECG or equivocal cardiac biomarkers	High	U (5)	B	(18)
Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD Coronary Calcium Scoring
10	Asymptomatic No known CAD	High global risk estimates	U (6)	A	(45-48, 50, 52)
Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD Coronary CTA
11	Asymptomatic No known CAD	Intermediate global risk estimates	U (5)	A	(56, 57, 61, 62)
Detection of CAD in Patients with Newly Developed or Newly Diagnosed HF and No History of CAD
13	Reduced left ventricular ejection fraction	High	U (5)	A	(73)
14	Normal left ventricular ejection fraction	Low	U (5)	C	NA
		Intermediate	U (5)	C	NA
		High	U (5)	C	NA
Detection of CAD in Patients with Arrhythmias with Etiology Still Unclear after Initial Evaluation
17	Nonsustained ventricular tachycardia		U (6)	C	(87)
18	Syncope		U (4)	C	NA
Elevated Troponin Levels of Uncertain Clinical Significance
19	Elevated troponin without additional evidence of ACS or symptoms suggestive of CAD		U (6)	C	NA
Use of CTA in the Setting of Prior CCS
25	Zero CAC >5y ago		U (4)	A	(129)
27	Diagnostic impact of coronary calcium on the decision to perform coronary CT angiography in symptomatic patients	CAC 401-1000	U (6)	A	(14, 16, 44, 139, 140),
		CAC >1000	U (4)	A	

	Evaluation of New or Worsening Symptoms in the Setting of Past Stress Imaging Study				
30	Evaluation of new or worsening symptoms	Previous stress imaging: Abnormal	U (6)	C	NA
	Preoperative Evaluation in Intermediate-Risk Noncardiac Surgery				
34	Functional capacity <4 METs with 1 or more clinical risk predictors		U (6)	C	(141, 149)
	Preoperative Evaluation in Vascular Surgery				
38	Functional capacity <4 METs with 1 or more clinical risk predictors		U (6)	C	(141, 150)
	Post Revascularization: Symptomatic (Suspected of Ischemic Chest Pain)				
42	Prior coronary stent with stent diameter <3 mm or not known		U (5)	A	(161, 162)
	Asymptomatic CABG patients				
43	Prior CABG	Time since CABG	<5 y ago	U (6)	A	(161, 162)
	Evaluation of Ventricular Structure and Systolic Function				
49	Initial evaluation of LV function, following acute MI or in HF patients		U (4)	C	NA
53	Assessment of myocardial viability, prior to myocardial revascularization for ischemic LV systolic dysfunction, other imaging modalities are inadequate or contraindicated		U (5)	B	(217-219)
54	To determine the location and extent of myocardial infarction including 'no-reflow' regions, post-acute MI		U (6)	C	(221)
	Evaluation of Intra- and Extracardiac Structures				
58	Initial evaluation of cardiac mass (suspected tumor or thrombus)		U (4)	C	NA
	Coronary CT Angiography in Kawasaki Disease Patients				
67	Asymptomatic, No previous definite test (invasive angiography, MRCA or CCT) available		U (5)	C	NA

Table 3. Inappropriate Indications (Median Score 1-3)

				Appropriateness Criteria (Median Score)	Level of Evidence	Key References
Non-acute Chest Pain Patients Suspected of Ischemic Chest Pain					
1	ECG interpretable and capable of exercise	High		I (3)	B	(16)
Acute Chest Pain Patients Suspected of ACS					
3	Definite MI			I (1)	C	NA
Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD Noncontrast CT for CCS					
10	Asymptomatic No known CAD	Low global CHD estimates		I (3)	A	(45-48, 50, 52)
Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD Coronary CTA					
11	Asymptomatic No known CAD	Low global CHD estimates		I (2)	A	(56, 57, 61, 62)
Detection of CAD in Patients with Arrhythmias – Etiology Unclear After Initial Evaluation					
16	New-onset atrial fibrillation			I (2)	C	(88)
Use of CTA in the Setting of Prior Exercise ECG					
22	Prior ECG exercise testing	Duke Treadmill Score	Low	I (3)	B	(14, 107) (112, 114)
			High	I (3)	B	
Sequential Testing After Stress Imaging Procedures					
24	Prior stress imaging results	Moderate or Severe		I (3)	B	(112, 118, 125)
Use of CTA in the Setting of Prior CCS					
26	Positive CAC >2y ago			I (3)	A	(44, 139)
Asymptomatic or Stable Symptoms: Periodic Repeat Testing in the Setting of Prior Stress Imaging or Prior Coronary Angiography					
28	No known CAD	Last study <2 y ago		I (2)	C	NA
		Last study ≧2 y ago		I (3)	C	
29	Known CAD	Last study <2 y ago		I (2)	C	NA
		Last study ≧2 y ago		I (3)	C	
Preoperative Evaluation in Low-Risk Non-cardiac Surgery					
31	Preoperative evaluation for non-cardiac surgery risk assessment, irrespective of functional capacity			I (2)	C	(141)
Preoperative Evaluation in Intermediate-Risk Non-cardiac Surgery					
32	No clinical risk predictors			I (3)	C	(141, 149)
33	Functional capacity ≧4 METs			I (3)	C	(141, 149)

35	Asymptomatic <1 y following a normal coronary angiogram, stress test, or a coronary revascularization procedure			I (2)	C	NA
Preoperative Evaluation in Vascular Surgery						
36	No clinical risk predictors			I (2)	C	(141, 150)
37	Functional capacity ≧4 METs			I (2)	C	(141, 150)
39	Asymptomatic <1 y following a normal coronary angiogram, stress test, or a coronary revascularization procedure			I (2)	C	NA
Asymptomatic Patients with Coronary Artery Stents						
45	stent diameter ≧3 mm	Time since PCI	≧2 y ago	I (3)	A	(161, 162, 177, 178)
		Time since PCI	<2 y ago	I (3)	A	
46	stent diameter <3 mm or not known			I (3)	C	

2. Definitions of Terms

Definition of Chest Pain Syndrome
Any constellation of symptoms that the physician feels may represent a complaint consistent with obstructive CAD (e.g., chest pain, chest tightness, burning sensation, dyspnea, shoulder pain, and jaw pain, etc.).

Definition of Angina
As defined by the ACC/AHA 2002 Guideline Update on Exercise Testing
    1. Typical (Definite) Angina: 1) Substernal pain or discomfort that is 2) provoked by exertion or emotional stress and 3) relieved by rest and/or nitroglycerin
    2. Atypical (Probable) Angina: Chest pain or discomfort that lacks one of the characteristics of typical angina
    3. Non-anginal Chest Pain: Chest pain or discomfort that meets one or none of the typical angina characteristics

Definition of Acute Coronary Syndrome (ACS)
Patients with an ACS include those whose clinical presentations cover the following range of diagnoses: unstable angina, MI without ST-elevation (NSTEMI), and myocardial infarction with ST-elevation (STEMI), as defined by the ACC/AHA guidelines for the Management of Patients with STEMI.

Determining Risk Assessment of Coronary Heart Disease (CHD) in Asymptomatic Patients
Estimation of CHD risk is determined according to the methods of Adult Treatment Panel III report.
1. Low CHD Risk: The age-specific risk level is below average (10-year absolute CHD risk <10%).
2. Intermediate CHD Risk: The age-specific risk level is average or above average (10-year absolute CHD risk between 10% to 20%).
3. High CHD Risk: The presence of diabetes mellitus in a patient ≥40 years of age, peripheral arterial disease or other coronary risk equivalents, or 10-year absolute CHD risk of >20%.

Determining Pretest probability of CAD
As modified by the ACC/AHA guideline for chronic stable angina

Age	Sex	Typical Angina	Atypical Angina	Nonanginal Chest Pain	Asymptomatic
≤39	Male	Intermediate	Intermediate	Low	Very low
	Female	Intermediate	Very low	Very low	Very low
40-49	Male	High	Intermediate	Intermediate	Low

	Female	Intermediate	Low	Very low	Very low
50-59	Male	High	Intermediate	Intermediate	Low
	Female	Intermediate	Intermediate	Low	Very low
≥60	Male	High	Intermediate	Intermediate	Low
	Female	High	Intermediate	Intermediate	Low

High: Greater than 90% pre-test probability; Intermediate: Between 10% and 90% pre-test probability; Low: Between 5% and 10% pre-test probability; Very Low: Less than 5% pre-test probability. No data exist for patients less than 30 years or greater than 69 years, but it can be assumed that prevalence of CAD increases with age.

Estimated Metabolic Equivalent of Task (MET)

1-4 METs	Can you take care of yourself? Can you eat, dress, or use the toilet? Can you walk indoors around the house? Can you walk a block or 2 on level ground at 2 to 3 mph (3.2 to 4.8 kph) Can you do light work around the house like dusting or washing dishes?
4-10 METs	Can you climb a flight of stairs or walk up a hill? Can you walk on level ground at 4 mph (6.4 kph)? Can you run a short distance? Can you do heavy work around the house (scrubbing floors or lifting or moving heavy furniture) Can you participate in moderate recreational activities (golf, bowling, dancing, doubles tennis, or throwing a baseball or football)?
>10 METs	Can you participate in strenuous sports (swimming, singles tennis, football, basketball, or skiing)?

3. Quality Assessment of Guidelines by K-AGREE

	Domain 1. Scope and Purpose	Domain 2. Stakeholder Involvement	Domain 3. Rigour of Development	Domain 4. Clarity of Presentation	Domain 5. Applicability	Domain 6. Editorial Independence
Guideline 1 (ACCF 2010)	**83.3**	**66.7**	**57.5**	**86.1**	**12.5**	**100.0**
Guideline 2 (CAR 2009)	30.6	13.9	33.3	33.3	4.2	16.7
Guideline 3 (ASCI 2010)	**77.8**	**41.7**	**55.0**	**77.8**	**6.3**	**8.3**
Guideline 4 (ANZ 2011)	33.3	13.9	8.3	27.8	2.1	8.3

Guideline 1: ACCF/SCCT/ACR/AHA/ASE/ASNC/SCAI/SCMR 2010 Appropriate Use Criteria for Cardiac Computed Tomography

Guideline 2: CAR Guidelines and Standards for Cardiac Computed Tomography

Guideline 3: ASCI 2010 appropriateness criteria for cardiac computed tomography: a report of the Asian Society of Cardiovascular Imaging cardiac computed tomography and cardiac magnetic resonance imaging guideline Working Group

Guideline 4: Noninvasive Coronary Artery Imaging: Current Clinical Applications Cardiac Society of Australia and New Zealand Guidelines

4. Guideline Matrix

Table 1. Detection of CAD in Symptomatic Patients with No Previous History of CAD

			ACCF 2010	ASCI 2010
Non-acute Chest Pain Patients Suspected of Ischemic Chest Pain				
1.	ECG interpretable and capable of exercise	Low	5*	-
		Intermediate	7	7
		High	3	-
2.	ECG uninterpretable or unable to exercise	Low	7	-
		Intermediate	8	9
		High	4	6
Acute Chest Pain Patients Suspected of ACS				
3.	Definite MI		1	3
4.	Persistent ECG ST-segment elevation following exclusion of MI		6	-
5.	Acute chest pain of uncertain cause (differential diagnosis includes pulmonary embolism, aortic dissection, and ACS ["triple rule out"])		6	7
6.	Normal ECG and cardiac biomarkers	Low	7	4
		Intermediate	7	7
		High	4	7
7.	ECG uninterpretable	Low	7	-
		Intermediate	7	-
		High	4	-
8.	Non-diagnostic ECG or Equivocal cardiac biomarkers	Low	7	-
		Intermediate	7	-
		High	4	-

[ ] : *Pretest probability of CAD*

Table 2. Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD

			ACCF 2010	ASCI 2010
Coronary Calcium Scoring				
9.	Family history of premature CHD Low global CHD risk		7	-
10.	Asymptomatic No known CAD	Low	2	-
		Intermediate	7	-
		High	4	-
Coronary CT Angiography				
11.	Asymptomatic No known CAD	Low	2	2
		Intermediate	2	5
		High	4	7
Coronary CTA Following Heart Transplantation				
12.	Routine evaluation of coronary arteries		6	-

▭ : *Global CHD risk estimate*

Table 3. Detection of CAD in Various Clinical Scenarios

			ACCF 2010	ASCI 2010
Newly Developed or Newly Diagnosed HF with No History of CAD				
13.	Reduced left ventricular ejection fraction	Low	7	7
		Intermediate	7	
		High	4	
14.	Normal left ventricular ejection fraction	Low	5	
		Intermediate	5	
		High	4	
Coronary Artery Assessment Prior to Non-coronary Cardiac Surgery				
15.	Coronary evaluation before non-coronary cardiac surgery	Low	6	7
		Intermediate	7	
		High	3	
Arrhythmias with Etiology Still Unclear after Initial Evaluation				
16.	New-onset atrial fibrillation (atrial fibrillation is underlying rhythm during imaging)		2	-
17.	Non-sustained ventricular tachycardia		6	-
18.	Syncope		4	-
Elevated Troponin Levels of Uncertain Clinical Significance				
19.	Elevated troponin without additional evidence of ACS or symptoms suggestive of CAD		6	-
Before PCI				
20.	Evaluation of complex lesions before PCI (i.e., chronic total occlusions, bifurcation lesions)		-	8

▢ : *Pretest probability of CAD*

Table 4. Use of CT According to Different Test Results

				ACCF 2010	ASCI 2010
Prior Exercise ECG					
21.	Prior normal exercise ECG, Continued symptoms			7	-
22.	Prior exercise ECG results	Duke Treadmill Score	Low	2	-
			Intermediate	7	8
			High	3	-
After Stress Imaging Procedures					
23.	Discordant exercise ECG and imaging results			8	-
24.	Prior stress imaging procedure		Equivocal	8	8
			Mild	6	-
			Moderate or Severe	2	6
Prior Coronary Calcium Scoring					
25.	Zero CAC >5 y ago			4	-
26.	Positive CAC >2 y ago			2	-
27.	Diagnostic impact of coronary calcium on the decision to perform coronary CT angiography in symptomatic patients	CAC <100		8	-
		CAC 100-400		8	-
		CAC 401-1000		6	6
		CAC >1000		4	
Asymptomatic or Stable Symptoms:					
Periodic Repeat Testing in the Setting of Prior Stress Imaging or Prior Coronary Angiography					
28.	No known CAD	Last study <2 y ago		2	-
		Last study ≧2 y ago		3	-
29.	Known CAD	Last study <2 y ago		2	-
		Last study ≧2 y ago		3	-
Evaluation of New or Worsening Symptoms in the Setting of Past Stress Imaging Study					
30.	Evaluation of new or worsening symptoms	Previous stress imaging Normal		8	-
		Abnormal		6	-

Table 5. Risk Assessment in Patients without Acute Heart Disease before Non-cardiac Surgery

		ACCF 2010	ASCI 2010
Low-Risk Surgery			
31.	Preoperative evaluation for noncardiac surgery risk assessment, irrespective of functional capacity	1	3
Intermediate-Risk Surgery			
32.	No clinical risk predictors	2	6
33.	Functional capacity ≧4 METs	2	
34.	Functional capacity <4 METs with 1 or more clinical risk predictors	5	
35.	Asymptomatic <1 y following a normal coronary angiogram, stress test, or a coronary revascularization procedure	1	
Vascular Surgery			
36.	No clinical risk predictors	2	-
37.	Functional capacity >=4 METs	2	-
38.	Functional capacity <4 METs with 1 or more clinical risk predictors	6	-
39.	Asymptomatic <1 y following a normal coronary angiogram, stress test, or a coronary revascularization procedure	2	-

Table 6. Risk Assessment after Coronary Revascularization (PCI or CABG)

				ACCF 2010	ASCI 2010
Symptomatic (Suspected of Ischemic Chest Pain)					
40.	Evaluation of graft patency after CABG			8	9
41.	Prior coronary stent with stent diameter <3 mm or not known			3	7
42.	Prior coronary stent with stent diameter ≧3 mm			6	
Asymptomatic CABG patients					
43.	Prior CABG	Time since CABG	<5 y Ago	2	6
			≧ 5 y Ago	5	7
Asymptomatic patients with coronary artery stents					
44.	Prior left main coronary stent Stent diameter ≧3 mm			7	6
45.	Stent diameter <3 mm or not known	Time since PCI	<2 y	2	
			≧2 y	2	
46.	Stent diameter ≧3 mm	Time since PCI	<2 y	3	
			≧2 y	4	

Table 7. Evaluation of Heart Structure and Function

		ACCF 2010	ASCI 2010
Congenital Heart Disease in Adults			
47.	Assessment of anomalies of coronary arterial and other thoracic arteriovenous vessels	9	8
48.	Assessment of complex adult congenital heart disease	8	8
Evaluation of Ventricular Structure and Systolic Function			
49.	Initial evaluation of LV function, Following acute MI or in HF patients	2	5
50.	Evaluation of LV function, Following acute MI or in HF patients, Inadequate images from other noninvasive methods	7	7
51.	Quantitative evaluation of RV function	7	
52.	Assessment of RV morphology, Suspected arrhythmogenic right ventricular dysplasia	7	7
53.	Assessment of myocardial viability, Prior to myocardial revascularization for ischemic LV systolic dysfunction, Other imaging modalities are inadequate or contraindicated	5	5
54.	To determine the location and extent of myocardial infarction including 'no-reflow' regions, Post-acute MI	-	6
Evaluation of Intra- and Extracardiac Structures			
55.	Characterization of native cardiac valves, Suspected clinically significant valvular dysfunction Inadequate images from other noninvasive methods	8	7
56.	Characterization of prosthetic cardiac valves, Suspected clinically significant valvular dysfunction Inadequate images from other noninvasive methods	8	7
57.	Initial evaluation of cardiac mass (suspected tumor or thrombus)	3	-
58.	Evaluation of cardiac mass (suspected tumor or thrombus) Inadequate images from other noninvasive methods	8	8
59.	Evaluation of pericardial anatomy	8	8
60.	Evaluation of pulmonary vein anatomy, Prior to radiofrequency ablation for atrial fibrillation	8	9
61.	Noninvasive coronary vein mapping, Prior to placement of biventricular pacemaker	8	7
62.	Localization of coronary bypass grafts and other retrosternal anatomy, Prior to reoperative chest or cardiac surgery	8	8
63.	Anatomic assessment before percutaneous device closure of ASD or VSD or percutaneous aortic valve replacement	-	8
Morphologic Study of Congenital Heart disease			
64.	Assessment of complex congenital heart disease including anomalies of coronary circulation, great vessels, and cardiac chambers and valves	-	8
65.	Assessment of post-operative congenital heart disease, such as residual	-	8

		ACCF 2010	ASCI 2010
	pulmonary stenosis, ventricular septal defect and patency check for Blalock-Taussig shunt		
One-stop shop of Ischemic Heart Disease			
66.	Serving as an 'one-stop shop' for ischemic heart disease in diagnosis, comprehensive evaluation, and treatment strategy planning in difficult cases	-	7

Table 8. CAD detection in patients with Kawasaki disease

		ACCF 2010	ASCI 2010
Asymptomatic			
67.	No previous definite test (invasive angiography, MR coronary angiography or coronary CT angiography) available	-	5*
68.	Previous tests (invasive angiography, MR coronary angiography or coronary CT angiography) documented coronary aneurysm/stenosis, for follow up	-	7
Symptomatic			
69.	No previous definite test available	-	7
70.	Previous tests (invasive angiography, MR coronary angiography or coronary CT angiography) documented coronary aneurysm/stenosis, for follow up	-	8

5. Delphi Summary

Table 1. Detection of CAD in Symptomatic Patients with No Previous History of CAD

			Appropriateness Criteria (Median Score)	Agreement Round	Appropriate (A)	Uncertain (U)	Inappropriate(I)
Non-acute Chest Pain Patients Suspected of Ischemic Chest Pain							
1	ECG interpretable and capable of exercise	Low	U (5)	1	15%	85%	0%
1	ECG interpretable and capable of exercise	Intermediate	A (7)	1	95%	5%	0%
1	ECG interpretable and capable of exercise	High	I (3)	2	0%	25%	75%
2	ECG uninterpretable or unable to exercise	Low	A (7)	1	90%	10%	0%
2	ECG uninterpretable or unable to exercise	Intermediate	A (8)	1	100%	0%	0%
2	ECG uninterpretable or unable to exercise	High	U (5)	2	5%	95%	0%
Acute Chest Pain Patients Suspected of ACS							
3	Definite MI		I (1)	1	0%	0%	100%
4	Persistent ECG ST-segment elevation following exclusion of MI		U (6)	2	20%	80%	0%
5	Acute chest pain of uncertain cause (differential diagnosis includes pulmonary embolism, aortic dissection, and ACS ['triple rule out'])		A (7)	1	95%	5%	0%
6	Normal ECG and cardiac biomarkers	Low	A (7)	2	85%	15%	0%
6	Normal ECG and cardiac biomarkers	Intermediate	A (7)	1	90%	10%	0%
6	Normal ECG and cardiac biomarkers	High	A (7)	3	75%	25%	0%
7	ECG uninterpretable	Low	A (7)	1	85%	15%	0%
7	ECG uninterpretable	Intermediate	A (7)	1	95%	5%	0%
7	ECG uninterpretable	High	U (5)	2	5%	95%	0%
8	Nondiagnostic ECG or equivocal cardiac biomarkers	Low	A (7)	1	80%	20%	0%
8	Nondiagnostic ECG or equivocal cardiac biomarkers	Intermediate	A (7)	1	100%	0%	0%
8	Nondiagnostic ECG or equivocal cardiac biomarkers	High	U (5)	2	10%	90%	0%

 : Pretest probability of CAD

Table 2. Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD

			Appropriateness Criteria (Median Score)	Agreement Round	A	U	I
Coronary Calcium Scoring							
9	Family history of premature CHD	Low	A (7)	2	90%	10%	0%
10	Asymptomatic No known CAD	Low	I (3)	1	0%	15%	85%
		Intermediate	A (7)	2	80%	20%	0%
		High	U (6)	1	15%	85%	0%
Coronary CT Angiography							
11	Asymptomatic No known CAD	Low	I (2)	1	0%	10%	90%
		Intermediate	U (5)	2	5%	75%	20%
		High	A (7)	3	75%	25%	0%
12	Routine evaluation of coronary arteries following heart transplantation		A (7)	3	75%	25%	0%

☐ : Global CHD risk estimates

Table 3. Detection of CAD in Various Clinical Scenarios

			Appropriateness Criteria (Median Score)	Agreement Round	A	U	I
New-Onset or Newly Diagnosed Clinical HF and No Prior CAD							
13	Reduced left ventricular ejection fraction	Low	A (7)	1	95%	5%	0%
		Intermediate	A (7)	1	95%	5%	0%
		High	U (5)	2	15%	85%	0%
14	Normal left ventricular ejection fraction	Low	U (5)	2	15%	85%	0%
		Intermediate	U (5)	2	15%	85%	0%
		High	U (5)	2	15%	80%	5%
Preoperative Coronary Assessment Prior to Non-coronary cardiac Surgery							
15	Coronary evaluation before noncoronary cardiac surgery	Low	A (7)	3	75%	20%	5%
		Intermediate	A (7)	1	95%	5%	0%
		High	A (7)	3	75%	25%	0%
Arrhythmias – Etiology Unclear After Initial Evaluation							
16	New-onset atrial fibrillation		I (2)	1	5%	15%	80%
17	Non-sustained ventricular tachycardia		U (6)	2	5%	95%	0%
18	Syncope		U (4)	2	15%	85%	0%
Elevated Troponin of Uncertain Clinical Significance							
19	Elevated troponin without additional evidence of ACS or symptoms suggestive of CAD		U (6)	3	5%	95%	0%
Before PCI							
20	Evaluation of complex lesions before PCI (i.e. chronic total occlusions, bifurcation lesions)		A (8)	1	95%	5%	0%

[shaded] : Pretest probability of CAD

Table 4. Use of CT According to Different Test Results

			Appropriateness Criteria (Median Score)	Agreement Round	A	U	I
Prior Exercise ECG						
21		Prior normal exercise ECG, continued symptoms	A (7)	1	100%	0%	0%
22	Prior exercise ECG results	Duke Treadmill Score — Low	I (3)	2	0%	20%	80%
		Duke Treadmill Score — Intermediate	A (7)	1	95%	5%	0%
		Duke Treadmill Score — High	I (3)	2	0%	20%	80%
After Stress Imaging Procedures						
23		Discordant exercise ECG and imaging results	A (8)	1	100%	0%	0%
24	Prior stress imaging results	Equivocal	A (8)	1	100%	0%	0%
		Mild	A (7)	2	75%	25%	0%
		Moderate or Severe	I (3)	2	0%	25%	75%
Prior Coronary Calcium Scoring						
25		Zero CAC >5 y ago	U (4)	1	0%	80%	20%
26		Positive CAC >2 y ago	I (3)	2	5%	10%	85%
27	Diagnostic impact of coronary calcium on the decision to perform contrast CTA in symptomatic patients	**CAC** <100	A (8)	1	100%	0%	0%
		CAC 100-400	A (8)	1	95%	5%	0%
		CAC 401-1000	U (6)	2	15%	85%	0%
		CAC >1000	U (4)	1	15%	75%	10%
Asymptomatic or Stable Symptoms: **Periodic Repeat Testing in the Setting of Prior Stress Imaging or Prior Coronary Angiography**						
28	No known CAD	Last study <2 y ago	I (2)	1	0%	10%	90%
		Last study ≧2 y ago	I (3)	2	0%	10%	90%
29	Known CAD	Last study <2 y ago	I (2)	1	5%	10%	85%
		Last study ≧2 y ago	I (3)	2	0%	25%	75%
Evaluation of New or Worsening Symptoms in the Setting of Past Stress Imaging Study						
30	Evaluation of new or worsening symptoms	Previous stress imaging: Normal	A (8)	1	90%	10%	0%
		Previous stress imaging: Abnormal	U (6)	2	25%	75%	0%

Table 5. Risk Assessment in Patients without Acute Heart Disease before Non-cardiac Surgery

		Appropriateness Criteria (Median Score)	Agreement Round	A	U	I
Low-Risk Surgery						
31	Preoperative evaluation for non-cardiac surgery risk assessment, irrespective of functional capacity	I (2)	1	0%	10%	90%
Intermediate-Risk Surgery						
32	No clinical risk predictors	I (3)	2	0%	20%	80%
33	Functional capacity ≧4 METs	I (3)	3	0%	25%	75%
34	Functional capacity <4 METs with 1 or more clinical risk predictors	U (6)	2	25%	75%	0%
35	Asymptomatic <1 y following a normal coronary angiogram, stress test, or a coronary revascularization procedure	I (2)	2	0%	5%	95%
Vascular Surgery						
36	No clinical risk predictors	I (2)	1	0%	15%	85%
37	Functional capacity ≧4 METs	I (2)	2	0%	25%	75%
38	Functional capacity <4 METs with 1 or more clinical risk predictors	U (6)	1	25%	75%	0%
39	Asymptomatic <1 y following a normal coronary angiogram, stress test, or a coronary revascularization procedure	I (2)	1	0%	10%	90%

Table 6. Risk Assessment after Coronary Revascularization (PCI or CABG)

			Appropriateness Criteria (Median Score)	Agreement Round	A	U	I
Patients Suspected of Ischemic Chest Pain							
40	Evaluation of graft patency after CABG		A (9)	1	100%	0%	0%
41	Prior coronary stent with stent diameter ≧3 mm		A (7)	2	85%	15%	0%
42	Prior coronary stent with stent diameter <3 mm or not known		U (5)	2	20%	75%	5%
Asymptomatic CABG Patients							
43	Prior CABG	Time since CABG	≧5 y ago	A (7)	2	95%	5%	0%
			<5 y ago	U (6)	2	10%	90%	0%
Asymptomatic Patients with Coronary Artery Stents							
44	Prior left main coronary stent with stent diameter ≧3 mm		A (7)	1	85%	15%	0%
45	Stent diameter ≧3 mm	Time since PCI	≧2 y ago	I (3)	2	0%	15%	85%
			<2 y ago	I (3)	2	0%	15%	85%
46	Stent diameter <3 mm or not known		I (3)	3	0%	15%	85%

Table 7. Evaluation of Heart Structure and Function

		Appropriateness Criteria (Median Score)	Agreement Round	A	U	I
Congenital Heart Disease in Adults						
47	Assessment of anomalies of coronary arterial and other thoracic vasclatures	A (9)	1	100%	0%	0%
48	Assessment of complex adult congenital heart disease	A (9)	1	100%	0%	0%
Evaluation of Ventricular Structure and Systolic Function						
49	Initial evaluation of LV function, following acute MI or in HF patients	U (4)	3	0%	75%	25%
50	Evaluation of LV function, following acute MI or in HF patients, inadequate images from other noninvasive methods	A (7)	1	90%	10%	0%
51	Quantitative evaluation of RV function	A (7)	2	85%	10%	0%
52	Assessment of RV morphology, suspected arrhythmogenic RV dysplasia	A (7)	1	85%	15%	0%
53	Assessment of myocardial viability, prior to myocardial revascularization for ischemic LV systolic dysfunction, other imaging modalities are inadequate or contraindicated	U (5)	1	15%	75%	10%
54	To determine the location and extent of myocardial infarction including 'no-reflow' regions, post-acute MI	U (6)	1	5%	90%	5%
55	Serving as an 'one-stop shop' for ischemic heart disease in diagnosis, comprehensive evaluation and treatment strategy planning in difficult cases	A (8)	1	95%	5%	0%
Evaluation of Intra- and Extracardiac Structures						
56	Characterization of native cardiac valves, Suspected clinically significant valvular dysfunction, inadequate images from other noninvasive methods	A (8)	1	95%	5%	0%
57	Characterization of prosthetic cardiac valves, suspected clinically significant valvular dysfunction, inadequate images from other noninvasive methods	A (8)	1	100%	0%	0%
58	Initial evaluation of cardiac mass (suspected tumor or thrombus)	U (4)	3	0%	75%	25%
59	Evaluation of cardiac mass (suspected tumor or thrombus),	A (8)	1	100%	0%	0%

	Inadequate images from other noninvasive methods					
60	Evaluation of pericardial anatomy	A (8)	1	100%	0%	0%
61	Evaluation of pulmonary vein anatomy, prior to radiofrequency ablation for atrial fibrillation	A (8)	1	95%	5%	0%
62	Noninvasive coronary vein mapping, prior to placement of biventricular pacemaker	A (8)	1	100%	0%	0%
63	Localization of coronary bypass grafts and other retrosternal anatomy, prior to reoperative chest or cardiac surgery	A (8)	1	100%	0%	0%
64	Anatomic assessment before percutaneous device closure of ASD or VSD or percutaneous aortic valve replacement	A (8)	1	100%	0%	0%
Morphologic Study of Congenital Heart disease						
65	Assessment of complex congenital heart disease including anomalies of coronary circulation, great vessels, and cardiac chambers and valves	A (8)	1	100%	0%	0%
66	Assessment of post-operative congenital heart disease, such as residual pulmonary stenosis, ventricular septal defect and patency check for Blalock-Taussig shunt	A (8)	2	85%	15%	0%
Coronary CT angiography in patients with Kawasaki disease						
67	Asymptomatic, No previous definite test (invasive angiography, MR coronary angiography or coronary CT angiography) available	U (5)	1	20%	80%	0%
68	Asymptomatic, Previous tests (invasive angiography, MR coronary angiography or coronary CT angiography) documented coronary aneurysm/stenosis, for follow up	A (7)	1	90%	10%	0%
69	Symptomatic, No previous definite test available	A (7)	1	85%	15%	0%
70	Symptomatic, Previous tests (invasive angiography, MR coronary angiography or coronary CT angiography) documented coronary aneurysm/stenosis, for follow up	A (8)	1	90%	10%	0%

6. Literature Review Strategies

(1) Search for Guidelines

A comprehensive search of previous publications on cardiac CT application and related guidelines was done for the adaptive development. The following search field settings were used for each database.

PubMed database (www.pubmed.gov)

For the PubMed database, (Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND ((Guideline[ptyp] OR Practice Guideline[ptyp]) AND ("2000/01/01"[PDAT] : "2012/12/31"[PDAT])) was used to filter pubulication searches. Of these, 98 publications were reviewed.

Cochrane Library (www.interscience.wiley.com)

For the Cochrane library, (Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND Guideline was used to filter publication searches and 13 related publications were reviewed.

Embase (www.embase.com)

For the Embase, (cardiac OR coronary OR heart) AND ('computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography'))) AND 'practice guideline'/exp AND [humans]/lim AND [2000-2012]/py AND 'practice guideline'/de AND 'article'/it was used to filter publication searches and 152 related publications were reviewed.

National Guideline Clearing House (http://www.guideline.gov/)

(cardiac or coronary or heart) AND ('CT angiography' OR 'CT' or 'computed tomography' OR 'computed tomography angiography') were used and 136 publications were found.

CMA Infobase (http://www.cma.ca/index.php/ci_id/54316/la_id/1.htm)

(cardiac or coronary or heart) AND ('CT angiography' OR 'CT' or 'computed tomography' OR 'computed tomography angiography') were used and 13 publications were found.

(2) Literature Searches for Evidence

I. Detection of Coronary Artery Disease (CAD) in Symptomatic Patients with No Previous History of CAD

I-1. Non-acute chest pain patients suspected of ischemic chest pain

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND (electrocardiography OR electrocardiogram OR ecg OR exercise) AND (angina pectoris or stable angina or chest pain) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 412 publications were found.

For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('electrocardiography'/exp OR electrocardiography OR ecg OR electrocardiogram OR 'exercise'/exp OR exercise) AND ('angina'/exp OR angina AND pectoris OR (stable AND ('angina'/exp OR angina)) OR ('chest'/exp OR chest AND ('pain'/exp OR pain))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical

trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used and 56 publications were found. Of these, 13 related publications were reviewed.

I-2 Acute chest pain patients suspected of acute coronary syndrome

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND (acute coronary syndrome or acute chest pain) AND (("2000/01/01"[PDAT]: "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 480 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND (acute AND coronary AND ('syndrome'/exp OR syndrome) OR (acute AND ('chest'/exp OR chest) AND ('pain'/exp OR pain))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 53 publications were found. Of these, 15 related publications were reviewed.

II. Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD

II-1. Coronary calcium scoring in asymptomatic patients with no previous history of CAD

Family history of premature CAD

For the PubMed database, (Coronary calcium score OR Coronary calcium scoring) AND Premature coronary heart disease AND (Family history OR Parental history OR Sibling history) AND (Asymptomatic OR Subclinical atherosclerosis) AND (Coronary artery disease OR coronary heart disease) AND ("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) were used to filter publication searches and 72 publications were found. For the EmBase, ((coronary AND ('calcium'/exp OR calcium) AND score) OR (coronary AND ('calcium'/exp OR calcium) AND scoring) OR 'coronary artery calcium score'/exp) AND (('premature'/exp OR premature) AND ('ischemic heart disease'/exp OR 'coronary heart disease'/exp OR 'coronary heart disease')) AND ('family history'/exp OR 'family history' OR 'parental history' OR 'sibling history') AND (asymptomatic OR 'subclinical atherosclerosis') AND ('coronary artery disease'/exp OR 'coronary artery disease' OR 'coronary heart disease'/exp OR 'coronary heart disease') AND [2000-2012]/py were used and 6 publications were found.   Of these, 6 related publications were reviewed.

Use of Coronary Calcium Scoring

For the PubMed database, (Coronary calcium score OR Coronary calcium scoring) AND (Asymptomatic OR Subclinical atherosclerosis) AND (Coronary artery disease OR coronary heart disease) AND ("2000/01/01"[PDAT] : "2012/12/31"[PDAT])   AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb]) were used to filter publication searches and 24 publications were found. For the EmBase, ((coronary AND ('calcium'/exp OR calcium) AND score) OR (coronary AND ('calcium'/exp OR calcium) AND scoring) OR 'coronary artery calcium score'/exp) AND (asymptomatic OR 'subclinical atherosclerosis') AND ('coronary artery disease'/exp OR 'coronary artery disease' OR 'coronary heart disease'/exp OR 'coronary heart disease') AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 11 publications were found. Of these, 16 related publications were reviewed.

II-2. Coronary CT angiography in asymptomatic patients with no previous history of CAD

For the PubMed database, (Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND (Asymptomatic OR Subclinical atherosclerosis) AND

(Coronary artery disease OR Coronary heart disease) AND ("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb]), were used to filter publication searches and 65 publications were found. For the EmBase, ('coronary computed tomography' OR 'cardiac computed tomography' OR (coronary AND 'computer assisted tomography'/exp AND 'angiography'/exp) OR 'coronary computed tomography angiography') AND (asymptomatic OR 'subclinical atherosclerosis') AND ('coronary artery disease'/exp OR 'coronary artery disease' OR 'coronary heart disease'/exp OR 'coronary heart disease') AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 17 publications were found. Of these, 10 related publications were reviewed.

II-3. Coronary CT angiography after cardiac transplantation

For the PubMed database, (Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND Heart transplantation AND (Coronary artery disease OR Coronary artery evaluation OR coronary allograft vasculopathy) AND ("2000/01/01"[PDAT]: "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb]) were used to filter publication searches and 20 publications were found. For the EmBase, ('coronary computed tomography' OR 'cardiac computed tomography' OR (coronary AND 'computer assisted tomography'/exp AND 'angiography'/exp) OR 'coronary computed tomography angiography') AND ('heart transplantation'/exp OR 'heart transplantation') AND ('coronary artery disease'/exp OR 'coronary artery disease' OR 'coronary artery evaluation' OR 'coronary allograft vasculopathy'/exp OR 'coronary allograft vasculopathy') AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 7 publications were found. Of these, 5 related publications were reviewed.

III. Detection of CAD in Various Clinical Scenarios

III-1. Heart failure newly developed or newly diagnosed in patients with no history of CAD

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND (new-onset heart failure OR newly diagnosed heart failure OR left ventricular ejection fraction) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 314 publications were found. For the EmBase, computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('new onset' OR 'newly diagnosed' AND ('heart failure'/exp OR 'heart failure') OR 'left ventricular ejection fraction'/exp OR 'left ventricular ejection fraction') AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 53 publications were found. Of these, 17 related publications were reviewed.

III-2. Coronary artery assessment prior to non-coronary cardiac surgery

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND (before OR Preoperative OR Prior) AND (Noncardiac surgery OR Vascular surgery OR Cardiac evaluation) AND (Risk assessment OR Risk factor OR Risk) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 110 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted

tomography' AND ('angiography'/exp OR 'angiography')) AND (preoperative AND coronary AND assessment OR (noncoronary AND cardiac AND ('surgery'/exp OR surgery))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 11 publications were found. Of these, 13 related publications were reviewed.

III-3. Arrhythmia with etiology still unclear after initial evaluation

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND arrhythmias AND (("2000/01/01"[PDAT]: "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 329 publications were found. For the EmBase, ('computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography'))) AND (asymptomatic OR 'premature'/exp OR premature) AND (arrhythmias OR 'heart arrhythmia'/exp) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 73 publications were found. Of these, 8 related publications were reviewed.

III-4. Elevated troponin levels of uncertain clinical significance

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND Troponin AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 77 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('troponin'/exp OR troponin) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 25 publications were found. Of these, 19 related publications were reviewed.

III-5. CT before PCI

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND (before OR Preoperative OR Prior) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 58 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND (before OR preoperative AND period OR prior) AND ('percutaneous coronary intervention'/exp OR 'percutaneous coronary intervention' OR 'stents'/exp OR stents OR 'stent'/exp OR stent) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 24 publications were found. Of these, 13 related publications were reviewed.

IV. Use of CT According to Different Test Results

IV-1. Use of coronary CT angiography according to exercise ECG results

For the PubMed database, (coronary AND (computed tomography OR CT) AND angiography AND (ECG OR electrocardiography) AND (Exercise test OR exercise) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang])) were used to filter publication searches and 170

publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('ecg'/exp OR ecg OR 'electrocardiography'/exp OR electrocardiography) AND ('exercise test'/exp OR 'exercise test' OR 'exercise'/exp OR exercise) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 24 publications were found. Of these, 17 related publications were reviewed.

IV-2. Use of coronary CT angiography after stress imaging procedures

For the PubMed database, (coronary AND (computed tomography OR CT) AND angiography AND (ECG OR electrocardiography) AND (Exercise test OR exercise) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang])) were used to filter publication searches and 276 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('stress'/exp OR stress AND ('imaging'/exp OR imaging) OR 'stress'/exp OR stress) AND image AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 32 publications were found. Of these, 13 related publications were reviewed.

IV-3. Use of coronary CT angiography after coronary calcium scoring

For the PubMed database, (coronary AND (computed tomography OR CT) AND angiography AND (coronary calcium (scores OR Score)) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang])) were used to filter publication searches and 453 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('coronary calcium score' OR (coronary AND ('calcium'/exp OR calcium) AND score)) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 40 publications were found. Of these, 16 related publications were reviewed.

IV-4. Use of coronary CT angiography after stress imaging procedures or coronary angiography

For the PubMed database, (Computed Tomography OR CT OR Coronary angiography) AND (stress imaging OR stress image) AND (examination OR Screening OR test OR Radiation Monitoring) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) were used to filter publication searches and 3 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('stress'/exp OR stress AND ('imaging'/exp OR imaging) OR 'stress'/exp OR stress) AND image AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 32 publications were found. However, no publication was related with these indications.

V. Risk Assessment in Patients without Acute Heart Disease before Non-cardiac Surgery

V-1. Low-risk surgery

For the PubMed database, Cardiovascular AND (assessment or evaluation) AND preoperative AND Noncardiac surgery AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 108 publications were found. For the EmBase, cardiovascular AND assessment OR (cardiovascular AND ('evaluation'/exp OR evaluation)) AND preoperative AND noncardiac AND ('surgery'/exp OR surgery) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 36 publications were found. Of these, 6 related publications were reviewed.

V-2. Intermediate-risk surgery

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND riskAND (assessment or evaluation) AND preoperative AND (Noncardiac surgery or surgery) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 58 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('risk'/exp OR risk AND assessment OR ('risk'/exp OR risk AND ('evaluation'/exp OR evaluation))) AND (preoperative AND noncardiac AND ('surgery'/exp OR surgery) OR (preoperative AND ('surgery'/exp OR surgery))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 22 publications were found. Of these, 7 related publications were reviewed.

V-3. Vascular surgery

For the PubMed database, coronary AND (computed tomography OR CT) AND angiography AND riskAND (assessment or evaluation) AND preoperative AND (Noncardiac surgery or vascular surgery) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 39 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('risk'/exp OR risk AND assessment OR ('risk'/exp OR risk AND ('evaluation'/exp OR evaluation))) AND (preoperative AND noncardiac AND ('surgery'/exp OR surgery) OR (preoperative AND vascular AND ('surgery'/exp OR surgery))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 21 publications were found. Of these, 5 related publications were reviewed.

VI. Risk Assessment after Coronary Revascularization

VI-1. Patients suspected of ischemic chest pain after coronary revascularization

CT after CABG

For the PubMed database, [(Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND (coronary artery bypass graft OR coronary artery

bypass OR CABG OR postoperative) AND ("2000/01/01": "2012/12/31") AND (Randomized Controlled Trial)/ AND (Meta-Analysis) / (Systematic)] were used to filter publication searches and 14 RCTs, 7 systematic reviews, and 2 meta-analysis were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('coronary artery bypass graft'/exp OR 'coronary artery bypass surgery'/exp OR (coronary AND ('artery'/exp OR artery) AND bypass) OR cabg OR postoperative) AND (graft AND ('occlusion'/exp OR occlusion) OR graft AND ('obstruction'/exp OR obstruction) OR 'natives'/exp OR natives AND coronary OR 'recurrence'/exp OR recurrence) AND ('angina'/exp OR angina) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 6 publications were found. Of these, 9 related publications were reviewed.

CT after PCI

For the PubMed database, [(Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND (percutaneous coronary intervention OR stent) AND ("2000/01/01": "2012/12/31") AND (Randomized Controlled Trial)/ AND (Meta-Analysis) / (Systematic)] were used to filter publication searches and 5 RCTs, 4 systematic reviews, and 2 meta-analysis were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND (before OR preoperative AND period OR prior) AND ('percutaneous coronary intervention'/exp OR 'percutaneous coronary intervention' OR 'stents'/exp OR stents OR 'stent'/exp OR stent) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 24 publications were found. Of these, 6 related publications were reviewed.

VI-2. Asymptomatic CABG patients

For the PubMed database, [(Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND (coronary artery bypass graft OR coronary artery bypass OR CABG OR postoperative) AND (Graft occlusion OR Graft obstruction OR Native coronary OR recurrence angina) AND ("2000/01/01": "2012/12/31") AND (Randomized Controlled Trial)/ AND (Meta-Analysis) / (Systematic)] were used to filter publication searches and 14 RCTs, 4 systematic reviews, and 4 meta-analysis were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('coronary artery bypass graft'/exp OR 'coronary artery bypass surgery'/exp OR (coronary AND ('artery'/exp OR artery) AND bypass) OR cabg OR postoperative) AND (graft AND ('occlusion'/exp OR occlusion) OR graft AND ('obstruction'/exp OR obstruction) OR 'natives'/exp OR natives AND coronary OR 'recurrence'/exp OR recurrence) AND ('angina'/exp OR angina) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 6 publications were found. Of these, 7 related publications were reviewed.

VI-3. Asymptomatic patients with coronary artery stents

CT after LM stenting

For the PubMed database, [(Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND (percutaneous coronary intervention OR stent) AND (left main coronary artery stent OR large coronary artery stent) AND ("2000/01/01": "2012/12/31") AND (Randomized Controlled Trial)/ AND (Meta-Analysis) / (Systematic)] were used to filter publication searches and 16 RCTs, 4 systematic reviews, and 4 meta-analysis were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('percutaneous coronary intervention'/exp OR 'percutaneous coronary intervention' OR 'stents'/exp OR stents OR 'stent'/exp OR stent) AND (left AND main AND coronary AND ('artery'/exp OR artery) AND ('stent'/exp OR stent) OR large) AND coronary AND ('artery'/exp OR artery) AND ('stent'/exp OR stent) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 10 publications were found. Of these, 8 related publications were reviewed.

CT after stenting in a vessel other than LM coronary artery

For the PubMed database, [(Coronary computed tomography OR Cardiac computed tomography OR Coronary computed tomography angiography) AND (percutaneous coronary intervention OR stent) AND ("2000/01/01": "2012/12/31") AND (Randomized Controlled Trial)/ AND (Meta-Analysis) / (Systematic)] were used to filter publication searches and 14 RCTs, 4 systematic reviews, and 4 meta-analysis were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND (before OR preoperative AND period OR prior) AND ('percutaneous coronary intervention'/exp OR 'percutaneous coronary intervention' OR 'stents'/exp OR stents OR 'stent'/exp OR stent) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 24 publications were found. Of these, 7 related publications were reviewed.

VII. Evaluation of Heart Structure and Function

VII-1. Congenital heart disease in adults

For the PubMed database, (Cardiac OR heart) AND computed tomographyAND (congenital heart disease)AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) and (Cardiac OR heart) AND computed tomographyAND(Coronary Vessel Anomalies OR Coronary artery anomalies) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches, and 320 and 274 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('heart disease'/exp/dm_cn OR 'congenital heart diseases' OR 'congenital heart disease'/exp OR 'congenital heart disease' OR 'heart diseases congenital') AND ([adult]/lim OR [aged]/lim) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) and 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND

('coronary vessel anomalies'/exp OR 'coronary vessel anomalies' OR 'coronary vessel malformation'/exp OR 'coronary artery anomaly'/exp OR 'coronary artery anomaly') AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches, and 10 and 3 publications were found. Of these, 23 publications related with adult congenital disease and 16 publications related with coronary artery anomaly were reviewed.

VII-2. Evaluation of the ventricular structure and systolic function

For the PubMed database, (Cardiac OR heart) AND computed tomography AND left ventricular function AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches, and 412 publications were found. (Cardiac OR heart) AND computed tomography AND Right ventricular function AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 76 publications were found. For the EmBase, 'computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography') AND ('heart left ventricle function'/exp OR 'left ventricular function'/exp OR 'left ventricular function') AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 46 publications were found. 'computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography') AND ('heart right ventricle function'/exp OR 'right ventricular function') AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) and 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('ischemic heart disease'/exp/dm_di OR 'ischemic heart diseases') AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches and 8 and 208 publications were found. Of these, 21 related publications were reviewed.

VII-3. Evaluation of intra- and extracardiac structures

For the PubMed database, (Cardiac OR heart) AND computed tomography AND ("Heart Valves"[Mesh] OR "Heart Valve Prosthesis"[Mesh]) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches, and 911 publications were found. (Coronary computed tomography OR Cardiac computed tomography OR Coronary angiography) AND (Heart Valve Prosthesis OR prosthetic heart valve OR prosthetic Cardiac valve OR prosthetic valve) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) revealed 15 publications. (Coronary computed tomography angiography OR Cardiac computed tomography angiography OR Coronary angiography computed tomography) AND (Cardiac Mass OR thrombus) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) were used to filter publication searches, and 32 publications were found. (Coronary computed tomography OR Cardiac computed tomography angiography OR Coronary angiography) AND (pericardium OR pericardial) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) revealed 18 publications. (Coronary computed tomography OR Cardiac computed tomography angiography OR Coronary angiography) AND pulmonary vein AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-

Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) demonstrated 15 publications. (Coronary computed tomography OR Cardiac computed tomography angiography OR Coronary angiography computed tomography) AND coronary vein AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) demonstrated 66 publications. (Coronary computed tomography OR Cardiac computed tomography angiography OR Coronary angiography) AND (coronary artery bypass graft OR coronary artery bypass OR CABG) AND (reoperative OR Reoperation) AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) demonstrated 17 publications. (Coronary computed tomography OR Cardiac computed tomography angiography OR Coronary angiography) AND percutaneous device closure AND (("2000/01/01"[PDAT] : "2012/12/31"[PDAT]) AND (Meta-Analysis[ptyp] OR Randomized Controlled Trial[ptyp] OR systematic[sb])) demonstrated 18 publications.

For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('heart valve prosthesis'/exp OR 'heart valve prosthesis' OR (prosthetic AND ('heart'/exp OR heart) AND ('valve'/exp OR valve) OR prosthetic AND cardiac AND ('valve'/exp OR valve) OR prosthetic AND ('valve'/exp OR valve) OR 'prosthesis'/exp OR prosthesis AND ('heart'/exp OR heart) AND ('valve'/exp OR valve) OR 'prosthesis'/exp OR prosthesis AND ('valve'/exp OR valve))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) demonstrated 2 publications. 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND (cardiac AND ('mass'/exp OR mass) OR 'thrombus'/exp OR thrombus) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) showed 65 publications. 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('pericardium'/exp OR pericardium OR pericardial) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) demonstrated 7 publications. 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('pulmonary vein'/exp OR (pulmonary AND ('veins'/exp OR veins))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) revealed 15 publications. 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('coronary vein'/exp OR 'coronary vein' OR 'coronary veins' OR (coronary AND ('vein'/exp OR vein) OR coronary AND ('veins'/exp OR veins))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) showed 13 publications. 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND

('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('coronary artery bypass graft'/exp OR 'coronary artery bypass surgery'/exp OR (coronary AND ('artery'/exp OR artery) AND bypass) OR cabg) AND (reoperative OR 'reoperation'/exp OR reoperation OR 'second look surgery'/exp OR 'second look surgery' OR 're do') AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) showed 5 publications. 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND percutaneous AND ('device'/exp OR device) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches, and 73 publications were found. Of these, 45 related publications were reviewed.

VII-4. Morphologic study of congenital heart disease in pediatric patients

For the PubMed database, (Cardiac OR heart) AND computed tomography AND (congenital heart disease) AND (("2000/01/01"[PDAT]: "2012/12/31"[PDAT]) AND "humans"[MeSH Terms] AND English[lang]) were used to filter publication searches and 316 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('heart disease'/exp/dm_cn OR 'congenital heart diseases' OR 'congenital heart disease'/exp OR 'congenital heart disease' OR 'heart diseases congenital') AND ([embryo]/lim OR [fetus]/lim OR [newborn]/lim OR [infant]/lim OR [preschool]/lim OR [school]/lim OR [child]/lim OR [adolescent]/lim)AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches, and 8 publications were found. Of these, 18 related publications were reviewed.

VII-5. Coronary CT angiography in Kawasaki disease patients

For the PubMed database, coronary AND (computed tomography OR CT)AND angiography AND Kawasaki diseaseAND (("2000/01/01"[PDAT]: "2012/12/31"[PDAT]) AND "humans"[MeSH Terms]) were used to filter publication searches and 76 publications were found. For the EmBase, 'computed tomographic angiography'/exp OR (computed AND ('tomography'/exp OR tomography) AND ('angiography'/exp OR angiography)) OR ('computer assisted tomography'/exp OR 'computer assisted tomography' AND ('angiography'/exp OR 'angiography')) AND ('mucocutaneous lymph node syndrome'/exp OR (kawasaki AND ('disease'/exp OR disease))) AND [humans]/lim AND [2000-2012]/py AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [meta analysis]/lim OR [randomized controlled trial]/lim OR [systematic review]/lim) were used to filter publication searches, and 5 publications were found. Of these, 15 related publications were reviewed.

7. Evidence Tables

Evidence Table 1. Detection of Coronary Artery Disease (CAD) in Symptomatic Patients with No Previous History of CAD

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
11. Paech, D.C. and A.R. Weston, A systematic review of the clinical effectiveness of 64-slice or higher computed tomography angiography as an alternative to invasive coronary angiography in the investigation of suspected coronary artery disease. BMC Cardiovasc Disord, 2011. 11: p. 32.	Systematic review	28 studies, 3674 patients	To summarize recent evidence pertaining to the clinical effectiveness of 64-slice or higher CTA in patients with suspected CAD.	28 studies examining 3,674 patients. The primary meta-analysis at the patient-level indicated a sensitivity of 98.2% and specificity of 81.6%. The median (range) PPV was 90.5% (76%-100%) and NPV 99.0% (83%-100%). In all vessels, the pooled sensitivity was 94.9%, specificity 89.5%, and median (range) PPV 75.0% (53%-95%) and NPV 99.0% (93%-100%). At the individual artery level, overall diagnostic accuracy appeared to be slightly higher in the left main coronary artery and slightly lower in the left anterior descending and circumflex artery. In all segments, the sensitivity was 91.3%, specificity 94.0% and median (range) PPV 69.0% (44%-86%) and NPV 99.0% (98%-100%).	1
13. Nieman, K., et al., Computed tomography versus exercise electrocardiography in patients with stable chest complaints: real-world experiences from a fast-track chest pain clinic. Heart, 2009. 95(20): p. 1669-75.	Well-designed cross sectional study	471 patients	To compare the diagnostic performance of CTA and exercise electrocardiography (XECG) in a symptomatic population with a low-intermediate prevalence of CAD.	Results by CTA and XECG matched for 185 patients (68%, p = 0.63). Catheter angiography showed obstructive CAD in 57/98 patients (58%). Sensitivity, specificity, positive and negative predictive value of CTA to identify patients with ≥50% stenosis was 96%, 37%, 67% and 88%, respectively; compared with XECG: 71%, 76%, 80% and 66%, respectively. Quantitative CTA slightly overestimated diameter stenosis: 6 (21)% (R = 0.71), compared with QCA. Of	2

				the 312 patients (66%) with a negative CTA, 44 (14%) had a positive XECG, but only 2/17 who underwent catheter angiography had significant CAD.	
15. Ghostine, S., et al., Non-invasive detection of coronary artery disease in patients with left bundle branch block using 64-slice computed tomography. J Am Coll Cardiol, 2006. 48(10): p. 1929-34.	Well-designed cross sectional study	66 patients	To evaluate the diagnostic accuracy of 64-sliceCT to identify coronary artery disease (CAD) in patients with complete left bundle branch block (LBBB).	Lower heart rates were associated with improved image quality. Computed tomography correctly identified 35 of 37 (95%) patients without significant stenosis and 28 of 29 (97%) patients with significant stenosis on CCA. Computed tomography correctly assessed 68 of 94 (72%) significant stenosis. Overall, accuracy, sensitivity, specificity, positive predictive value, and negative predictive value of 64-slice CT for identifying CAD by patient was 95%, 97%, 95%, 93%, and 97%, respectively, and by segment was 97%, 72%, 99%, 91%, and 97%, respectively.	2
16. Arbab-Zadeh, A., et al., Diagnostic accuracy of computed tomography coronary angiography according to pre-test probability of coronary artery disease and severity of coronary arterial calcification. The CORE-64 (Coronary Artery Evaluation Using 64-Row Multidetector Computed Tomography Angiography) International Multicenter Study. J Am Coll Cardiol, 2012. 59(4): p. 379-87.	Well-designed cross sectional study	371 patients	To assess the impact of patient population characteristics on accuracy by CTA to detect obstructive CAD.	Analysis of patient-based quantitative CTA accuracy revealed an AUC of 0.93 (95% confidence interval [CI]: 0.90 to 0.95). The AUC remained 0.93 (95% CI: 0.90 to 0.96) after excluding patients with known CAD but decreased to 0.81 (95% CI: 0.71 to 0.89) in patients with calcium score ≥600 (p = 0.077). While AUCs were similar (0.93, 0.92, and 0.93, respectively) for patients with intermediate, high pre-test probability for CAD, and known CAD, negative predictive values were different: 0.90, 0.83, and 0.50, respectively. Negative predictive values decreased from 0.93 to 0.75 for patients with calcium score <100 or ≥100, respectively (p = 0.053).	2

18. Chang, S.A., et al., Usefulness of 64-slice multidetector computed tomography as an initial diagnostic approach in patients with acute chest pain. Am Heart J, 2008. 156(2): p. 375-83.	Inception cohort study	266 patients	To evaluate the role of MDCT as part of the initial diagnosis for evaluating acute chest pain	The number of patients ultimately diagnosed with an ACS did not differ between the 2 strategies. Emergency department LOS and total admissions were not different between strategies. Patients in the MDCT-based strategy had a decreased hospital LOS (P = .049) and fewer admissions deemed unnecessary (P = .007). Reductions in unnecessary admissions were more prominent in intermediate-risk patients (P = .015). None of the patients discharged from the ED in the MDCT-based strategy experienced major adverse cardiac events at follow-up.	2
21. Samad, Z., et al., A meta-analysis and systematic review of computed tomography angiography as a diagnostic triage tool for patients with chest pain presenting to the emergency department. J Nucl Cardiol, 2012. 19(2): p. 364-76.	Systematic review and Meta-analysis	9 studies, 1,349 patients	To assess clinical utility of CTA in the diagnosis of chest pain patients presenting to emergency departments, we conducted a meta-analysis of CTA in patients with suspected acute coronary syndromes (ACSs).	Nine studies (N = 1349) formed the data set. The pooled patient population was 52 ± 2 years of age, 51% male, with low to intermediate pretest probability for ACS. Risk factors included 12% diabetes, 42% hypertension, 35% smokers, 29% had hyperlipidemia, and 7% known CAD. ACS was subsequently diagnosed in 10% of patients. The bivariate summary estimate of sensitivity of CTA for ACS diagnosis was 95% (95% CI 88-100) and specificity was 87% (95% CI 83-92), yielding a negative likelihood ratio of 0.06 (95% CI 0-0.14) and positive likelihood ratio of 7.4 (95% CI 4.8-10). The 30-day event rate included no deaths and no additional MIs.	1
22. Schlett, C.L., et al., Prognostic value of CT angiography for major	Inception cohort study	333 patients	To determine the 2-year prognostic value of cardiac CT	333 patients (90.5%) with a median follow-up period of 23 months. At the end of the follow-up	2

adverse cardiac events in patients with acute chest pain from the emergency department: 2-year outcomes of the ROMICAT trial. JACC Cardiovasc Imaging, 2011. 4(5): p. 481-91.			for predicting major adverse cardiac events (MACE) in patients presenting to the emergency department with acute chest pain.	period, 25 patients (6.8%) experienced 35 MACE (no cardiac deaths, 12 myocardial infarctions, and 23 revascularizations). Cumulative probability of 2-year MACE increased across CT strata for coronary artery disease (CAD) (no CAD 0%; nonobstructive CAD 4.6%; obstructive CAD 30.3%; log-rank p < 0.0001) and across combined CT strata for CAD and RWMA (no stenosis or RWMA 0.9%; 1 feature-either RWMA [15.0%] or stenosis [10.1%], both stenosis and RWMA 62.4%; log-rank p < 0.0001). The c statistic for predicting MACE was 0.61 for clinical Thrombolysis In Myocardial Infarction risk score and improved to 0.84 by adding CT CAD data and improved further to 0.91 by adding RWMA (both p < 0.0001).	
23. Hollander, J.E., et al., One-year outcomes following coronary computerized tomographic angiography for evaluation of emergency department patients with potential acute coronary syndrome. Acad Emerg Med, 2009. 16(8): p. 693-8.	Inception cohort study	481 patients	To evaluate the long-term outcome of patients discharged from the ED with negative coronary CTA	Of 588 patients who received coronary CTA in the ED, 481 met study criteria. They had a mean (+/-SD) age of 46.1 (+/-8.8) years, 63% were black or African American, and 60% were female. There were 53 patients (11%) rehospitalized and 51 patients (11%) who received further diagnostic testing (stress or catheterization) over the subsequent year. There was one death (0.2%; 95% confidence interval [CI] = 0.01% to 1.15%) with unclear etiology, no AMI (0%; 95% CI = 0 to 0.76%), and no revascularization procedures (0%; 95% CI = 0 to 0.76%) during this time period.	2
25. Rubinshtein, R., et al.,	Inception	58 patients	We examined performance	The patients underwent 64-slice contrast-enhanced	2

Usefulness of 64-slice cardiac computed tomographic angiography for diagnosing acute coronary syndromes and predicting clinical outcome in emergency department patients with chest pain of uncertain origin. Circulation, 2007. 115(13): p. 1762-8.	cohort study		characteristics of MDCT for diagnosing or excluding an acute coronary syndrome in patients presenting to the emergency department (ED) with possible ischemic chest pain and examined relation to clinical outcome during a 15-month follow-up period.	MDCT, which showed normal coronary vessels (no or trivial atheroma) in 15 patients, nonobstructive plaque in 20 (MDCT-negative patients), and obstructive coronary disease (> or = 50% luminal narrowing) in 23 (MDCT-positive group). By further investigation (new elevation of cardiac biomarkers, abnormal myocardial perfusion scintigraphy and/or invasive angiography), acute coronary syndrome was diagnosed in 20 of the 23 MDCT-positive patients (ED MDCT sensitivity 100% [20/20], specificity 92% [35/38], positive predictive value 87% [20/23], negative predictive value 100% [35/35]). During a 15-month follow-up period, no deaths or myocardial infarctions occurred in the 35 patients discharged from the ED after initial triage and MDCT findings. One patient underwent late percutaneous coronary intervention (late major adverse cardiovascular events rate, 2.8%). Overall, ED MDCT sensitivity for predicting major adverse cardiovascular events (death, myocardial infarction, or revascularization) during hospitalization and follow-up was 92% (12/13), specificity was 76% (34/45), positive predictive value was 52% (12/23), and negative predictive value was 97% (34/35).	
31. Madder, R.D., et al., Comparative diagnostic yield and 3-month outcomes of "triple rule-out" and standard protocol	Study without consistently applied reference	2,068 patients	To describe the diagnostic yield and clinical outcomes of patients undergoing triple rule-out in clinical practice.	Among 2068 patients (272 triple rule-out and 1796 cardiac CT angiograms), the composite diagnostic yield was 14.3% with triple rule-out and 16.3% with cardiac CT (P = 0.41) and was driven by the	3

coronary CT angiography in the evaluation of acute chest pain. J Cardiovasc Comput Tomogr, 2011. 5(3): p. 165-71.	standards/ Cohort study			diagnosis of obstructive coronary artery disease (13.2% triple rule-out versus 16.1% cardiac CT, P = 0.22). The diagnostic yield for pulmonary embolism was low (1.1% triple rule-out and 0.2% cardiac CT, P = 0.052) and no aortic dissections were found in either group. Compared with cardiac CT, the triple rule-out approach was associated with higher radiation exposure (12.0 ± 5.6 mSv versus 8.2 ± 4.0 mSv, P < 0.0001), a greater incidence of subsequent emergency center cardiac evaluations (5.9% versus 2.5%, P = 0.0017), and more downstream pulmonary embolism-protocol CT angiography (3.3% versus 0.9%, P = 0.0034).	

Evidence Table 2. Risk Assessment and Detection of CAD in Asymptomatic Patients with No Previous History of CAD

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
37. Nasir, K., et al., Family history of premature coronary heart disease and coronary artery calcification: Multi-Ethnic Study of Atherosclerosis (MESA). Circulation, 2007. 116(6): p. 619-26.	Well-designed cross sectional study	6,814 patients	To assess the strength of the association between a family history (FH) of premature CHD and coronary artery calcification (CAC) in a multiethnic cohort of asymptomatic individuals. To determine whether individuals with a reported FH of premature CHD have an increased atherosclerotic burden among those classified as being at low to intermediate risk on the basis of the conventional Framingham risk score.	The demographics (age, gender, and race)–adjusted OR for CAC >0 with versus without a FH of premature CHD was 1.94 (95% CI, 1.64 to 2.29). On adjustment for CHD risk factors, the association was slightly attenuated to an OR of 1.84 (95% CI, 1.55 to 2.19). FH of premature CHD was significantly associated with CAC in all ethnic groups. The age-, gender-, and race-adjusted prevalence of CAC >0 was significantly higher with presence of any FH of premature CHD than for those with no FH of premature CHD among individuals classified as low risk (35% versus 23%, P<0.0001) and among those at intermediate risk (70% versus 60%, P=0.01). Similarly, the prevalence of age-gender-race–based CAC ≥75th percentile in low-risk (24% versus 14%, P=0.0003) and intermediate-risk (34% versus 20%, P<0.001) individuals was also higher among those with a FH of premature CHD. Compared with those without a FH of premature CHD, the association with the presence of CAC was strongest in participants reporting such history in both a parent and a sibling (odds ratio, 2.74; 95% CI, 1.64 to 4.59), followed by those reporting a FH in a sibling only (odds ratio, 2.06; 95% CI, 1.64 to 2.58) and those reporting a FH of premature CHD only in a parent	2

				(odds ratio, 1.52; 95% CI, 1.19 to 1.93).	
38. Nasir, K., et al., Coronary artery calcification and family history of premature coronary heart disease. Circulation, 2004. 110(15): p. 2150-2156.	Well-designed cross sectional study	13,389 patients	To assess the association of a family history (FH) of premature coronary heart disease CHD with coronary artery calcification (CAC) in asymptomatic individuals and to compare the effects of sibling or parental FH on the risk of subclinical atherosclerosis.	Those with (1) no FH of CHD, (2) FH of premature CHD in parents, or (3) FH in siblings had a prevalence of CAC of 55%, 64%, and 78% (P<0.0001) among men and 27%, 36%, and 56% (P<0.0001) among women, respectively. The multivariate regression analysis demonstrated that the odds ratio (95% confidence interval) for the presence of CAC was 1.3 (1.1 to 1.6) among those with positive FH of premature CHD in parents only, 2.3 (1.7 to 3.1) and 2.5 (1.8 to 3.3) among those in siblings and a combined FH compared with those without FH of CHD in men, respectively. Among women, the corresponding odds ratios were 1.3 (1.0 to 1.8), 2.3 (1.7 to 3.6), and 1.9 (1.3 to 3.1), respectively. A similar trend was observed in the association of FH of premature CHD with increasing CAC scores.	2
45. Detrano, R., et al., Coronary calcium as a predictor of coronary events in four racial or ethnic groups. New England Journal of Medicine, 2008. 358(13): p. 1336-1345.	Inception cohort study	6,722 patients	The Multi-Ethnic Study of Atherosclerosis (MESA) 24 investigates the prevalence, correlates, and progression of subclinical cardiovascular disease. The study cohort is a population-based sample from six urban communities, with oversampling of blacks, Chinese, and Hispanics. We	There were 162 coronary events, of which 89 were major events (myocardial infarction or death from coronary heart disease). In comparison with participants with no coronary calcium, the adjusted risk of a coronary event was increased by a factor of 7.73 among participants with coronary calcium scores between 101 and 300 and by a factor of 9.67 among participants with scores above 300 (P<0.001 for both comparisons). Among the four racial and ethnic groups, a doubling of the calcium score	2

			used the data collected from the MESA cohort to study the relationship between coronary calcification and future coronary events in four major ethnic groups	increased the risk of a major coronary event by 15 to 35% and the risk of any coronary event by 18 to 39%. The areas under the receiver-operating-characteristic curves for the prediction of both major coronary events and any coronary event were higher when the calcium score was added to the standard risk factors.	
46. Greenland, P., et al., Coronary artery calcium score combined with Framingham score for risk prediction in asymptomatic individuals. JAMA: the journal of the American Medical Association, 2004. 291(2): p. 210-215.	Inception cohort study	1,461 patients	To determine whether CACS assessment combined with FRS in asymptomatic adults provides prognostic information superior to either method alone and whether the combined approach can more accurately guide primary preventive strategies in patients with CHD risk factors.	During a median of 7.0 years of follow-up, 84 patients experienced MI or CHD death; 70 patients died of any cause. There were 291 (28%) participants with an FRS of more than 20% and 221 (21%) with a CACS of more than 300. Compared with an FRS of less than 10%, an FRS of more than 20% predicted the risk of MI or CHD death (hazard ratio [HR], 14.3; 95% confidence interval [CI]; 2.0-104; P = .009). Compared with a CACS of zero, a CACS of more than 300 was predictive (HR, 3.9; 95% CI, 2.1-7.3; P<.001). Across categories of FRS, CACS was predictive of risk among patients with an FRS higher than 10% (P<.001) but not with an FRS less than 10%.	2
47. Lakoski, S.G., et al., Coronary artery calcium scores and risk for cardiovascular events in women classified as" low risk" based on Framingham risk score: the multi-ethnic study of atherosclerosis (MESA). Archives of internal	Inception cohort study	3601 patients	To assess coronary artery calcium (CAC) score and subsequent risk for coronary heart disease (CHD) and cardiovascular (CVD) events among asymptomatic women judged to be at low risk by	Excluding women with diabetes and those older than 79 years, 90% of women in MESA (mean ± SD age, 60 ± 9 years) were classified as "low risk" based on FRS. The prevalence of CAC (CAC score > 0) in this low-risk subset was 32% (n = 870). Compared with women with no detectable CAC, low-risk women with a CAC score greater than 0	2

| medicine, 2007. 167(22): p. 2437. | | | the Framingham risk score (FRS), a common approach for determining 10-year absolute risk for CHD. Based on population survey data, 95% of American women are considered at low risk based on FRS | were at increased risk for CHD (hazard ratio, 6.5; 95% confidence interval, 2.6-16.4) and CVD events (hazard ratio, 5.2; 95% confidence interval, 2.5-10.8). In addition, advanced CAC (CAC score ≥ 300) was highly predictive of future CHD and CVD events compared with women with nondetectable CAC and identified a group of low-risk women with a 6.7% and 8.6% absolute CHD and CVD risk, respectively, over a 3.75-year period | |
| 48. Budoff, M.J., et al., Coronary calcium predicts events better with absolute calcium scores than age-sex-race/ethnicity percentiles: MESA (Multi-Ethnic Study of Atherosclerosis). Journal of the American College of Cardiology, 2009. 53(4): p. 345-352. | Inception cohort study | 6,814 patients | The presence and extent of CAC correlates with the overall magnitude of coronary atherosclerotic plaque burden and with the development of subsequent coronary events. In this study, we aimed to establish whether age-sex-specific percentiles of coronary artery calcium (CAC) predict cardiovascular outcomes better than the actual (absolute) CAC score. | There were 163 (2.4%) incident CHD events (median follow-up 3.75 years). Expressing CAC in terms of age- and sex-specific percentiles had significantly lower area under the receiver-operating characteristic curve (AUC) than when using absolute scores (women: AUC 0.73 versus 0.76, p = 0.044; men: AUC 0.73 versus 0.77, p < 0.001). Akaike's information criterion indicated better model fit with the overall score. Both methods robustly predicted events (>90th percentile associated with a hazard ratio [HR] of 16.4, 95% confidence interval [CI]: 9.30 to 28.9, and score >400 associated with HR of 20.6, 95% CI: 11.8 to 36.0). Within groups based on age-, sex-, and race/ethnicity-specific percentiles there remains a clear trend of increasing risk across levels of the absolute CAC groups. In contrast, once absolute CAC category is fixed, there is no increasing trend across levels of age-, sex-, and race/ethnicity-specific categories. Patients with low | 2 |

				absolute scores are low-risk, regardless of age-, sex-, and race/ethnicity-specific percentile rank. Persons with an absolute CAC score of >400 are high risk, regardless of percentile rank	
50. Taylor, A.J., et al., Coronary calcium independently predicts incident premature coronary heart disease over measured cardiovascular risk factors: mean three-year outcomes in the Prospective Army Coronary Calcium (PACC) project. J Am Coll Cardiol, 2005. 46(5): p. 807-14.	Inception cohort study	2,000 patients	To examine the independent predictive value of coronary artery calcium detection for coronary outcomes in a non-referred cohort of healthy men and women ages 40 to 50 years	Coronary calcium was found in 22.4% of men and 7.9% of women. A total of 9 acute events occurred in men at a mean age of 46 years, including 7 of 364 men with coronary calcium (1.95%) and 2 of 1,263 men without coronary calcium (0.16%; p < 0.0001 by log-rank). No events occurred in women. In these men, coronary calcium was associated with an 11.8-fold increased risk for incident coronary heart disease (CHD) (p = 0.002) in a Cox model controlling for the Framingham risk score. Among those with coronary artery calcification, the risk of coronary events increased incrementally across tertiles of coronary calcium severity (hazard ratio 4.3 per tertile). A family history of premature CHD was also predictive of incident events. The marginal cost effectiveness, assuming a 30% improvement in survival associated with primary prevention among at-risk men, was modeled to be $37,633 per quality-adjusted life year saved.	2
52. Greenland, P., et al., ACCF/AHA 2007 clinical expert consensus document on coronary artery calcium scoring by computed tomography in global	Meta-analysis	6 studies, 27,622 patients	This document has updated information on CAC measurement with particular emphasis on data that have appeared since 2000 when the	From 6 recently published reports in 27 622 patients (n=395 CHD death or MI). The relative risk ratio of 4.3 (95% confidence interval [CI]=3.5 to 5.2) for any measurable calcium as compared with a low-risk CAC (generally using a score of 0) (p less	1

cardiovascular risk assessment and in evaluation of patients with chest pain: a report of the American College of Cardiology Foundation Clinical Expert Consensus Task Force (ACCF/AHA Writing Committee to Update the 2000 Expert Consensus Document on Electron Beam Computed Tomography) developed in collaboration with the Society of Atherosclerosis Imaging and Prevention and the Society of Cardiovascular Computed Tomography. Journal of the American College of Cardiology, 2007. 49(3): p. 378-402.			previous ACC/AHA Expert Consensus Document was published.	than 0.0001). These data imply that the 3 to 5 year risk of any detectable calcium elevates a patient's CHD risk of events by nearly 4-fold (p less than 0.0001). Importantly, patients without detectable calcium (or a CAC score = 0) have a very low rate of CHD death or MI (0.4%) over 3 to 5 years of observation (n = 49 events/11 815 individuals). With even higher CAC scores, the 3 to 5 year event rates increased substantially. For scores ranging from 100 to 400, the summary relative risk ratio was 4.3 (95% CI = 3.1 to 6.1) when compared to patients with no detectable coronary calcium (p less than 0.0001). For the high (CAC scores of 400 to 1000) and very high (greater than 1000) risk CAC scores, pooled CHD death or MI rates were 4.6% and 7.1% at 3 to 5 years after CAC testing, resulting in relative risk ratios of 7.2 (95% CI _ 5.2 to 9.9, p less than 0.0001) and 10.8 (95% CI _ 4.2 to 27.7, p less than 0.0001) when compared to the low-risk group (CAC score = 0) as reference.	
56. Lee, S., et al., Subclinical coronary artery disease as detected by coronary computed tomography angiography in an asymptomatic population. Korean circulation journal, 2010. 40(9): p. 434-441.	Cross sectional study without reference standard	4,320 patients	Primary prevention of coronary artery disease (CAD) has become a public health issue, according to increasing awareness of the substantial risks posed by asymptomatic atherosclerosis. The aims of this study were to determine	Coronary artery plaques were present in 1,053 (24%) individuals. Significant stenosis (diameter stenosis ≥50%) was identified in 139 (3%) subjects, and most of the significant lesions (87%) were located in the left anterior descending artery. CCTA revealed noncalcified plaques in 5% of subjects with a coronary calcium score of zero (n=801). Although 25% (n=10) of those with noncalcified plaque had	3

			the prevalence and characteristics of subclinical CAD using coronary computed tomography angiography (CCTA), and to evaluate the role of this advanced technology in identifying subclinical CAD in asymptomatic Korean individuals, compared with conventional risk stratification.	significant stenosis, most of them (90%) were classified into low- or moderate-risk groups according to National Cholesterol Education Program risk stratification guidelines. In a young population (age ≤55 years for males, ≤65 years for females), 30% of subjects with significant stenosis were classified into a low-risk group and 60% had low (0 to 100) calcium scores	
57. Yoo, D.H., et al., Significance of noncalcified coronary plaque in asymptomatic subjects with low coronary artery calcium score: assessment with coronary computed tomography angiography. The International Journal of Cardiovascular Imaging (formerly Cardiac Imaging), 2012: p. 1-9.	Cross sectional study without reference standard	7,515 patients	To investigate the prevalence and severity of noncalcified coronary plaques (NCP) using coronary CT angiography (CCTA) and analyze predictors of significant coronary stenosis by NCP in asymptomatic subjects with low coronary artery calcium score (CACS).	We also investigated the cardiac events of the patients through medical records. Compared to subjects with 0 CACS, those with low CACS showed higher prevalence of NCP (6.9% vs. 31.5%, P < 0.001) and significant stenosis caused by NCP (0.8% vs. 7.5%, P < 0.001). In the low CACS group, independent predictors for significant NCP included diabetes mellitus (DM), hypertension, and elevated low-density lipoprotein (LDL)-cholesterol (all P < 0.05). However, 47.2% of subjects with significant NCP were classified into the low to intermediate risk according to Framingham Risk Score. At the median follow up of 42 months (range: 3–60 months), cardiac events were significantly higher in the low CACS group compared to the 0 CACS group (2.6% vs. 0.27%, P < 0.001).	3
61. Cho, I., et al., Coronary	Inception	27,125	The predictive value of	Both CACS and cCTA significantly improved the	2

| Computed Tomographic Angiography and Risk of All-Cause Mortality and Nonfatal Myocardial Infarction in Subjects Without Chest Pain Syndrome From the CONFIRM Registry (Coronary CT Angiography Evaluation for Clinical Outcomes: An International Multicenter Registry) Clinical Perspective. Circulation, 2012. 126(3): p. 304-313. | cohort study | patients | coronary computed tomographic angiography (cCTA) in subjects without chest pain syndrome (CPS) has not been established. We investigated the prognostic value of coronary artery disease detection by cCTA and determined the incremental risk stratification benefit of cCTA findings compared with clinical risk factor scoring and coronary artery calcium scoring (CACS) for individuals without CPS. | performance of standard risk factor prediction models for all-cause mortality and the composite outcome (likelihood ratio P<0.05 for all), but the incremental discriminatory value associated with their inclusion was more pronounced for the composite outcome and for CACS (C statistic for model with risk factors only was 0.71; for risk factors plus CACS, 0.75; for risk factors plus CACS plus cCTA, 0.77). The net reclassification improvement resulting from the addition of cCTA to a model based on standard risk factors and CACS was negligible. | |
| 62. Cademartiri, F., et al., Coronary calcium score and computed tomography coronary angiography in high-risk asymptomatic subjects: assessment of diagnostic accuracy and prevalence of non-obstructive coronary artery disease. European radiology, 2010. 20(4): p. 846-854. | Well-designed cross sectional study | 213 patients | To compare the coronary artery calcium score (CACS) and computed tomography coronary angiography (CTCA) for the assessment of non-obstructive/obstructive coronary artery disease (CAD) in high-risk asymptomatic subjects. | The mean calcium score was 151 ± 403 and the prevalence of obstructive CAD was 17% (8% one-vessel and 10% two-vessel disease). Per-patient sensitivity, specificity, positive and negative predictive values of CACS were: 97%, 75%, 45%, and 100%, respectively (Agatston ≥1); 73%, 90%, 60%, and 94%, respectively (Agatston ≥100); 30%, 98%, 79%, and 87%, respectively (Agatston ≥1,000). Per-patient values for CTCA were 100%, 98%, 97%, and 100%, respectively (p < 0.05). CTCA detected 65% prevalence of all CAD (48% non-obstructive), while CACS detected 37% prevalence of all CAD (21% non-obstructive) (p < 0.05). | 2 |

| 63. Khan, R. and I.K. Jang, Evaluation of coronary allograft vasculopathy using multi-detector row computed tomography: a systematic review. European Journal of Cardio-Thoracic Surgery, 2012. 41(2): p. 415-422. | Systemic Review | 7 studies, 272 patients | This article systematically reviews the literature to determine the accuracy of MDCT in Coronary allograft vasculopathy(CAV) assessment. | Using per-segment analysis, MDCT assessed between 91% and 96% of all coronary segments when evaluating for stenosis. Pooled estimates for sensitivity and specificity for MDCT ranged from 82% to 89% and 89% to 99%, respectively, while NPV was 99%. Per-patient analysis revealed a sensitivity of 87–100% and NPV of 96–100%. PPV was less than 50% for 64-slice MDCT in both per-segment and per-patient analysis. When compared with IVUS, MDCT had a sensitivity of 74–96% and specificity of 88–92% in assessment of intimal thickening. NPV and PPV were 80–81% and 84–98%, respectively. The high sensitivity and NPV of MDCT suggest that it may be a useful, noninvasive screening tool to rule out CAV. | 1 |

Evidence Table 3. Detection of CAD in Various Clinical Scenarios

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
73. Bhatti, S., et al., Diagnostic performance of computed tomography angiography for differentiating ischemic vs nonischemic cardiomyopathy. J Nucl Cardiol, 2011. 18(3): p. 407-20.	Meta-analysis	6 studies, 452 patients	Although the use of CTA is considered "appropriate" to distinguish ischemic vs nonischemic etiology in patients with cardiomyopathy under the current clinical practice guideline, the evidence to support this has not been evaluated in larger scale studies. Thus, we conducted a meta-analysis of available studies published by October 2010 to address this question.	The pooled patient population was 62 +/- 3 years old, with 29% females, 16% diabetics, and 43% with a history of hypertension. Mean EF was 32% +/- 1%. The pooled summary estimate of sensitivity of CTA for diagnosis of ischemic cardiomyopathy was 98% [95% confidence interval (CI); 94% to 99%] and specificity was 97% (CI 94% to 98%), yielding a negative likelihood ratio of 0.06 (CI 0.02 to 0.13) and positive likelihood ratio of 20.85 (CI 12 to 36). The ROC analysis showed a robust discriminate diagnostic accuracy of ischemic etiology with an area under curve of 0.99 (P < .00001). CTA appears as a clinically applicable accurate diagnostic modality to exclude ischemic etiology in patients with cardiomyopathy of undetermined cause and this further supports the appropriateness of the use of CTA to determine the cause of new onset cardiomyopathy of unknown etiology.	1
77. Catalan, P., et al., Ruling out coronary artery disease with noninvasive coronary multidetector CT angiography before noncoronary cardiovascular surgery. Radiology, 2011. 258(2): p. 426-34.	Study without consistently applied reference standards / Cohort study	133 patients	To assess the usefulness of preoperative coronary CTA in the detection of coronary artery disease (CAD) in nonselected patients scheduled to undergo noncoronary cardiovascular	The interquartile range of the Agatston coronary calcium score was 0-471. Coronary CT angiography was diagnostic in 108 of 133 patients. Of these, 93 of 108 had no significant CAD (</= 50% stenosis), and noncoronary cardiovascular surgery was performed in them without preoperative ICA. No patients in this group had postoperative ischemic	3

				surgery to avoid unnecessary invasive coronary angiography (ICA).	events at follow-up. Coronary CT angiography was nondiagnostic in 25 of 133 patients who were referred for preoperative ICA. Multivariate analysis showed Agatston score to be the only independent predictor of nondiagnostic coronary CT angiography (odds ratio = 1.002; 95% confidence interval: 1.001, 1.003; P = .001). The best Agatston score cutoff for diagnostic coronary CT angiography was 579.	
78. Buffa, V., et al., Preoperative coronary risk assessment with dual-source CT in patients undergoing noncoronary cardiac surgery. Radiol Med, 2010. 115(7): p. 1028-37.	Study without consistently applied reference standards / Cohort study	100 patients	To assess the role of dual-source computed tomography (DSCT) in the preoperative evaluation of coronary artery disease in patients scheduled for noncoronary cardiac surgery.	No MACEs were recorded during the perioperative period; three noncardiac complications (one surgical revision for bleeding, one cardiac tamponade and one respiratory insufficiency) and one death related to severe respiratory insufficiency were observed. None of the 80 patients had MACEs during the 3-month follow-up period. Coronary evaluation with DSCT is able to rule out the presence of coronary disease in patients scheduled for cardiac surgery, without the need for coronary angiography confirmation. Patients with significant stenosis or nondiagnostic image quality should be referred for coronary angiography.	3
80. Shrivastava, V., et al., Is cardiac computed tomography a reliable alternative to percutaneous coronary angiography for patients awaiting valve surgery? Interact Cardiovasc Thorac Surg, 2007. 6(1):	Meta-analysis	11 studies	The question addressed was whether a CT angiogram could replace routine percutaneous coronary angiography for excluding coronary arterial disease for patients	We conclude that angiography with 64-slice multi-detector CT scanner provides reliable non-invasive imaging to exclude significant coronary artery stenoses prior to valve surgery. The negative predictive value of a normal CT scan is around 97%, thus providing a good alternative to conventional	1

p. 105-9.			undergoing a non-coronary cardiac procedure. Eleven papers represented the best evidence on the subject and the author, journal, date and country of publication, patient group studied, study type, relevant outcomes, results and study comments and weaknesses were tabulated.	angiography in lower atherosclerotic risk patients.	
87. Jonnalagadda, N., et al., Role of cardiac imaging evaluation of patients with documented or suspected ventricular arrhythmias. J Nucl Cardiol, 2010. 17(1): p. 145-52.	Review		To summarize our current understanding of the role of cardiac imaging in the diagnosis and management of patients with ventricular arrhythmias.		5
88. Wazni, O.M., et al., Cardiovascular imaging in the management of atrial fibrillation. J Am Coll Cardiol, 2006. 48(10): p. 2077-84.	Review		To review the impact of various imaging modalities in the evaluation and management of AF.		5
94. Choi, J.H., et al., Three-dimensional quantitative volumetry of chronic total occlusion plaque using coronary multidetector computed tomography. Circ J, 2011. 75(2): p.	Study without consistently applied reference standards / Cohort study	186	To investigate whether multidetector computed tomography (MDCT) can identify the nature of chronic total occlusion (CTO) plaque, which cannot be measured	The remodeling index decreased significantly as the duration of CTO lengthened. Volumetric plaque analysis using HU showed that volumetric fraction of calcification (>324HU) did not, but low-density plaque (<49HU) did decrease significantly as the duration of CTO lengthened. The overall PCI success	3

366-75.			quantitatively using traditional coronary angiography, and predict the success of percutaneous coronary intervention (PCI).	rate was 77.4% (144/186). In addition to the unknown or >12-month occlusion duration (odds ratio [OR]=3.0, 95% confidence interval [CI]=1.4-6.5, P=0.005), 2 MDCT parameters, that is, lesion length >18mm (OR=2.7, 95%CI=1.1-6.4, P=0.024) and segmental radiologic density >139HU (OR=2.7, 95%CI=1.2-6.4, P=0.021), were independent predictors of PCI failure on multivariate analysis. MDCT might be helpful for the prediction of successful CTO PCI. In addition to the occlusion duration, lesion length and high segmental radiologic density measured on MDCT were significant predictors of PCI failure in the present study.	
97. Garcia-Garcia, H. M., et al. (2009). "Computed tomography in total coronary occlusions (CTTO registry): radiation exposure and predictors of successful percutaneous intervention." EuroIntervention 4(5): 607-616.	Study without consistently applied reference standards / Cohort study	139	There is no mention in the current "appropriateness criteria for CTCA" of the need of CTCA investigation prior to an attempt at recanalisation of a CTO. To define better the role of CTCA in the treatment of patients with CTOs, we performed CTCA in a consecutive cohort of eligible patients who were scheduled for percutaneous recanalisation of a CTO.	Overall success rate was 62.7%. By CTCA, the occlusion length was 24.9 +/- 18.3 vs. 30.7 +/- 20.7 mm in successful and failed cases (p = 0.1), but the frequency of patients with an occlusion length >15 mm was different, i.e., 63.2% vs. 82.7%, respectively (p = 0.02). Severe calcification, (> 50% CSA) was more prevalent in failed cases (54.7% vs. 35.9%, p = 0.03). Calcification at the entry of the occlusion was present in 58.5% of the failures vs. 41.6% of the successful cases (p = 0.04), while calcium at the exit was not different. The length of calcification was 8.5 +/- 8.4 vs. 5.5 +/- 6.6 mm in the failed and successful cases respectively (p = 0.027). By multivariable analysis, the only independent	3

				predictor of procedural success was the absence of severe calcification as defined by CTCA. The mean effective radiation dose of the PCI was 39.3 +/- 30.1 mSv. The mean effective radiation dose of CT scan was 22.4 mSv: 19.2 +/- 6.5 mSv for contrast-enhanced scan, 3.2 +/- 1.7 mSv for calcium scoring scan. More severe calcified patterns, as assessed by CTCA, are seen in failed cases. The radiation exposure during a CT scan prior to a CTO PCI is considerable, and further studies are required to determine whether this extra diagnostic study is warranted.	
104. Watabe, H., et al., Impact of coronary plaque composition on cardiac troponin elevation after percutaneous coronary intervention in stable angina pectoris: a computed tomography analysis. J Am Coll Cardiol, 2012. 59(21): p. 1881-8.	Study without consistently applied reference standards / Cohort study	107	Percutaneous coronary intervention is often complicated by post-procedural myocardial necrosis manifested by elevated cardiac biomarkers. The authors used multidetector computed tomography (MDCT) to study the relation between culprit plaque characteristics and cardiac troponin T (cTnT) elevation after percutaneous coronary intervention (PCI).	Multivariate analysis showed presence of positive remodeling (remodeling index >1.05; odds ratio: 4.54; 95% confidence interval: 1.36 to 15.9; p = 0.014) and spotty calcification (odds ratio: 4.27; 95% confidence interval: 1.30 to 14.8; p = 0.016) were statistically significant independent predictors for cTnT elevation. For prediction of cTnT elevation, the presence of all 3 variables (CT attenuation value <55 HU; remodeling index >1.05, and spotty calcification) showed a high positive predictive value of 94%, and their absence showed a high negative predictive value of 90%. CONCLUSIONS: MDCT may be useful in detecting which lesions are at high risk for myocardial necrosis after PCI.	3

Evidence Table 4. Use of CT According to Different Test Results

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
13. Nieman, K., et al., Computed tomography versus exercise electrocardiography in patients with stable chest complaints: real-world experiences from a fast-track chest pain clinic. Heart, 2009. 95(20): p. 1669-75.	Well-designed cross sectional study	471 patients	To compare the diagnostic performance of CT angiography (CTA) and exercise electrocardiography (XECG) in a symptomatic population with a low-intermediate prevalence of coronary artery disease (CAD).	Results by CTA and XECG matched for 185 patients (68%, p = 0.63). Catheter angiography showed obstructive CAD in 57/98 patients (58%). Sensitivity, specificity, positive and negative predictive value of CTA to identify patients with > or =50% stenosis was 96%, 37%, 67% and 88%, respectively; compared with XECG: 71%, 76%, 80% and 66%, respectively. Quantitative CTA slightly overestimated diameter stenosis: 6 (21)% (R = 0.71), compared with QCA. Of the 312 patients (66%) with a negative CTA, 44 (14%) had a positive XECG, but only 2/17 who underwent catheter angiography had significant CAD.	2
14. Dedic, A., et al., Stable angina pectoris: head-to-head comparison of prognostic value of cardiac CT and exercise testing. Radiology, 2011. 261(2): p. 428-36.	Cohort study	471 patients	To determine and compare the prognostic value of cardiac computed tomographic (CT) angiography, coronary calcium scoring, and exercise electrocardiography (ECG)in patients with chest pain who are suspected of having coronary artery disease (CAD)	The presence of coronary calcification, obstructive CAD and nondiagnostic stress test results were univariable predictors of MACEs. In the multivariable model, CT angiography findings and nondiagnostic exercise ECG results remained independent predictors of MACEs. CT angiography findings showed incremental value beyond clinical predictors and stress testing, whereas coronary calcium scores did not have further incremental value	3
16. Arbab-Zadeh, A., et al., Diagnostic accuracy of computed tomography coronary angiography	Well-designed cross sectional study	371 patients	To assess the impact of patient population characteristics on accuracy by	Analysis of patient-based quantitative CTA accuracy revealed an AUC of 0.93 (95% confidence interval [CI]: 0.90 to 0.95). The AUC remained 0.93 (95% CI:	2

			computed tomography angiography (CTA) to detect obstructive coronary artery disease (CAD).	0.90 to 0.96) after excluding patients with known CAD but decreased to 0.81 (95% CI: 0.71 to 0.89) in patients with calcium score ≥600 (p = 0.077). While AUCs were similar (0.93, 0.92, and 0.93, respectively) for patients with intermediate, high pre-test probability for CAD, and known CAD, negative predictive values were different: 0.90, 0.83, and 0.50, respectively. Negative predictive values decreased from 0.93 to 0.75 for patients with calcium score <100 or ≥100, respectively (p = 0.053).	1
according to pre-test probability of coronary artery disease and severity of coronary arterial calcification. The CORE-64 (Coronary Artery Evaluation Using 64-Row Multidetector Computed Tomography Angiography) International Multicenter Study. J Am Coll Cardiol, 2012. 59(4): p. 379-87.					
21. Samad, Z., et al., A meta-analysis and systematic review of computed tomography angiography as a diagnostic triage tool for patients with chest pain presenting to the emergency department. J Nucl Cardiol, 2012. 19(2): p. 364-76.	Meta-analysis	386 studies	To assess clinical utility of computed tomography angiography (CTA) in the diagnosis of chest pain patients presenting to emergency departments (EDs), we conducted a meta-analysis of CTA in patients with suspected acute coronary syndromes (ACSs).	Nine studies (N = 1349) formed the data set. The pooled patient population was 52 ± 2 years of age, 51% male, with low to intermediate pretest probability for ACS. Risk factors included 12% diabetes, 42% hypertension, 35% smokers, 29% had hyperlipidemia, and 7% known CAD. ACS was subsequently diagnosed in 10% of patients. The bivariate summary estimate of sensitivity of CTA for ACS diagnosis was 95% (95% CI 88-100) and specificity was 87% (95% CI 83-92), yielding a negative likelihood ratio of 0.06 (95% CI 0-0.14) and positive likelihood ratio of 7.4 (95% CI 4.8-10). The 30-day event rate included no deaths and no additional MIs	1
44. Budoff, M.J., et al., Long-term prognosis associated with coronary calcification: observations from a registry of 25,253 patients.	Inception cohort study	25,253 patients	The purpose of this study was to develop risk-adjusted multivariable models that include risk factors and	The frequency of CAC scores was 44%, 14%, 20%, 13%, 6%, and 4% for scores of 0, 1 to 10, 11 to 100, 101 to 400, 401 to 1,000, and >1,000, respectively. During a mean follow-up of 6.8 ± 3 years, the	2

			coronary artery calcium (CAC) scores measured with electron-beam tomography in asymptomatic patients for the prediction of all-cause mortality.	death rate was 2% (510 deaths). The CAC was an independent predictor of mortality in a multivariable model controlling for age, gender, ethnicity, and cardiac risk factors (model chi-square = 2,017, p < 0.0001). The addition of CAC to traditional risk factors increased the concordance index significantly (0.61 for risk factors vs. 0.81 for the CAC score, p < 0.0001). Risk-adjusted relative risk ratios for CAC were 2.2-, 4.5-, 6.4-, 9.2-, 10.4-, and 12.5-fold for scores of 11 to 100, 101 to 299, 300 to 399, 400 to 699, 700 to 999, and >1,000, respectively (p < 0.0001), when compared with a score of 0. Ten-year survival (after adjustment for risk factors, including age) was 99.4% for a CAC score of 0 and worsened to 87.8% for a score of >1,000 (p < 0.0001).	
Journal of the American College of Cardiology, 2007. 49(18): p. 1860-1870.					
107. Maffei, E., et al., CT coronary angiography and exercise ECG in a population with chest pain and low-to-intermediate pre-test likelihood of coronary artery disease. Heart, 2010. 96(24): p. 1973-9.	Well-designed cross sectional study	177 consecutive patients	To evaluate diagnostic accuracy of exercise ECG (ex-ECG) versus 64 slice CT coronary angiography (CT-CA) for the detection of significant coronary artery stenosis in a population with low-to-intermediate pretest likelihood of coronary artery disease (CAD).	Sensitivity, specificity, positive and negative predictive values at the patient level were 100.0%,98.7%, 92.9%, 100%, respectively, for CT-CA and 46.2%, 16.6%, 8.7%, 64.1%, respectively, for ex-ECG. Agreement between CT-CA and ex-ECG was 20.9%. CTC performed equally well in men and women, while ex- ECG had a better performance in men. After considering the cut-off value of 70% for significant stenosis, the difference between CT-CA and ex-ECG remained significant (p<0.01), with a low agreement (21.5%).	2
110. Cademartiri, F., et al.,	Study without	43	To compare the role of multi	MSCT-CA increased the posttest probability of	4

Computed tomography coronary angiography vs. stress ECG in patients with stable angina. Radiol Med, 2009. 114(4): p. 513-23.	consistently applied reference standards / Cohort study	patients	slice computed tomography coronary angiography (MSCT-CA) and stress electrocardiography (ECG) in the diagnostic workup of patients with chronic chest pain.	significant CAD after a negative stress test From 50% to 86% and after a positive stress test from 88% to 100%. MSCT-CA correctly detected all patients without CAD.	
111. Bonello, L., et al., Non-invasive coronary angiography for patients with acute atypical chest pain discharged after negative screening including maximal negative treadmill stress test. A prospective study. Int J Cardiol, 2009. 134(1): p. 140-3.	Study without consistently applied reference standards / Cohort study	30 patients	To confirm the frequency of obstructive CAD in patients admitted in the ED for acute atypical chest pain and negative screening test including maximal negative treadmill stress test using a prospective design.	Seven patients (23%) had obstructive coronary artery disease on MSCT. Invasive coronary angiography (ICA) confirmed the diagnosis in all patients.	4
112. Blankstein, R., et al., Comparison of exercise treadmill testing with cardiac computed tomography angiography among patients presenting to the emergency room with chest pain: the Rule Out Myocardial Infarction Using Computer-Assisted Tomography (ROMICAT) study. Circ Cardiovasc Imaging, 2012. 5(2): p. 233-42.	Control arm of randomized trial	220 patients	To (1) examine how data from exercise treadmill testing (ETT) can identify patients who have coronary plaque or stenosis, using CT angiography (CTA) as the reference standard, and (2) identify patient characteristics that may be used in selecting ETT versus CTA.	Of the 220 patients who had ETT (mean age, 51 years; 63% men), 21 (10%) had positive results. A positive ETT had a sensitivity of 30% and specificity of 93% to detect >50% stenosis. The sensitivity increased to 83% after excluding uninterpretable segments and evaluating the ability to detect a >70% stenosis. Predictors of plaque included older age, male sex, diabetes, hypertension, hyperlipidemia, lower functional capacity, and a lower Duke Treadmill Score. Both a positive ETT and a low Duke Treadmill Score were significant univariate and multivariable predictors of stenosis	3

				>50% on CTA Whereas the prevalence of stenosis by CTA was greater among patients with more risk factors, coronary stenosis was not present among men <40 years old or women <50 years old or individuals who achieved at least 13 metabolic equivalents on ETT.	
113. Mollet, N.R., et al., Adjunctive value of CT coronary angiography in the diagnostic work-up of patients with typical angina pectoris. Eur Heart J, 2007. 28(15): p. 1872-8.	Study without consistently applied reference standards / Cohort study	62 consecutive patients	To determine the adjunctive value of CT coronary angiography (CTCA) in the diagnostic work-up of patients with typical angina pectoris.	CTCA increased the post-test probability of significant CAD after a negative exercise-ECG from 58 to 91%, and after a positive exercise-ECG from 89to 99%, while CT correctly identified patients without CAD (probability 0%).	3
114. Versteylen, M.O., et al., Combined use of exercise electrocardiography, coronary calcium score and cardiac CT angiography for the prediction of major cardiovascular events in patients presenting with stable chest pain. Int J Cardiol, 2012.	Cohort study	283 patients	To evaluate the prognostic value of the combined use of exercise-ECG and CCTA for the development of cardiovascular endpoints.	After a median follow-up of 769days, 6 ACS and 9 revascularizations were recorded. A positive exercise-ECG predicted for the combined endpoint, as well as a positive calcium score and a ≥50% stenosis on CCTA. OC-analysis showed an area under the curve (AUC) of 0.79 for exercise-ECG, which increased significantly when CCTA was added: 0.91 Multivariable Cox regression showed exercise-ECG predicted independently, as well as CCTA, but not calcium score.	3

118. de Azevedo, C.F., et al., Prognostic value of CT angiography in patients with inconclusive functional stress tests. JACC Cardiovasc Imaging, 2011. 4(7): p. 740-51.	Cohort study	529 consecutive patients	To determine the prognostic value of coronary computed tomographic angiography (CTA) in patients with inconclusive functional stress tests.	Among patients with inconclusive stress tests, the large majority (69%) did not demonstrate significant CAD by coronary CTA. During a mean follow-up of 30.1 +- 11.1 months, there were 20 (3.8%) deaths and 17 (3.2%) nonfatal myocardial infarctions. The presence of increasing degrees of obstructive CAD by CTA was an independent predictor of adverse events. Indeed, the presence of ≥50% coronary stenosis was associated with an increased risk of events. Likewise, the Duke prognostic CAD index was also found to be an independent predictor of events.	3
125. Abidov, A., et al., Clinical effectiveness of coronary computed tomographic angiography in the triage of patients to cardiac catheterization and revascularization after inconclusive stress testing: results of a 2-year prospective trial. J Nucl Cardiol, 2009. 16(5): p. 701-13.	Cohort study	199 patients	To prospectively investigate the characteristics of patients referred for CCTA after clinically inconclusive stress imaging studies, as well the effectiveness of CCTA findings in guiding the use of invasive management during the subsequent 2-year period.	None of the 93 patients with normal CCTA scans had MACE events, whereas 18 patients with evidence of CAD on the CCTA results underwent revascularization. Overall, physicians planned ICA in 125 patients (63.0%); after CCTA, ICA was performed in only 32 (16.0%) cases over 2 years. In this population with no other highly effective noninvasive clinical tools for diagnostic and prognostic estimation, the overall negative predictive value of CCTA for either CAD > 50% or MACE for 2 years was 99%.	3
126. Danciu, S.C., et al., Usefulness of multislice computed tomographic coronary angiography to identify patients with abnormal myocardial	Cohort study	421 patients	To establish whether CTA could guide the decision to use invasive coronary angiography (ICA) in patients with symptoms suggestive of	After MPSI-CTA assessment, 78 patients (18.5%) were sent for ICA and 343 (81.5%) were medically managed. Follow-up was 15+/-3 months. In the group referred for ICA, there were 50 cases of immediate revascularization, 1 non-ST-segment	3

perfusion stress in whom diagnostic catheterization may be safely avoided. Am J Cardiol, 2007. 100(11): p. 1605-8.			CAD considered at intermediate risk for cardiovascular events after myocardial perfusion stress imaging (MPSI).	elevation myocardial infarction, 1 death, and 5 patients requiring repeat ICA, 3 of whom underwent late revascularization. In the medically managed group, 6 patients required late ICA, 1 of whom underwent revascularization. In conclusion, in symptomatic patients with suspected coronary artery disease and intermediate-risk MPSI results, CTA can identify up to 80% of patients at low risk of events in whom ICA may be safely avoided.	
129. Sarwar, A., et al., Diagnostic and prognostic value of absence of coronary artery calcification. JACC Cardiovasc Imaging, 2009. 2(6): p. 675-88.	Meta-analysis	49 studies, more than 85,000 patients	To systematically assesse the diagnostic and prognostic value of absence of coronary artery calcification (CAC) in asymptomatic and symptomatic individuals.	13 studies assessed the relationship of CAC with adverse cardiovascular outcomes in 64,873 asymptomatic patients. In this cohort, 146 of 25,903 patients without CAC (0.56%) had a cardiovascular event during a mean follow-up period of 51 months. In the 7 studies assessing the prognostic value of CAC in a symptomatic population, 1.80% of patients without CAC had a cardiovascular event. Overall, 18 studies demonstrated that the presence of any CAC had a pooled sensitivity and negative predictive value of 98% and 93%, respectively, for detection of significant coronary artery disease on invasive coronary angiography. In 4,870 individuals undergoing myocardial perfusion and CAC testing, in the absence of CAC, only 6% demonstrated any sign of ischemia. Finally, 3 studies demonstrated that absence of CAC had a negative predictive value of 99% for ruling out acute coronary syndrome.	1
139. Abdulla, J., et al., Influence of	Meta-analysis	19 eligible	To determine via meta-analysis	Meta-analyses of per patient	1

coronary calcification on the diagnostic accuracy of 64-slice computed tomography coronary angiography: a systematic review and meta-analysis. Int J Cardiovasc Imaging, 2012. 28(4): p. 943-53.		studies	the diagnostic accuracy of 64-slice computed tomography coronary angiography (CTA) for assessment of significant obstructive coronary artery stenosis at different coronary artery calcium score (CACS) levels.	data comparing overall low versus high CAC Subgroups resulted in a sensitivity of 97.5 (95.5–99)% versus 97 (94.5–98.5)%, specificity of 85 (82–88)%versus 66.5 (58–74.5)%, overall accuracy of 91% versus 89% with 95% confidence interval, respectively. The drop in specificity was significant (P = 0.035), while the sensitivity and overall accuracy were insignificantly changed (P>0.05). Meta-analyses of independent subgroups at CACS levels ≤10 and ≤100 demonstrated high specificities of 90 (94–100) % and 88.5 (81–91.5) %, whereas at CACS levels ≥400 the specificity declined significantly to 42 (28–56) % but with consistently retained high sensitivity of 97.5 (94–99) %. The specificity of CTA decreases with increasing CACS, while the sensitivity remains high independent of that.	
140. Budoff MJ, Dowe D, Jollis JG, Gitter M, Sutherland J, Halamert E, Scherer M, Bellinger R, Martin A, Benton R, Delago A, Min JK. Diagnostic performance of 64-multidetector row coronary computed tomographic angiography for evaluation of coronary artery stenosis in individuals without known coronary artery disease: results	Well-designed cross sectional study	230 patients	To evaluate the diagnostic accuracy of electrocardiographically gated 64-multidetector row coronary computed tomographic angiography (CCTA) in individuals without known coronary artery disease (CAD).	On a patient-based model, the sensitivity, specificity, and positive and negative predictive values to detect ≥50% or ≥70% stenosis were 95%, 83%, 64%, and 99%, respectively, and 94%, 83%, 48%, 99%, respectively. No differences in sensitivity and specificity were noted for nonobese compared with obese subjects or for heart rates ≤65 beats/min compared with >65 beats/min, whereas calcium scores >400 reduced specificity significantly.	2

from the prospective multicenter ACCURACY (Assessment by Coronary Computed Tomographic Angiography of Individuals Undergoing Invasive Coronary Angiography) trial. J Am Coll Cardiol. 2008;52(21):1724-1732.				

Evidence Table 5. Risk Assessment in Patients without Acute Heart Disease before Non-cardiac Surgery

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
141. Fleisher, L.A., et al., ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery): Developed in Collaboration With the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. Circulation, 2007. 116(17): p. 1971-96.	Guideline/ Mechanism based reasoning				5
149. Chae, W.Y., et al., Clinical	Cohort study	247	Patients with advanced liver	Of the 247 patients evaluated, 27 (10.9%) showed	3

value of preoperative coronary risk assessment by computed tomographic arteriography prior to adult living donor liver transplantation. Transplant Proc, 2012. 44(2): p. 415-7.		patients	diseases are at increased risk of cardiovascular events, resulting in a higher incidence of cardiac complications following liver transplantation (OLT). We assessed the clinical value of computed tomographic coronary arteriography (CTCAG) as a routine preoperative cardiac evaluation test in adult patients scheduled for living donor OLT (LDLT).	abnormal findings on CTCAG, with 18 (7.3%) showing mild to moderate involvement of one vessel; 7 (2.8%), two-vessel; and 2 (0.8%), three-vessel involvement. Coronary artery calcification was identified in patients with significant coronary artery stenosis. No adverse events occurred after CTCAG. Noticeable hypotensive episodes during LDLT surgery occurred in 5% of patients, mostly related to massive bleeding or post-perfusion syndrome. During the first 3 months after LDLT, 3% of patients showed stress cardiomyopathy, but all recovered with supportive care.	
150. Abir, F., I. Kakisis, and B. Sumpio, Do vascular surgery patients need a cardiology work-up? A review of pre-operative cardiac clearance guidelines in vascular surgery. Eur J Vasc Endovasc Surg, 2003. 25(2): p. 110-7.	Review		To outline the appropriate pre-operative cardiac work-up for patients who are scheduled for major peripheral vascular surgery.	Peri-operative beta blockade has been shown to decrease cardiac complications after vascular surgery in all risk groups. Non-invasive cardiac testing is only necessary for patients in the intermediate/high risk group. Coronary revascularization should only be considered after a positive non-invasive cardiac test.	5

Evidence Table 6. Risk assessment after coronary revascularization

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
157. Hamon, M., et al., Diagnostic performance of 16- and 64-section spiral CT for coronary artery bypass graft assessment: meta-analysis. Radiology, 2008. 247(3): p. 679-86.	Meta-analysis	15 studies, 723 patients	To perform a meta-analysis to evaluate the accuracy of 16- and 64-section spiral computed tomography (CT) to help assess coronary artery bypass grafts (CABGs).	Of 158 screened articles, 15 fulfilled all inclusion criteria. Graft assessability (including distal anastomosis) ranged from 78%–100% among all included studies (mean, 92.4%; 90% with 16- and 96% with 64-section CT; P < .001). Statistical heterogeneity was observed for specificity and positive likelihood ratio (LR), justifying the use of the random-effects model. The analysis, pooled from 15 studies (723 patients, 2023 CABGs), provided the following results for the assessment of graft obstruction (occlusion and >50% stenosis): sensitivity, 97.6% (95% confidence interval [CI]: 96%, 98.6%); specificity, 96.7% (95% CI: 95.6%, 97.5%); positive predictive value, 92.7% (95% CI: 90.5%, 94.6%); negative predictive value, 98.9% (95% CI: 98.2%, 99.4%); positive LR, 23.42 (95% CI: 13.69, 40.07); negative LR, 0.045 (95% CI: 0.028, 0.071); and diagnostic odds ratio, 780.32 (95% CI: 379.12, 1606.1).	1
160. Jones, C.M., et al., Multi-detector computed tomography in coronary artery bypass graft assessment: a meta-analysis. Ann	Meta-analysis	13studies	This aim of this meta-analysis is to determine the diagnostic accuracy of 8-slice, 16-slice, and 64-slice MDCT versus angiography in the diagnosis	The literature search identified 168 articles using the MeSH headings, related articles function, and reference review. Further studies were included as citations became available. Fifteen studies were selected for inclusion using retrospective	1

| Thorac Surg, 2007. 83(1): p. 341-8. | | | of graft occlusion and stenosis. The effects of beta blocker administration, symptomatic status, and postoperative period are also analyzed. The increasingly direct diagnostic role of the cardiac surgeon is discussed, in the context of current and emerging MDCT capabilities, which provides a noninvasive alternative to angiography. | electrocardiogram gating to optimize image quality, although the number and timing of reconstructions varied. Information on scan time, heart rate, and patient age was incompletely present. Tube modulation was used in later studies. Quantitative coronary assessment was used in angiography protocols in 12 studies rather than visual assessment, which tends to overestimate the degree of luminal narrowing. All but three studies reported results based on multiple readers, reporting in consensus or independently. Thirteen studies of 1,791 grafts were included. One study provided results on a per segment basis and was excluded from the analysis. The calculated positive predictive value was 93.6% (95% confidence interval, 90.5% to 96.0%) and the negative predictive value was 99.4% (95% confidence interval, 98.9% to 99.8%) for diagnosis of occlusion. The summary receiver operating characteristic curve (for occlusion) for the 13 studies is shown in Figure 1. Subgroup analysis of arterial and venous grafts was performed. Beta blockers, ischemic symptoms, and postoperative period did not significantly affect accuracy. | |
| 161. Sun, Z. and A.M.D. Almutairi, Diagnostic accuracy of 64 multislice CT angiography in the | Meta-analysis | 14 studies | The aim of this study was to perform a meta-analysis of the diagnostic accuracy of 64-slice | Fourteen studies met selection criteria for inclusion in the analysis. The mean value of assessable stents was 89%. Prevalence of in-stent restenosis following | 1 |

assessment of coronary in-stent restenosis: a meta-analysis. European journal of radiology, 2010. 73(2): p. 266-273.			CT angiography for the detection of coronary in-stent restenosis in patients treated with coronary stents when compared to conventional coronary angiography	coronary stenting was 20% among these studies. Pooled estimates of the sensitivity and specificity of overall 64-slice CT angiography for the detection of coronary in-stent restenosis was 90% (95% CI: 86%, 94%) and 91% (95% CI: 90%, 93%), respectively, based on the evaluation of assessable stents. Diagnostic value of 64-slice CT angiography was found to decrease significantly when the analysis was performed with inclusion of nonassessable segments in five studies, with pooled sensitivity and specificity being 79% (95% CI: 68%, 88%) and 81% (95% CI: 77%, 84%). Stent diameter is the main factor affecting the diagnostic value of 64-slice CT angiography.	
162. Sun, Z., R. Davidson, and C.H.S. Lin, Multi-detector row CT angiography in the assessment of coronary in-stent restenosis: a systematic review. European journal of radiology, 2009. 69(3): p. 489-495.	Systematic review	15 studies	The aim of this study was to perform a systematic review of the diagnostic accuracy of multi-detector row computed tomography angiography (MDCT) for detection of coronary in-stent restenosis in patients treated with coronary stenting when compared to invasive catheter angiography.	15 studies met selection criteria for inclusion in the analysis. There were eight studies performed with 16-detector row CT scanners, and five studies with 64-detector row scanners and one study with a 40-detector scanner. The remaining study was performed with a mixture of 16-and 64-detector row scanners. Prevalence of in-stent restenosis following coronary stenting was 18% (95% CI: 13, 24%). Pooled estimates of the sensitivity and specificity of overall MDCT angiography for the detection of coronary in-stent restenosis was 85% (95% CI: 78, 90%) and 97% (95% CI: 95, 98%), respectively. No significant difference was found between 16- and 64-detector row scanners	1

				regarding the sensitivity and specificity of MDCT for assessment of in-stent restenosis (p > 0.05).	
177. Van Mieghem, C.A.G., et al., Multislice spiral computed tomography for the evaluation of stent patency after left main coronary artery stenting. Circulation, 2006. 114(7): p. 645-653.	Well-designed cross sectional study	74 patients	Surveillance conventional coronary angiography (CCA) is recommended 2 to 6 months after stent-supported left main coronary artery (LMCA) percutaneous coronary intervention due to the unpredictable occurrence of in-stent restenosis (ISR), with its attendant risks. We evaluated the diagnostic performance of high-resolution MSCT to detect ISR after stenting of the LMCA.	Overall, the accuracy of MSCT for detection of angiographic ISR was 93%. The sensitivity, specificity, and positive and negative predictive values were 100%, 91%, 67%, and 100%, respectively. When analysis was restricted to patients with stenting of the LMCA with or without extension into a single major side branch, accuracy was 98%. When both branches of the LMCA bifurcation were stented, accuracy was 83%. For the assessment of stent diameter and area, MSCT showed good correlation with intravascular ultrasound (r=0.78 and 0.73, respectively). An intravascular ultrasound threshold value ≥1 mm was identified to reliably detect in-stent neointima hyperplasia with MSCT.	2
178. Veselka, J., et al., Dual-source CT angiography for detection and quantification of in-stent restenosis in the left main coronary artery: comparison with intracoronary ultrasound and coronary angiography. Journal of Invasive Cardiology, 2011. 23(11): p. 460.	Well-designed cross sectional study	51	The aim of this study was to evaluate the diagnostic accuracy of dual-source computed tomography coronary angiography (CTCA) compared to coronary angiography (CAG) and intravascular ultrasound (IVUS) for detection and quantification of in-stent	Sensitivity, specificity, and positive and negative predictive values were 100%, 94%, 50%, and 100% for CAG, respectively, and 100%, 74%, 18%, and 100% for CTCA, respectively. There was a correlation between the minimal luminal areas (MLA) measured by CTCA and IVUS (r = 0.63; P<.01). A Bland-Altman analysis showed that the MLA measured by CTCA was underestimated (mean difference, 2.14 ± 2.24 mm²).	2

			restenosis after left main (LM) coronary artery stenting		

Evidence Table 7. Evaluation of Heart Structure and Function

Reference	Study type	Patients	Purpose of Study	Study Results	Level of Study
179. Kim, S.Y., et al., Coronary artery anomalies: classification and ECG-gated multi-detector row CT findings with angiographic correlation. Radiographics, 2006. 26(2): p. 317-33; discussion 333-4.	Systematic review		The recent development of ECG-gated multi-detector row CT allows accurate and noninvasive depiction of coronary artery anomalies of origin, course, and termination. Multi-detector row CT is superior to conventional angiography in delineating the ostial origin and proximal path of an anomalous coronary artery. Familiarity with the CT appearances of various coronary artery anomalies and an understanding of the clinical significance of these anomalies are essential in making a correct diagnosis and planning patient treatment.		1
183. Cademartiri, F., et al., Prevalence of anatomical variants and coronary anomalies in 543 consecutive patients studied with 64-slice CT coronary angiography.	Case series	543	To assess the prevalence of variants and anomalies of the coronary artery tree in patients who underwent 64-slice computed tomography	The coronary dominance pattern results were: right, 86.6%; left, 9.2%; balanced, 4.2%. The left main coronary artery had a mean length of 112 +/- 55 mm. The intermediate branch was present in the 21.9%. A variable number of diagonals (one, 25%;	4

Eur Radiol, 2008. 18(4): p. 781-91.			coronary angiography (CT-CA) for suspected or known coronary artery disease.	two, 49.7%; more than two, 24%; none, 1.3%) and marginals (one, 35.2%; two, 46.2%; more than two, 18%; none, 0.6%) was visualized. Furthermore, CT-CA may visualize smaller branches such as the conus branch artery (98%), the sinus node artery (91.6%), and the septal branches (93%). Single or associated coronary anomalies occurred in 18.4% of the patients, with the following distribution: 43 anomalies of origin and course, 68 intrinsic anomalies (59 myocardial bridging, nine aneurisms), three fistulas.	
187. Lee, H.J., et al., Anomalous origin of the right coronary artery from the left coronary sinus with an interarterial course: subtypes and clinical importance. Radiology, 2012. 262(1): p. 101-8.	Cohort study	87	To classify anomalous origins of the right coronary artery (RCA) from the left coronary sinus (AORL) with an interarterial course into two subtypes and to evaluate the clinical importance of each.	After excluding patients with combined cardiac disease, 87 patients (51 [59%] men, 36 [41%] women; mean age, 56.0 years) were enrolled. Of the 87 patients, 53 had a high interarterial course and 34 had a low interarterial course. A significant difference in the prevalence of typical angina (high [43%] vs low [6%], P = .001) and MACE (high [28%] vs low [6%], P = .012) was observed between the two subtypes. For patients with a high interarterial course, the odds ratio for typical angina was 12.3 (95% confidence interval: 2.7, 56.6), and the odds ratio for MACE was 6.3 (95% confidence interval: 1.3, 29.7). CONCLUSION: The prevalence of typical angina and that of MACE were significantly higher in patients with a high interarterial course than in those with a low interarterial course.	3

193. Leschka, S., et al., Pre- and postoperative evaluation of congenital heart disease in children and adults with 64-section CT. Radiographics, 2007. 27(3): p. 829-46.	Systematic review		To accurately document and interpret the altered flow conditions in patients with congenital heart disease, knowledge of the wide spectrum of surgical procedures and familiarity with the dedicated protocols for performing 64-section CT are needed.		1
198. Spevak, P.J., P.T. Johnson, and E.K. Fishman, Surgically corrected congenital heart disease: utility of 64-MDCT. AJR Am J Roentgenol, 2008. 191(3): p. 854-61.	Systematic review		To review the CT appearance of postoperative morphology and complications after surgical correction of congenital heart anomalies.	Echocardiography is typically the initial imaging technique used for congenital heart disease; however, some thoracic regions are beyond the imaging scope of echocardiography, particularly after surgical revision. This article shows, through a series of illustrative cases, the usefulness of 64-MDCT in these patients.	1
199. Hayabuchi, Y., et al., Polytetrafluoroethylene graft calcification in patients with surgically repaired congenital heart disease: evaluation using multidetector-row computed tomography. Am Heart J, 2007. 153(5): p. 806 e1-8.	Cross sectional study	47	To assess the feasibility of multidetector-row computed tomography (MDCT) for the evaluation of PTFE calcification in patients with surgically repaired congenital heart disease and to evaluate the development and characteristics of calcification for specific surgical procedures.	Calcification of prosthetic PTFE was detected in 5 of 29 cases (17%) for ventricular septal defect (VSD) patches, 26 of 32 (81%) for right ventricular outflow tract (RVOT) prosthesis, 2 of 8 (25%) for atrial septal patches of the Fontan procedure, and 7 of 7 (100%) for extracardiac conduits of total cavopulmonary connection. The CT attenuation of PTFE revealed significantly different values for VSD patches (114 +/- 61 Hounsfield units [HU]), RVOT prosthesis (243 +/- 132 HU), atrial septal patches (163 +/- 161 HU), and extracardiac conduits (230 +/- 29 HU) (P	3

				< .0001). The CT density value of VSD patches was significantly lower than those of RVOT grafts and extracardiac conduits (P < .05). The MDCT findings were consistent with histologic analysis in the evaluation of calcification.	
203. Juergens, K.U. and R. Fischbach, Left ventricular function studied with MDCT. Eur Radiol, 2006. 16(2): p. 342-57.	Systematic review		To discuss the diagnostic potential of MDCT for assessment of LV function with regards to accuracy and clinical applications, as well as limitations, particularly in comparison with CMR as modality of reference.	Cardiac function assessment with MDCT is on the cusp of entering clinical routine, as multiple studies have demonstrated that the determination of LV volumes and consequently global LV function parameters is feasible in good agreement with established and clinically widely used imaging modalities such as cine ventriculography, echocardiography, and CMR.	1
205. Greupner, J., et al., Head-to-head comparison of left ventricular function assessment with 64-row computed tomography, biplane left cineventriculography, and both 2- and 3-dimensional transthoracic echocardiography: comparison with magnetic resonance imaging as the reference standard. J Am Coll Cardiol, 2012. 59(21): p. 1897-907.	Well-designed cross sectional study	36	To compare the accuracy of 64-row CT, invasive cine ventriculography, 2-dimensional Echo, and 3-dimensional Echo for LV function assessment with MRI.	64-row CT may be more accurate than CVG, 2D Echo, and 3D Echo in comparison with MRI as the reference standard for assessment of global LV function.	2
211. Guo, Y.K., et al., Accuracy and reproducibility of assessing right ventricular function with 64-section multi-detector row CT:	Well-designed cross sectional study	47	To evaluate whether the 64-MDCT can assess RV function with high accuracy and reproducibility when compared	ECG-gated 64-MDCT can assess the RV function with high accuracy and reproducibility without geometric assumptions about right ventricle.	2

comparison with magnetic resonance imaging. Int J Cardiol, 2010. 139(3): p. 254-62.			to the results with those of MRI.		
212. Maffei, E., et al., Left and right ventricle assessment with Cardiac CT: validation study vs. Cardiac MR. Eur Radiol, 2012. 22(5): p. 1041-9.	Well-designed cross sectional study	79	To compare Magnetic Resonance (MR) and Computed Tomography (CT) for the assessment of left (LV) and right (RV) ventricular functional parameters.	Cardiac CT provides accurate and reproducible LV and RV volume parameters compared with MR, and can be considered as a reliable alternative for patients who are not suitable to undergo MR. KEY POINTS: Cardiac-CT is able to provide Left and Right Ventricular function. Cardiac-CT is accurate as MR for LV and RV volume assessment. Cardiac-CT can provide accurate evaluation of coronary arteries and LV and RV function.	2
213. Sugeng, L., et al., Multimodality comparison of quantitative volumetric analysis of the right ventricle. JACC Cardiovasc Imaging, 2010. 3(1): p. 10-8.	Well-designed cross sectional study	28	We undertook volumetric analysis of the right ventricle (RV) by real-time 3-dimensional echocardiography (RT3DE), cardiac magnetic resonance (CMR), and cardiac computed tomography (CCT) on images obtained in RV-shaped phantoms and in patients with a wide range of RV geometry.	The in vitro measurements showed that: 1) volumetric analysis of CMR images yielded the most accurate measurements; 2) CCT measurements showed slight (4%) but consistent overestimation; and 3) RT3DE measurements showed small underestimation, but considerably wider margins of error. In humans, both RT3DE and CCT measurements correlated highly with the CMR reference (r=0.79 to 0.89) and showed the same trends of underestimation and overestimation noted in vitro. All interobserver and intraobserver variability values were <14%, with those of CMR being the highest.	2
214. Bomma, C., et al., Evolving role of multidetector computed tomography in evaluation of	Cross sectional study	31	To report 1 center's experience with MDCT in the evaluation of patients suspected to have	RV dilatation/dysfunction is 1 of the most important criteria for establishing the diagnosis of ARVD/C. Cardiac magnetic resonance imaging (MRI) is the	3

arrhythmogenic right ventricular dysplasia/cardiomyopathy. Am J Cardiol, 2007. 100(1): p. 99-105.			arrhythmogenic right ventricular (RV) dysplasia/cardiomyopathy (ARVD/C).	most preferred imaging modality for the diagnosis of ARVD/C. In conclusion, cardiac MDCT has a strong potential to detect many qualitative and quantitative abnormalities of the right ventricle in patients with ARVD/C. Limitations include implantable cardioverter-defibrillators and motion artifacts, along with well-known radiation and contrast-induced reaction.	
215. Kimura, F., et al., Myocardial fat at cardiac imaging: how can we differentiate pathologic from physiologic fatty infiltration? Radiographics, 2010. 30(6): p. 1587-602.	Systematic Review		Pathologic conditions with myocardial fat include healed myocardial infarction (MI); arrhythmogenic RV cardiomyopathy or dysplasia (ARVC); and others, such as cardiac lipoma, lipomatous hypertrophy of the interatrial septum, tuberous sclerosis complex, dilated cardiomyopathy, and cardiomyopathy with muscular dystrophy.	Recognition of patient age, characteristic locations of myocardial fat, myocardial thickness, and ventricular size helps in differentiating physiologic and pathologic myocardial fat at cardiac imaging; findings of wall motion abnormality and late gadolinium enhancement at MR imaging help narrow the diagnosis.	1
217. Goetti, R., et al., Delayed enhancement imaging of myocardial viability: low-dose high-pitch CT versus MRI. Eur Radiol, 2011. 21(10): p. 2091-9.	Well-designed cross sectional study	24	To evaluate the accuracy of high-pitch delayed enhancement (DE) CT for the assessment of myocardial viability with MRI as the reference standard.	CTDE imaging in the high-pitch mode enables myocardial viability assessment at a low radiation dose and good accuracy compared with MR, although associated with a lower CNR and higher noise.	3

| 218. Krombach, G.A., et al., Characterization of myocardial viability using MR and CT imaging. Eur Radiol, 2007. 17(6): p. 1433-44. | Case series | | Cardiovascular magnetic resonance (MR) imaging is of proven clinical value for the noninvasive characterization of myocardial viability. Computed tomography (CT) is also being exploited for this indication. Examples of each of these imaging strategies for the assessment of myocardial viability will be provided in this review. | Key MRI concepts and practical considerations such as customized MR imaging techniques and tailored imaging protocols dedicated to viability assessment are outlined with the primary focus on recent developments. Clinical applications of MR-based viability assessment are reviewed, ranging from rapid functional cine imaging to tissue characterization using T2-weighted imaging and T1-weighted late-contrast-enhanced imaging. Next, the merits and limitations of state-of-the-art CT imaging are surveyed, and their implications for viability assessment are considered. The final emphasis is on current trends and future directions in noninvasive viability assessment using MRI and CT. | 4 |
| 219. Nikolaou, K., et al., Assessment of myocardial perfusion and viability from routine contrast-enhanced 16-detector-row computed tomography of the heart: preliminary results. Eur Radiol, 2005. 15(5): p. 864-71. | Well-designed cross sectional study | 30 | To assess the diagnostic accuracy of 16-detector-row computed tomography (16DCT) of the heart in the assessment of myocardial perfusion and viability in comparison to stress perfusion magnetic resonance imaging (SP-MRI) and delayed-enhancement magnetic resonance imaging (DE-MRI). A number of 30 patients underwent both 16DCT and MRI of the heart. | According to MRI, myocardial infarctions were detected in 11 of 30 cases, and perfusion defects not corresponding to an MI were detected in six of 30 patients. CTA was able to detect ten of 11 MI correctly (sensitivity 91%, specificity 79%, accuracy 83%), and detected three of six hypoperfusions correctly (sensitivity 50%, specificity 92%, accuracy 79%). Assessing the volume of perfusion defects correlating to history of MI on the CT images, a systematic underestimation of the true infarct size as compared to the results of DE-MRI was found (P<0.01). Routine, contrast-enhanced 16-detector row CT of the heart can detect chronic myocardial infarctions in the majority of cases, but ischemic | 3 |

				perfusion defects are not reliably detected under resting conditions.	
221. Sato, A., et al., Early validation study of 64-slice multidetector computed tomography for the assessment of myocardial viability and the prediction of left ventricular remodelling after acute myocardial infarction. Eur Heart J, 2008. 29(4): p. 490-8.	Cohort study	52	To validate the ability of multidetector computed tomography (MDCT) for assessing myocardial viability and predicting left ventricular (LV) remodelling after acute myocardial infarction (AMI).	Among the 52 patients, 18 patients (Group A) showed transmural contrast-delayed enhancement on MDCT images, 20 patients (Group B) showed subendocardial contrast-delayed enhancement, and 14 patients (Group C) had no contrast-delayed enhancement. In the acute phase, peak creatine kinase-MB [497 (189-744), 182 (90-358), 85 (40-204) IU/mL, respectively, P = 0.0004] was significantly higher in Group A, while the incidence of myocardial blush grade 3 (22, 67, 75%, respectively, P = 0.001) and LV ejection fraction (41 +/- 7, 53 +/- 12, 62 +/- 11%, respectively, P < 0.0001) were significantly lower in Group A. During the 6-month period, LV remodelling (P = 0.001) and the number of rehospitalization for heart failure (P = 0.0017) were more significantly observed in Group A.	3
222. Thilo, C., et al., Integrative computed tomographic imaging of cardiac structure, function, perfusion, and viability. Cardiol Rev, 2010. 18(5): p. 219-29.	Review; Mechanism-based reasoning		The use of MDCT for simultaneous assessment of coronary artery stenosis, atherosclerotic plaque formation, ventricular function, myocardial perfusion, and viability with a single modality is under intense investigation.	Recent technical developments hold promise for accomplishing this goal and establishing MDCT as a comprehensive stand-alone test for integrative imaging of coronary heart disease	5
225. Shah, R.G., et al., Aortic valve area: meta-analysis of diagnostic	Meta-Analysis	9 studies	Degenerative aortic valve stenosis (AS) has an incidence	Major criteria for article inclusion was the use of (a) multi-detector computed tomography as a	1

performance of multi-detector computed tomography for aortic valve area measurements as compared to transthoracic echocardiography. Int J Cardiovasc Imaging, 2009. 25(6): p. 601-9.			of 2-7% in the Western European and North American populations over 65 years of age. The aim of this study was to perform a meta-analysis of the published literature evaluating the accuracy of CT planimetry to measure the aortic valve area. The PUBMED and OVID databases were searched up to May 2008.	diagnostic test for the assessment of AVA in patients with AS, and (b) TTE as the reference standard. Nine studies were included in the analysis with 175 women and 262 men. The mean AVA as measured by CT was 1.0 +/- 0.1. The mean AVA measured by TTE was 0.9 +/- 0.1. The correlation between CT and TTE AVA measurements was r = 1.45. The mean difference was 0.03 +/- 0.05. The results of our meta-analysis suggest that multi-detector CT is an accurate method for obtaining AVA measurements in patients with AS.	
228. Chen, J.J., et al., CT angiography of the cardiac valves: normal, diseased, and postoperative appearances. Radiographics, 2009. 29(5): p. 1393-412.	Systematic review		CT angiography allows excellent visualization of the morphologic features and function of the normal valves, as well as of a wide range of valve diseases, including congenital and acquired diseases, infectious endocarditis, and complications of valve replacement.	Nevertheless, with further development of related imaging techniques, CT angiography can be expected to play an increasingly important role in the evaluation of the cardiac valves.	1
231. Delgado, V., et al., Transcatheter aortic valve implantation: role of multi-detector row computed tomography to evaluate prosthesis positioning and deployment in	Cohort study	53	The present evaluation studied the anatomic and morphological features of the aortic valve annulus that may predict aortic regurgitation after TAVI.	In 53 patients with severe aortic stenosis undergoing TAVI, multi-detector row computed tomography (MDCT) assessment of the aortic valve apparatus was performed. For aortic valve annulus sizing, two orthogonal diameters were measured (coronal and sagittal). In addition, the extent of	3

relation to valve function. Eur Heart J, 2010. 31(9): p. 1114-23.				valve calcifications was quantified. At 1-month follow-up after procedure, MDCT was repeated to evaluate and correlate the prosthesis deployment to the presence of aortic regurgitation. Successful procedure was achieved in 48 (91%) patients. At baseline, MDCT demonstrated an ellipsoid shape of the aortic valve annulus with significantly larger coronal diameter when compared with sagittal diameter (25.1 +/- 2.4 vs. 22.9 +/- 2.0 mm, P < 0.001). At follow-up, MDCT showed a non-circular deployment of the prosthesis in six (14%) patients. Moderate post-procedural aortic regurgitation was observed in five (11%) patients. These patients showed significantly larger aortic valve annulus (27.3 +/- 1.6 vs. 24.8 +/- 2.4 mm, P = 0.007) and more calcified native valves (4174 +/- 1604 vs. 2444 +/- 1237 HU, P = 0.005) at baseline and less favourable deployment of the prosthesis after TAVI.	
232. Jilaihawi, H., et al., Cross-sectional computed tomographic assessment improves accuracy of aortic annular sizing for transcatheter aortic valve replacement and reduces the incidence of paravalvular aortic regurgitation. J Am Coll Cardiol, 2012. 59(14): p. 1275-86.	Study without consistently applied reference standards	136	To critically analyze and compare the predictive value of multiple measures of the aortic annulus for post-TAVR paravalvular (PV) regurgitation and then assess the impact of a novel cross-sectional computed tomographic (CT) approach to annular sizing.	In receiver-operating characteristic models, cross-sectional CT parameters had the highest discriminatory value for post-TAVR PV regurgitation: This was with the area under the curve for [maximal cross-sectional diameter minus prosthesis size] of 0.82 (95% confidence interval: 0.69 to 0.94; p < 0.001) and that for [circumference-derived cross-sectional diameter minus prosthesis size] of 0.81 (95% confidence interval: 0.7 to 0.94; p < 0.001). In contrast, traditional echocardiographic measures	3

				were nondiscriminatory in relation to post-TAVR PV aortic regurgitation. The prospective application of a CT-guided annular sizing approach resulted in less PV aortic regurgitation of grade worse than mild after TAVR (7.5% vs. 21.9%; p = 0.045).	
233. Willson, A.B., et al., 3-dimensional aortic annular assessment by multidetector computed tomography predicts moderate or severe paravalvular regurgitation after transcatheter aortic valve replacement: a multicenter retrospective analysis. J Am Coll Cardiol, 2012. 59(14): p. 1287-94.	Study without consistently applied reference standards	109 patients	To analyze MDCT 3-dimensional aortic annular dimensions for the prediction of paravalvular aortic regurgitation (PAR) following transcatheter aortic valve replacement (TAVR)	Moderate or severe PAR (13 of 102) was associated with THV undersizing (THV diameter - mean diameter = -0.7 +/- 1.4 mm vs. 0.9 +/- 1.8 mm for trivial to mild PAR, p < 0.01). The difference between THV size and MDCT annular size was predictive of PAR (mean diameter: area under the curve [AUC]: 0.81, 95% confidence interval [CI]: 0.68 to 0.88; area: AUC: 0.80, 95% CI: 0.65 to 0.90; circumference: AUC: 0.76, 95% CI: 0.59 to 0.91). Annular eccentricity was not associated with PAR (AUC: 0.58, 95% CI: 0.46 to 0.75). We found that 35.3% (36 of 102) and 45.1% (46 of 102) of THVs were undersized relative to the MDCT mean diameter and area, respectively. THV oversizing relative to the annular area was not associated with THV eccentricity or underexpansion (oversized vs. undersized THVs; expansion: 102.7 +/- 5.3% vs. 106.1 +/- 5.6%, p = 0.03; eccentricity: median: 1.7% [interquartile range: 1.4% to 3.0%] vs. 1.7% [interquartile range: 1.1% to 2.7%], p = 0.28)	3
237. Symersky, P., et al., Comparison of multidetector-row computed tomography to	Study without consistently applied	13	Our objective was to evaluate whether multidetector-row computed tomographic	Multidetector-row computed tomography disclosed a morphologic substrate for obstruction in 8 of 13 patients. MDCT findings compatible with obstruction	3

echocardiography and fluoroscopy for evaluation of patients with mechanical prosthetic valve obstruction. Am J Cardiol, 2009. 104(8): p. 1128-34.	reference standards		(MDCT) imaging could detect the morphologic substrate for such functional abnormalities.	were confirmed at surgery or autopsy in 6 patients. In a seventh patient, incomplete leaflet closure found with multidetector-row computed tomography was confirmed at surgery. The most commonly identified causes for obstruction were subprosthetic tissue (6 patients) and abnormal anatomic orientation (3 patients). Despite an indication for surgery, 2 patients were not operated on due to recurrent bacteremias and prohibitive co-morbidity. Multidetector-row computed tomography detected leaflet motion restriction in 7 patients compared to 4 by fluoroscopy. Confirmation of leaflet restriction was available in 5 patients. Multidetector-row computed tomography missed a periprosthetic leak.	
238. Tsai, I.C., et al., Correctness of multi-detector-row computed tomography for diagnosing mechanical prosthetic heart valve disorders using operative findings as a gold standard. Eur Radiol, 2009. 19(4): p. 857-67.	Study without consistently applied reference standards	25	The purpose was to compare the findings of multi-detector computed tomography (MDCT) in prosthetic valve disorders using the operative findings as a gold standard.	Prosthetic valve disorders were suspected in 12 patients by either MDCT or TTE. Six patients received an operation that included three redo aortic valve replacements, two redo mitral replacements and one Amplatzer ductal occluder occlusion of a mitral paravalvular leak. The concordance of MDCT for diagnosing and localizing prosthetic valve disorders and the surgical findings was 100%. Except for images impaired by severe beam-hardening artifacts, MDCT provides excellent delineation of prosthetic valve disorders.	3
239. Habets, J., et al., Prosthetic heart valve assessment with	Study without consistently	84	We assessed the image quality of different prosthetic heart	Eighty-four CT examinations (66 cardiac, 18 limited-dose aortic protocols) of 83 patients with a total of	4

multidetector-row CT: imaging characteristics of 91 valves in 83 patients. Eur Radiol, 2011. 21(7): p. 1390-6.	applied reference standards		valve (PHV) types to determine which valves are suitable for MDCT evaluation.	91 PHVs in the aortic (n = 71), mitral (n = 17), pulmonary (n = 1) and tricuspid (n = 2) position were included. CT was performed on a 16-slice (n = 4), 64-slice (n = 28) or 256-slice (n = 52) MDCT system. Median image quality scores for the supra-, peri- and subvalvular regions and valvular detail were (3.5, 3.3, 3.5 and 3.5, respectively) for bileaflet PHV; (3.0, 3.0, 3.5 and 3.0, respectively) for Medtronic Hall PHV; (1.0, 1.0, 1.0 and 1.0, respectively) for Bjork-Shiley and Sorin monoleaflet PHV and (3.5, 3.5, 4.0 and 2.0 respectively) for biological PHV.	
243. Anavekar, N.S., et al., Computed tomography of cardiac pseudotumors and neoplasms. Radiol Clin North Am, 2010. 48(4): p. 799-816.	Systematic review		Important features of cardiac masses can be clearly delineated on cardiac computed tomography (CT) imaging.	This modality is useful in identifying the presence of a mass, its relationship with cardiac and extracardiac structures, and the features that distinguish one type of mass from another. A multimodality approach to the evaluation of cardiac tumors is advocated, with the use of echocardiography, CT imaging and magnetic resonance imaging as appropriately indicated. In this article, various cardiac masses are described, including pseudotumors and true cardiac neoplasms, and the CT imaging findings that may be useful in distinguishing these rare entities are presented.	1
244. Hur, J., et al., Dual-enhanced cardiac CT for detection of left atrial appendage thrombus in patients with stroke: a prospective	Well-designed cross sectional study	83	To assess the diagnostic performance of a dual-enhanced cardiac CT protocol for detection of left atrial	Among the 83 patients, a total of 13 thrombi combined with spontaneous echo contrast and 14 spontaneous echo contrasts were detected by transesophageal echocardiography. All 13 thrombi	2

comparison study with transesophageal echocardiography. Stroke, 2011. 42(9): p. 2471-7.			appendage thrombi and for differentiation between thrombus and circulatory stasis in patients with stroke.	combined with spontaneous echo contrast were correctly diagnosed on CT. Using transesophageal echocardiography as the reference standard, the overall sensitivity and specificity of CT for the detection of thrombi and circulatory stasis in the left atrial appendage were 96% (95% CI, 78% to 99%), and 100% (95% CI, 92% to 100%), respectively. On CT, the mean left atrial appendage/ascending aorta Hounsfield unit ratios were significantly different between thrombus and circulatory stasis (0.15 Hounsfield unit versus 0.27 Hounsfield unit, P=0.001). The mean effective radiation dose was 3.11 mSv.	
246. Verhaert, D., et al., The role of multimodality imaging in the management of pericardial disease. Circ Cardiovasc Imaging, 2010. 3(3): p. 333-43.	Systematic review		To discuss the potential role of different imaging modalities in the diagnosis and management of pericardial disorders, with a specific focus on what constitutes a rational multimodality imaging approach.	Continuous advances in cardiac CT and CMR technology allow excellent visualization and characterization of pericardial pathology, making these tomographic techniques complimentary to echocardiography. An integrated multimodality imaging strategy is sometimes needed to answer specific clinical questions, but the rational use of such an approach also requires good knowledge of the strengths and limitations of each technique	1
252. Saremi, F. and M. Tafti, The role of computed tomography and magnetic resonance imaging in ablation procedures for treatment of atrial fibrillation. Semin Ultrasound CT MR, 2009. 30(2): p.	Systematic review		Understanding the morphological characteristics of the left atrium (LA) and pulmonary veins (PV) in detail and identification of its anatomic variants is crucial to	Multi-dimentional computed tomography and magnetic resonance angiography are invaluable techniques for better visualization of the anatomic landmarks that are essential for cardiac ablation procedures as well as prompt diagnosis and, in selected cases, prevention of procedure-related	1

125-56.			perform a successful ablation procedure and minimize complications.	complications. Some of the complications of ablation procedures may include cardiac tamponade, PV stenosis, as well as esophageal and phrenic nerve injuries.	
253. Abbara, S., et al., Noninvasive evaluation of cardiac veins with 16-MDCT angiography. AJR Am J Roentgenol, 2005. 185(4): p. 1001-6.	Study without consistently applied reference standards	54	Anatomic mapping of the cardiac veins is important to guide transvenous therapeutic procedures such as biventricular pacing. As an alternative to invasive venography, we studied the feasibility of MDCT of the cardiac venous anatomy.	Cardiac venous anatomy is variable. MDCT is a noninvasive method that allows detailed imaging of the cardiac venous anatomy, including small cardiac veins and thebesian valves. Therefore, cardiac MDCT may be a valuable tool for guiding procedures that involve the cardiac venous system.	3
254. Jongbloed, M.R., et al., Noninvasive visualization of the cardiac venous system using multislice computed tomography. J Am Coll Cardiol, 2005. 45(5): p. 749-53.	Study without consistently applied reference standards	38	To evaluate the value of multislice computed tomography (MSCT) to depict the cardiac venous anatomy.	The most frequently observed variant had a separate insertion of the CS and the small cardiac vein in the right atrium (24 patients [63%]). In 11 patients (29%), there was continuity of the anterior and posterior venous system at the crux cordis. In three patients (8%), the posterior interventricular vein (PIV) did not connect to the CS. The mean distance from the PIV to the posterior vein of the left ventricle (PVLV) was 42.4 +/- 18.1 mm, from the PVLV to the left marginal vein (LMV) 39.9 +/- 15.6 mm, and from the LMV to the anterior interventricular vein 45.4 +/- 15.3 mm. The diameter of the CS ostium was 12.6 +/- 3.6 mm in anteroposterior and 15.5 +/- 4.5 mm in the superoinferior direction (p < 0.01).	3

255. Tada, H., et al., Three-dimensional visualization of the coronary venous system using multidetector row computed tomography. Circ J, 2005. 69(2): p. 165-70.	Study without consistently applied reference standards	70	To investigate the applicability and image quality of contrast-enhanced visualization of the coronary venous system (CVS) by multidetector row computed tomography (MDCT).	The quality of all images reconstructed from the 6 data sets was too poor to evaluate the CVS in 6 patients (9%). In the remaining 64 patients (91%), the diameter of the CVS was usually greater in the images reconstructed from data acquired during systole than in those reconstructed from data acquired during diastole. However, artifacts were observed more often in images from systole than from diastole. The coronary sinus and middle cardiac vein were visible in all 64 patients. The left marginal and posterior veins also were identified in 54 (84%) and 60 patients (94%), respectively	3
258. Kamdar, A.R., et al., Multidetector computed tomographic angiography in planning of reoperative cardiothoracic surgery. Ann Thorac Surg, 2008. 85(4): p. 1239-45.	Study without consistently applied reference standards	167	We sought to determine if high-risk preoperative MDCTA findings were associated with greater use of preventive surgical strategies during redo cardiac surgery in patients with prior CABG.	Mean risk score was high (7.5 +/- 3). High-risk MDCTA findings included proximity (<1 cm) of right ventricle/aorta to chest wall (24%) or CABG crossing midline in close proximity (<1 cm anteroposteriorly) to sternum (38%). Preventive surgical strategies included surgery cancelled (4%), non-midline incision (8%), deep hypothermic circulatory arrest (5%), initiation of peripheral cardiopulmonary bypass (11%) and extrathoracic vascular exposure before incision (53%). These strategies were used at a higher frequency in patients with high-risk MDCTA findings versus those without (88% versus 28%, p < 0.0001). Frequency of severe bleeding, graft injuries, and 1-month mortality were 4.4%, 5%, and 2.5%, respectively.	3
259. Khan, N.U. and N. Yonan,	Systemic	7 studies	A best evidence topic was	We conclude that preoperative CT angiography	1

| Does preoperative computed tomography reduce the risks associated with re-do cardiac surgery? Interact Cardiovasc Thorac Surg, 2009. 9(1): p. 119-23. | review | | written according to the structured protocol. The question addressed was whether preoperative computed tomography (CT) scan reduces the risk associated with re-do cardiac surgery. A Medline search revealed 412 papers, of which seven were deemed relevant to the topic. | using ECG-gated multi-detector scan enables excellent anatomical details of heart, aorta and previous grafts, and highlights high-risk cases due to adherent grafts or ventricle or aortic atherosclerosis. This allows for better risk stratification and change of surgical strategy to reduce the potential risk in patients coming for re-do cardiac surgery. According to published reports, high-risk CT-scan findings in these patients caused clinicians to cancel surgery in up to 13% of cases, while preventive surgical strategies including non-midline approach, peripheral vascular exposure or establishing cardiopulmonary bypass prior to re-sternotomy have been reported in over two-thirds of patients with significant reduction in the operative risk. The risk of damage to vital structures, including previous grafts, heart or larger vessels is generally reported fewer than 10%, with evidence of significantly lower incidence of intra-operative injuries in patients who had prior CT-scans compared to those who did not. Hence, adequate preoperative imaging using ECG-gated multi-slice CT is essential for optimum planning of re-do cardiac surgery. | |
| 260. Quaife, R.A., et al., Pre-procedural planning for percutaneous atrial septal defect closure: transesophageal | Well-designed cross sectional study | 35 | To determine the accuracy of computed tomographic angiography (CTA) in predicting a defect's size | Of the 35 patients with secundum-type ASDs, 5 subjects had disqualifying anatomy by CTA and 2 had an unsuccessful closure, resulting in a procedural success rate of 93%. Measurement of | 2 |

echocardiography compared with cardiac computed tomographic angiography. J Cardiovasc Comput Tomogr, 2010. 4(5): p. 330-8.			compared with pre-procedural transesophageal echocardiography (TEE) and to the current "gold standard" balloon sizing by intracardiac echocardiography (ICE).	defect area by gated MPR images provided the strongest correlate to ICE balloon size. In large ASDs, TEE was less well correlated to the maximum defect size and identification of the inferior/inferoposterior rims than CTA. Cardiac CTA is an accurate and useful technique for pre-procedural assessment of ASDs and may be superior to conventional TEE in large defects that have deficient inferior rims.	
261. Goo, H.W., et al., Computed tomography for the diagnosis of congenital heart disease in pediatric and adult patients. Int J Cardiovasc Imaging, 2005. 21(2-3): p. 347-65; discussion 367.	Systematic review		The development of multi-slice spiral computed tomography (CT) has increased the clinical use of cardiac CT imaging in patients with congenital heart disease. Multi-slice CT has the advantages of fast scan speed; high spatial resolution, enabling the acquisition of isotropic volume data; and simultaneous evaluation of airways and lung parenchyma, thus increasing the ability to answer most clinical questions about structural abnormalities in patients with congenital heart disease.	When coupled with electrocardiography-gating, multi-slice spiral CT can be used in functional evaluations, including ventricular wall motion, ventricular ejection fraction, and motion of cardiac valves, as well as enabling the performance of high-quality coronary CT angiography. In this article, we review imaging techniques of multi-slice spiral CT and imaging findings in pediatric and adult patients with various congenital heart diseases.	1
263. Kawano, T., et al., Three-dimensional helical computed	Case- series	17	Therefore the purposes of our study were to determine the	3D helical CT angiography was performed in 17 patients with various types of complex CHD. Their	4

tomographic angiography in neonates and infants with complex congenital heart disease. Am Heart J, 2000. 139(4): p. 654-60.			quality and limitations of current 3D helical CT angiography for neonates and infants with complex CHD and to assess the clinical utility of this technique.	median age was 41 days (range 3 days to 9 months), and mean body weight was 3.6 kg (range 2.2 to 8.5 kg). All 3D images were produced with the 3D reconstruction algorithm of shaded-surface display. Oral sedation was required in only 4 infants during the procedure. 3D helical CT angiography clearly demonstrated the shape and spatial relation of great arteries, proximal branch pulmonary arteries, anomalous pulmonary venous connections, the patent ductus arteriosus, and a shunt. The 3D information of extracardiac morphologic characteristics and 3D anatomic relation of each extracardiac structure were easily recognized by this imaging process. However, intracardiac structure could not be visualized because of blurred and/or unclear edges of the ventricular wall caused by respiratory movement.	
266. Goo, H.W. and D.H. Yang, Coronary artery visibility in free-breathing young children with congenital heart disease on cardiac 64-slice CT: dual-source ECG-triggered sequential scan vs. single-source non-ECG-synchronized spiral scan. Pediatr Radiol, 2010. 40(10): p. 1670-80.	Study without consistently applied reference standards	93	To compare coronary artery visibility in free-breathing young children with congenital heart disease on cardiac 64-slice CT between dual-source ECG-triggered sequential (DSET) scan and single-source non-ECG-synchronized spiral (SSNE) scan.	Visual grades were significantly higher (P<0.001 or =0.011) on DSET scan than on SSNE scan except for the distal left anterior descending artery. Coronary arteries were traceable in 79.3% on DSET scan and 54.3% on SSNE scan in the overlapped scan range (P<0.0001), and 97.1% and 71.9% for the origins and proximal segments (P<0.0001). Visibility of side branches was improved on DSET scan by a factor of 2.0. Heart rates and trigger delays for DSET scan were 131+/-24 beats per min and 199+/-44 ms, respectively. Effective doses of DSET and SSNE scans	3

				were 0.36+/-0.12 mSv and 0.99+/-0.23 mSv, respectively.	
276. Carbone, I., et al., Adolescent Kawasaki disease: usefulness of 64-slice CT coronary angiography for follow-up investigation. Pediatr Radiol, 2011. 41(9): p. 1165-73.	Case- series	12	To evaluate the feasibility of 64-slice CT angiography (CTA) for follow-up of patients with KD using previously performed invasive catheter coronary angiography (CCA) as reference standard.	Adequate image quality was obtained in all patients. Mean effective dose for CTA was 6.56 +/- 0.95 mSv. CTA allowed accurate identification, characterization and measurement of all coronary aneurysms (n = 32), stenoses (n = 3) and occlusions (n = 9) previously demonstrated by CCA. One patient with disease progression went on to have percutaneous coronary intervention. Coronary lesions were reliably evaluated by 64-slice CTA in the follow-up of compliant patients with KD, reducing the need for repeated diagnostic invasive CCA. Hence, in an adequately selected patient population, the role of CCA could be limited almost only to therapeutic procedures.	4
277. Peng, Y., et al., Usefulness of 64-slice MDCT for follow-up of young children with coronary artery aneurysm due to Kawasaki disease: initial experience. Eur J Radiol, 2009. 69(3): p. 500-9.	Case- series	12	To evaluate the initial application and value of 64-slice multidetector computed tomography as an alternative diagnostic modality in the follow-up of young children with coronary artery aneurysm due to Kawasaki disease.	A total of 118/156 segments permitted visualization with diagnostic image quality, the CT measurements showed good inter-observer and intra-observer reliability, coefficients were 0.93 and 0.88, respectively. A total of 30 coronary artery aneurysms were identified with measured mean of 7.5+/-3.8 mm in diameter, and of 12.4+/-9.1 mm in longitudinal lengths.10 tumors were small, 8 tumors were medium and 12 tumors were giant aneurysm. The affected segments included LM7/12(58.3%), 9/12(75%) of LAD1, 4/12(33.3%) of LAD2, 2/12(16.7%) of LCX1; 6/12(50%) of RCA1, 9/12(75%)	4

| | | | | of RCA2 and 4/12(33.3%) of RCA3, including affected two segments in 9 tumors and three segments in 1 tumor. Calcifications were found in 5 aneurysms and 3/5 with thrombosis; six stenotic segments were found. ECHO failed to detect 8 tumors with 2/8 in LAD, 1/8 in LCX and 5/8 in RCA, and those included 4 small aneurysms. The use of 64-slice MDCT angiography proved valuable for monitoring young children with Kawasaki disease. However, further study is necessary to specify the sensitivity and specificity of MDCT in the follow-up. | |