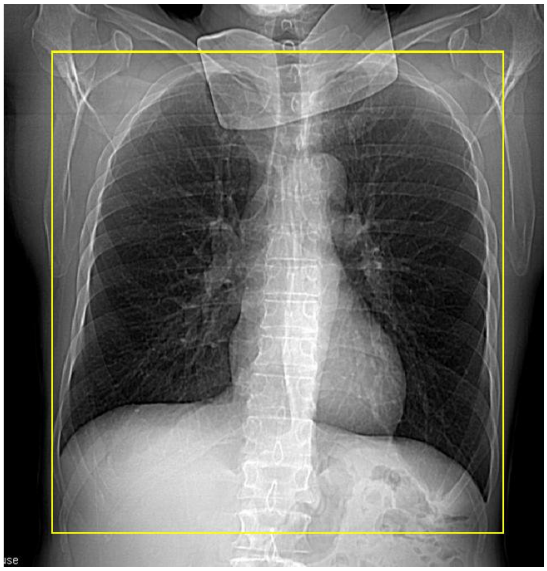
Chapter 20. Thoracic Protocols

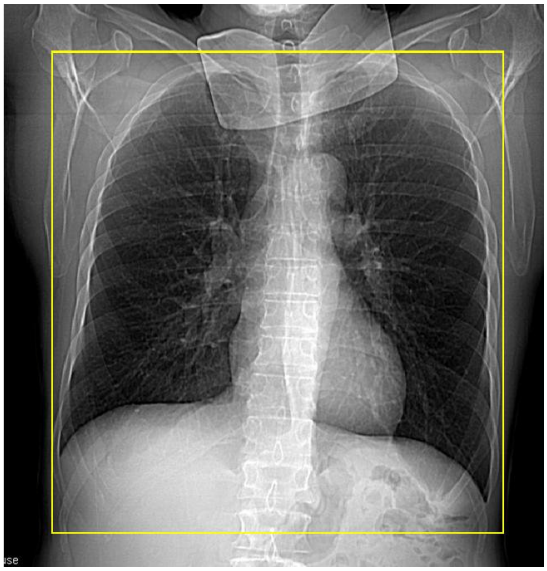
Routine Chest



Examples of clinical indications: Infection, mass, empyema, evaluation of abnormalities discovered on chest radiographs, evaluation of known or suspected congenital thoracic anomalies, evaluation of trauma
Scouts: AP and lateral
Scan Type: Helical
Start Location: Just above lung apices End Location: Just below costophrenic angles (note: for known or suspected lung cancer, end just below adrenal glands)
Breath-Hold: Inspiration
IV Contrast: 80 mL at 3.0 mL/s. 50 mL saline flush. Scan delay = 35 seconds Oral Contrast: None (note: for known or suspected lung cancer, give 16 oz barium sulfate just before exam)
DFOV: ~38 cm (optimize for individual)

SFOV: Large body		
Algorithm: Standard		
Window Settings: 350 ww/50 wl (Soft tissue) 1500 ww/ –700 wl (Lung)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	2.5 mm/1.25	2.5 mm/1.25
Pitch	1.375	1.375
kVp	120	120
mA	Auto: min 100/max 150 (noise index 15)	Auto: min 100/max 150 (noise index 15)

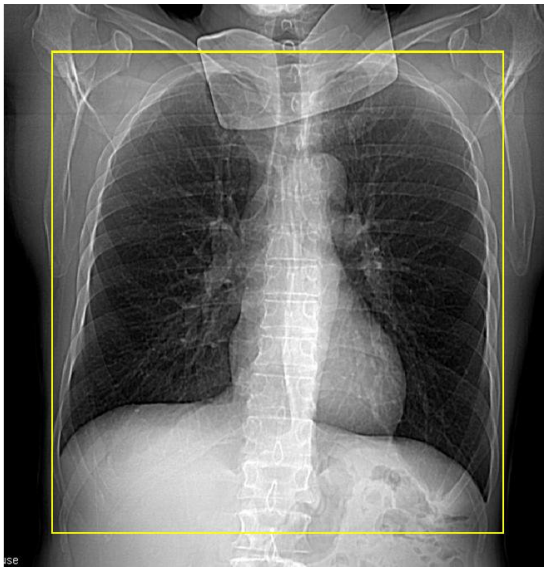
Lung Nodule



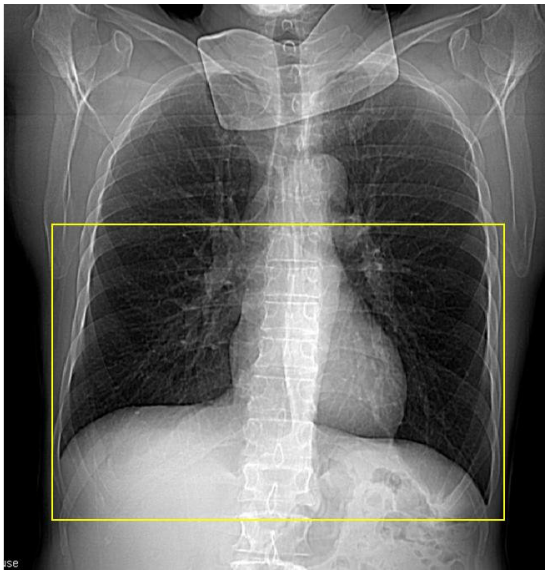
Examples of clinical indications: Evaluate suspected lung nodule
Scouts: AP and lateral
Scan Type: Helical
Start Location: Just above lung apices End Location: Just below costophrenic angles
Breath-Hold: Inspiration
IV Contrast: None Oral Contrast: None
DFOV: ~38 cm (optimize for individual)
SFOV: Large body
Algorithm: Standard
Window Settings: 350 ww/50 wl (Soft tissue) 1500 ww/ –700 wl (Lung)

	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.5 sec	0.5 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	2.5 mm/2.0 mm	2.5 mm/2.0
Pitch	1.375	1.375
kVp	120	120
mA	80 – 160 (depending on patient size)	80 – 160 (depending on patient size)
Reconstruction 2:		
Algorithm: Standard		
Slice thickness/interval	1.25 mm/0.625 mm	1.25 mm/0625

High-Resolution Chest



Groups 1 & 2



Group 3

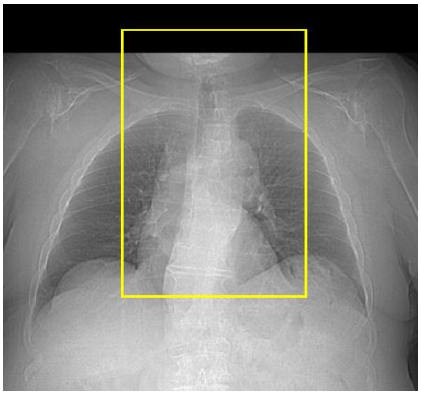
Examples of clinical indications: Asbestos exposure, inhalation injury, interstitial disease, diffuse pulmonary disease, suspected bronchiectasis, suspected small airway disease
Scouts: AP and lateral
Group 1. Supine Inspiration
Scan Type: Helical
Start Location: Just above lung apices End Location: Just below costophrenic angles
IV Contrast: None Oral Contrast: None
Breath-Hold: Inspiration
DFOV: ~38 cm (optimize for individual)
SFOV: Large body

Algorithm: Bone		
Window Settings: 1500 ww/ –700 wl (Lung)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	Small: 0.5 sec Medium: 0.5 sec Large: 0.6 sec	Small: 0.5 sec Medium: 0.5 sec Large: 0.6 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 0.625 = 10 mm	32 x 0625 mm = 20
Reconstruction (Slice thickness/interval)	1.25 mm/1.25 mm	1.25 mm/1.25 mm
Pitch	1.375	1.375
kVp	140	140
mA	Small: 150 Medium: 300 Large: 375	Small: 150 Medium: 300 Large: 375
Reconstruction 2:		
Algorithm: Bone		
Slice thickness/interval	1.25 mm/10 mm	1.25 mm/10 mm
Group 2. Supine Expiration		
Scan Type: Axial		
Start Location: Just above lung apices End Location: Just below costophrenic angles		

Breath-Hold: Expiration		
DFOV: ~38 cm (optimize for individual)		
SFOV: Large body		
Algorithm: Bone		
Window Settings: 1500 ww/ –700 wl (Lung)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	1.0 sec	1.0 sec
Acquisition (detector width x # detector rows = detector coverage)	1 x 1.25 = 1.25 mm	2 x 0.625 mm = 1.25 mm
Reconstruction (Slice thickness/interval)	1.25 mm x 20 mm	1.25 mm x 20 mm
kVp/mA	140/220	140/220
Group 3. Prone Inspiration		
Scouts: PA and lateral		
Scan Type: Axial		
Start Location: Carina End Location: Just below costophrenic angles		
Breath-Hold: Inspiration		
DFOV: ~38 cm (optimize for individual)		
SFOV: Large body		
Algorithm: Bone		

Window Settings: 1500 ww/ -700 wl (Lung)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	1.0 sec	1.0 sec
Acquisition (detector width x # detector rows = detector coverage)	1 x 1.25 = 1.25 mm	2 x 0.625 mm = 1.25 mm
Reconstruction (Slice thickness/interval)	1.25 mm/20 mm	1.25 mm/20 mm
kVp/mA	140/220	140/220

Tracheobronchial



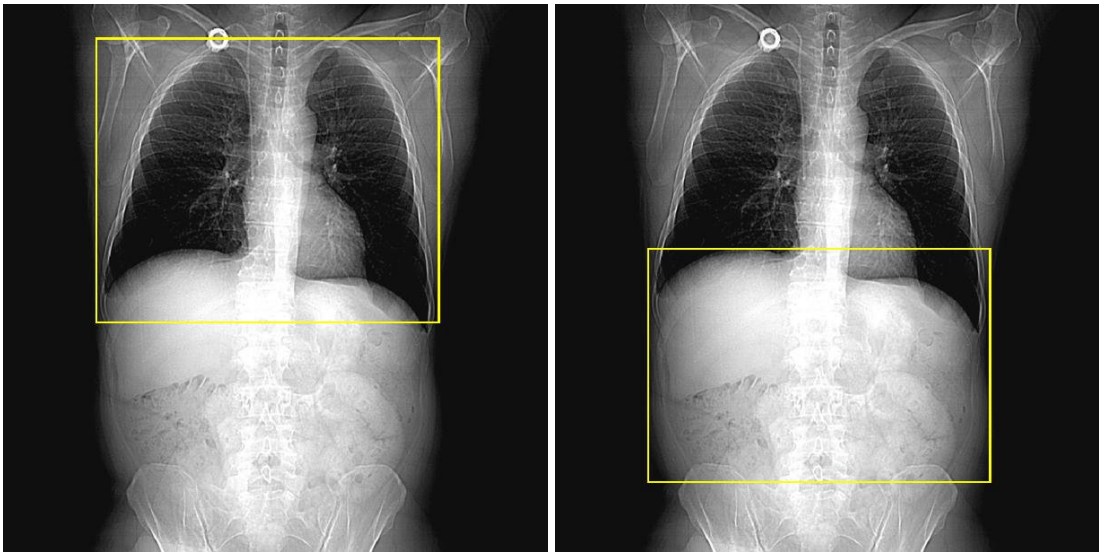
*Scan patient with arms at side

Examples of clinical indications: Suspected congenital tracheobronchial anomalies, assessment of tracheal narrowing, detection or confirmation of tracheomalacia, suspected foreign body aspiration
Group 1. Supine Inspiration
Scouts: AP and lateral
Scan Type: Helical
Start Location: 7 cm below the carina End Location: 1 cm above the epiglottis
IV Contrast: None Oral Contrast: None
Breath-Hold: Inspiration
DFOV: 22 cm
SFOV: Large body
Algorithm: Standard
Window Settings: 350 ww/50 wl (Soft tissue)

1500 ww/ –700 wl (Lung)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 0.625 = 10 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	1.25 mm/0.625 mm	1.25 mm/0.625 mm
Pitch	1.375	1.375
kVp/mA	120/150	120/150
Group 2. Supine Expiration		
Scan Type: Helical		
Start Location: 7 cm below the carina End Location: 1 cm above the epiglottis Use the same start/end location and RAS coordinates as group 1		
Breath-Hold: Expiration		
DFOV: 22 cm		
SFOV: Large body		
Algorithm: Standard		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width	16 x 0.625 = 10 mm	64 x 0.625 = 40 mm

x # detector rows = detector coverage)		
Reconstruction (Slice thickness/interval)	1.25 mm/0.625 mm	1.25 mm/0.625
Pitch	1.375	1.375
kVp/mA	120/150	120/150

Chest Abdomen



Examples of clinical indications: Infection, mass, evaluation of trauma
Group 1. Venous Scan of Chest
Scouts: AP and lateral
Scan Type: Helical
Start Location: Just above lung apices End Location: Just below costophrenic angles
IV Contrast: 125 mL at 3.0 mL/s. 50 mL saline flush. Scan delay = 35 sec Oral Contrast: 900 mL, 1 hour before scan
Breath-Hold: Inspiration
DFOV: ~38 (optimize for individual)
SFOV: Large body
Algorithm: Standard

Window Settings: 350 ww/50 wl (Soft tissue) 1500 ww/ –700 wl (Lung)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	2.5 mm/1.25 mm	2.5 mm/1.25 mm
Pitch	1.375	1.375
kVp	120	120
mA	Auto: min 100/max 150 (noise index 15)	Auto: min 100/max 150 (noise index 15)
Group 2. Venous Scan of Abdomen Begin 65 sec after the start of the contrast injection		
Scan Type: Helical		
Start Location: Just above diaphragm End Location: 1 cm below iliac crest		
Breath-Hold: Inspiration		
DFOV: ~38 (optimize for individual)		
SFOV: Large body		
Algorithm: Standard		
	16-Detector Protocol	64-Detector Protocol

Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	5.0 mm/5.0 mm	5.0 mm/5.0 mm
Pitch	1.375	1.375
kVp/mA	120/320	120/320

CTA – Chest for Pulmonary Embolism

Examples of clinical indications: Suspected pulmonary embolism
Scouts: AP and lateral (scouts should begin at just above lung apices and extend to just below tibial plateau so that they can be used for both group 1 and group 2)
Group 1. Arterial Scan
Scan Type: Helical
Start Location: Just below lowest hemidiaphragm End Location: Lung apices (Scans are inferior to superior)
IV Contrast: 120 mL [370 concentration] total, split bolus 70 mL at 4.0 mL/s Scan delay = Smart Prep; set monitor location at the level of the main pulmonary artery,

initiate the scan at first sight of contrast in the main pulmonary artery (~ 70 HU). 25 sec pause after first 70-mL injection is complete, then 50 mL at 3 mL/s Oral Contrast: None		
Breath- Hold: Instruct patient to stop breathing (avoid deep inspiration)		
DFOV: ~38 (optimize for individual)		
SFOV: Large body		
Algorithm: Standard		
Window Settings: 700 ww/ 180 wl (vascular)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.5 sec	0.6 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.0 = 16 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	1.25 mm/0.625 mm	1.25 mm/0.625 mm
Pitch	1.375	1.375
kVp/mA	120/500	120/500
Group 2. Lower Extremity Run-off Begin 180 sec after the start of the contrast injection		
Scan Type: Helical		
Start Location: 2 cm below tibial plateau End Location: Iliac crest (if patient has a inferior vena cava [IVC], as seen on scout image, end 2 cm above the IVC filter)		

Breath-Hold: None		
DFOV: ~48 (optimize for individual)		
SFOV: Large body		
Algorithm: Standard		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.0 = 16 mm	32 x 0.625 = 20 mm
Reconstruction (Slice thickness/interval)	5.0 mm/7.5 mm	5.0 mm/7.5 mm
Pitch	1.375	1.375
kVp/mA	120/190	120/190

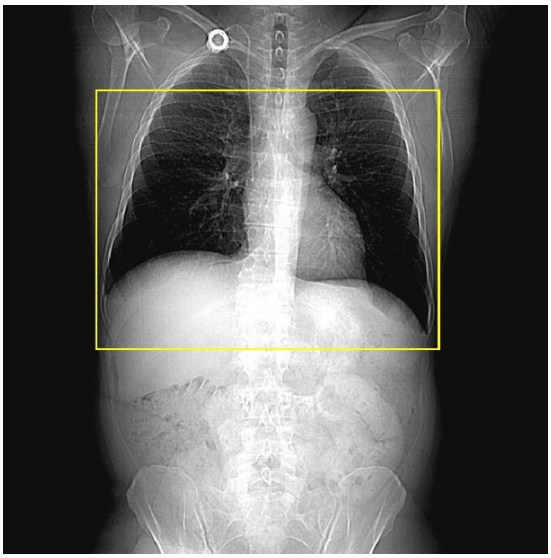
Cardiac Calcium Scoring (Gated)

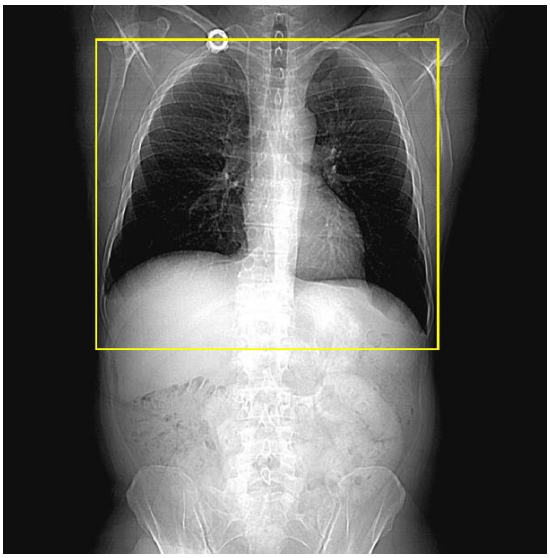
Position patient on the Cardiac CA score phantom. Do not use breast shields.

Examples of clinical indications: To help assess risk in asymptomatic individuals who have one or more risk factors for CAD; the evaluation of patients presenting with equivocal symptoms of CAD; follow-up patients undergoing therapy		
Scouts: AP and lateral		
Scan Type: Cine		
Start Location: 1 cm below carina End Location: Just below heart apex		
Breath-Hold: Inspiration		
IV Contrast: None Oral Contrast: None		
DFOV: 25		
SFOV: Large body		
Algorithm: Standard		
Window Settings: 350 ww/50 wl		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.4 sec Segment	0.35 sec Segment
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice	2.5 mm/2.5 mm	2.5 mm/2.5 mm

thickness/interval)		
kVp/mA (small patient)	120/250-300	120/250-300
kVp/mA (medium patient)	120/350-400	120/350-400
kVp/mA (large to extra large patient	120/450-550	120/450-550
Reconstruction 2:		
Algorithm: Standard		
DFOV: Optimize (include entire chest)		
Slice thickness/interval	2.5 mm/20 mm	2.5 mm/40 mm
Gating Information:		
Center R-Peak %	75%	75%
Time Between Images	50 ms	50 ms
Image per R-R interval	3	3

CTA – Chest Aorta (Gated)



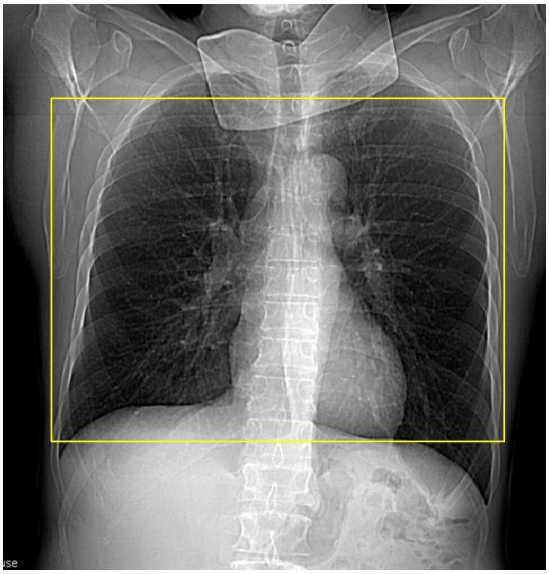


Examples of clinical indications: Blunt trauma, aortic dissection, aneurysm rupture, atherosclerotic occlusive disease, congenital vascular anomalies
Group 1. Unenhanced Scan
Scouts: AP and lateral
Scan Type: Helical
Start Location: 2 cm above aortic arch End Location: 2 cm below celiac artery
IV Contrast: None Oral Contrast: None
Breath-Hold: Inspiration
DFOV: ~38 (optimize for individual)

SFOV: Large body		
Algorithm: Standard		
Window Settings: 350 ww/ 50 wl (soft tissue)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.8 sec	0.8 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	5.0 mm/5.0 mm	5.0 mm/5.0 mm
Pitch	1.375	1.375
kVp/mA	100/150 (pt < 165 lbs) 120/150 (pt >165lbs)	100/150 (pt < 165 lbs) 120/150 (pt >165lbs)
Group 2. Gated Arterial Scan		
Scan Type: Cardiac helical		
Scouts: AP and lateral		
Start Location: Just above lung apices End Location: 2 cm below celiac artery		
IV Contrast: 100 mL [370 concentration] at 4.0 mL/s 20 mL Saline at 4.0 mL/s Scan delay = from timing bolus (use descending aorta at level of carina for ROI), add 3 seconds to peak for 16-detector, add 6 seconds to peak for 64-detector Oral Contrast: None		

Breath-Hold: Inspiration (hyperventilation)		
DFOV: 25		
SFOV: Large body		
Algorithm: Standard		
Window Settings: 700 ww/ 180 wl (vascular)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.4 sec	0.35 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	1.25 mm/1.25 mm	1.25 mm/1.25 mm
Pitch	Determined by patient's heart rate	Determined by patient's heart rate
kVp	100 (pt < 165 lbs) 120 (pt >165lbs)	100 (pt < 165 lbs) 120 (pt >165lbs)
ECG Modulated mA Small patient min/max	100 – 500	100 – 500
ECG Modulated mA Medium patient min/max	120 – 600	120 – 600
ECG Modulated mA Large patient min/max	140 – 700	140 – 700

CTA – Heart General



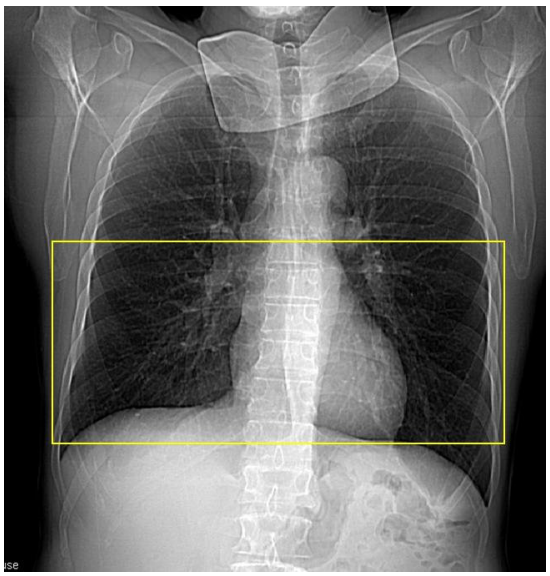
Patient on 2 liters oxygen.

Examples of clinical indications: Follow-up after CABG.
Scouts: AP and lateral
Group 1. Unenhanced Scan
Scan Type: Helical
Start Location: Just above clavicular heads End Location: 2 cm below heart apex
IV Contrast: None Oral Contrast: None
Breath Hold: Inspiration (hyperventilation)
DFOV: ~38 (optimize; include entire chest)
SFOV: Large body
Algorithm: Standard

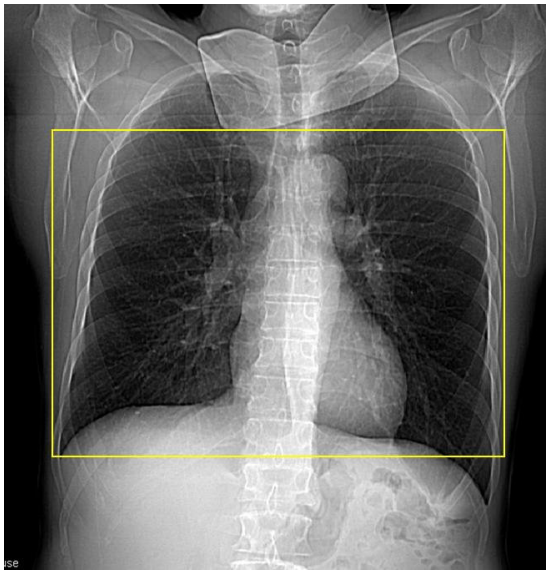
Window Settings: 350 ww/ 50 wl (soft tissue)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.4 sec	0.35 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	2.5 mm/1.25	2.5 mm/1.25 mm
Pitch	1.375	1.375
kVp/mA	120/150	120/150
Group 2. Gated Arterial Scan		
Scan Type: Cardiac helical		
Scouts: AP and lateral		
Start Location: Just above clavicular heads End Location: 2 cm below heart apex		
IV Contrast: 80 mL [IOCM] at 5.0 mL/s, 20 mL at 3.5 mL/s 50 mL Saline at 5.0 mL/s {If patient weight ≥ 210 lbs, use 120 mL 370 concentration contrast agent) Scan delay = from timing bolus (use aortic root at level of LMA for ROI), add 3 seconds to peak for 16-dectector, add 6 to peak for 64-detector Oral Contrast: None		
Breath-Hold: Inspiration (hyperventilation)		
DFOV: 25		
SFOV: (dependent on patient size) Cardiac S, M, L		

Algorithm: Standard		
Cardiac Filters: C1, C2, or C3 (by body habitus)		
Window Settings: 700 ww/ 180 wl (vascular)		
	16-Detector Protocol	64-Detector Protocol Cardiac Helical
Gantry Rotation Time	0.4 sec	0.35 sec Segment
Acquisition (detector width x # detector rows = detector coverage)	16 x 0.625 mm = 10	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	0.625 mm/0.625 mm	0.625 mm/0.625 mm
Pitch/Speed	Determined by patient's heart rate	Determined by patient's heart rate
kVp/mA	120/800	120/800
Phase Reconstructions:		
DFOV: 25		
Start Location: Just above left atrial appendage End Location: Just below heart apex		
40–50% by 5%, using 0.625-mm slice thickness		
70–80% by 5% using 0.625-mm slice thickness		
0–95% by 5% using 1.25-mm slice thickness		

CTA – Coronary



Group 1



Patient on 2 liters oxygen. Do not use breast shield for the calcium score series, but use it for the rest of the exam.

If patient is status post-CABG (from history or if sternal wires are seen on scout), skip the cardiac score series.

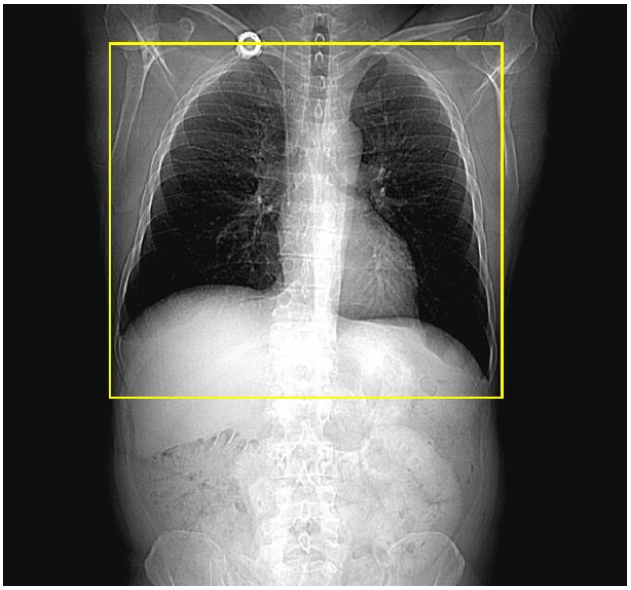
Examples of clinical indications: Suspected coronary artery disease (patients with

nonspecific complaints or ambiguous stress tests), suspected coronary anomalies		
Scouts: AP and lateral		
Group 1. Cardiac Score (unenhanced)		
Scan Type: Cine		
Start Location: 1 cm below carina End Location: Just below heart apex		
IV Contrast: None Oral Contrast: None		
Breath-Hold: Inspiration (hyperventilation)		
DFOV: 25		
SFOV: Large body		
Algorithm: Standard		
Window Settings: 350 ww/ 50 wl (soft tissue)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.4 sec	0.35 sec
Acquisition (detector width x # detector rows = detector coverage)	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	2.5 mm/2.5 mm	2.5 mm/2.5 mm
kVp/mA	120/350	120/500
Group 2. Gated Arterial Scan		
Scan Type: Cardiac helical		

Scouts: AP and lateral		
Start Location: Just above clavicular heads End Location: 2 cm below heart apex		
IV Contrast: 60 mL [IOCM] at 5.0 mL/s, 20 mL at 3.5 mL/s (if patient weight is ≥ 210 lbs, use 370 concentration of LOCM) 50 mL saline at 5.0 mL/s Scan delay = from timing bolus (use aortic root at level of LMA for ROI), add 6 seconds to peak Oral Contrast: None		
Breath-Hold: Inspiration (hyperventilation)		
DFOV: 25		
SFOV: (dependent on patient size) Cardiac S, M, L		
Algorithm: Standard		
Cardiac Filters: C1, C2, or C3 (by body habitus)		
Window Settings: 700 ww/ 180 wl (vascular)		
	16-Dectector Protocol Cardiac Helical	64-Detector Protocol Cardiac Helical
Gantry Rotation Time	0.4 sec	0.35 sec Segment
Acquisition (detector width x # detector rows = detector coverage)	16 x 0.625 = 10	64 x 0.625 = 40 mm
Reconstruction (Slice thickness/interval)	0.625 mm/0.625 mm	0.625 mm/0.625 mm

Pitch	Determined by patient's heart rate	Determined by patient's heart rate
kVp/mA	120/800	120/800
Phase Reconstructions:		
DFOV: 25		
Start Location: Just above left atrial appendage End Location: Just below heart apex		
40–50% by 5%, using 0.625-mm slice thickness		
70–80% by 5%, using 0.625-mm slice thickness		
0–95% by 5%, using 1.25-mm slice thickness		

CTA – Pulmonary Veins (Gated)



Examples of clinical indications:

Radiofrequency catheter ablation (RFCA) of the pulmonary veins and posterior left atrium can be used to treat atrial fibrillation. CTA of the pulmonary veins can provide anatomic information for RFCA, including the number, location, and angulation of pulmonary veins and their branches, and left atrial volume.		
Group 1. Gated Arterial Scan		
Scan Type: Cardiac helical		
Scouts: AP and lateral		
Start Location: Just above lung apices End Location: 2 cm below celiac artery		
IV Contrast: 100 mL [use 370 concentration if patient is > 210 lbs] at 4.0 mL/s 50 mL saline at 4.0 mL/s Scan delay = from timing bolus (use left atrium for ROI) Oral Contrast: None		
Breath-Hold: Inspiration (hyperventilation)		
DFOV: 25		
SFOV: Large body		
Algorithm: Standard		
Cardiac Filters: C1, C2, or C3 (special bowtie filter for cardiac applications)		
Window Settings: 700 ww/ 180 wl (vascular)		
	16-Detector Protocol	64-Detector Protocol
Gantry Rotation Time	0.4 sec	0.35 sec
Acquisition (detector width x # detector rows = detector	16 x 1.25 = 20 mm	64 x 0.625 = 40 mm

coverage)		
Reconstruction (Slice thickness/interval)	1.25 mm/1.25 mm	1.25 mm/1.25 mm
Pitch	Determined by patient's heart rate	Determined by patient's heart rate
kVp	100 (pt < 165 lbs) 120 (pt >165lbs)	100 (pt < 165 lbs) 120 (pt >165lbs)
ECG Modulated mA Small patient min/max	100 – 500	100 – 500
ECG Modulated mA Medium patient min/max	120 – 600	120 – 600
ECG Modulated mA Large patient min/max	250 – 700	250 – 700
Reconstruction 2:		
Algorithm: Standard		
DFOV: Optimize (Include full chest)		
Center R-Peak Delay: 75%		
Slice thickness/interval: 1.25 mm/1.25 mm		
Phase Reconstructions:		
DFOV: 25		
Start Location: Just above left atrial appendage End Location: Just below heart apex		
0–95% by 5%, using 1.25-mm slice thickness		