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ADULT ROUTINE CHEST CT

Indications (include but are not limited to)

- Evaluation of findings on chest radiographs or other CT exams as seen on other imaging modalities:
- Evaluation of lung and other primary thoracic malignancies, and detection and evaluation of metastatic disease;
- Evaluation for thoracic manifestations of known extrathoracic diseases;
- Evaluation of chest infections;
- Evaluation of inflammations involving the chest:
- Evaluation of abnormalities within the chest; i.e. fluid or abscess
- Evaluation of the chest wall;
- Evaluation of pleural disease;
- Evaluation of the mediastinum and lymph nodes.

Diagnostic Tasks (include but are not limited to)

- Detect nodules or masses and characterize their size and shape and relationships to organs;
- Identify abnormal aeration or expansion of the lungs;
- Detect abnormal fluid collections in the chest;
- Identify abnormal air collections both in and around the lungs;
- Detect mediastinal and paravascular masses and nodules;
- Characterize chest wall masses;
- Detect calcifications in soft tissues or the mediastinum.

Key Elements

- Contrast enhancement;
- One breath-hold (motion is problematic);
- Can reconstruct additional images for high-resolution chest CT.

Contrast

- Oral: None.
- Injected: Certain indications require administration of intravenous contrast media.
- Intravenous contrast enhancement should be performed as directed by the supervising radiologist using appropriate injection protocols and in accordance with the <u>ACR-SPR Practice</u> <u>Guideline for the Use of Intravascular Contrast Media</u> and the <u>ACR Manual on Contrast Media</u>.

Patient Positioning

- Center the patient within the gantry; this is critical for proper functioning of AEC systems.
- Patient supine, arms above head;

Scan Range

 From top of lungs through the bottom of lungs. Instruct patient to hold breath at inspiration during entire scan.

Suspension of Respiration

• Patient should be instructed to hold his/her breath at end of inspiration.

Additional Image Reconstructions

- Certain indications may require that images be reconstructed in coronal and/or sagittal planes.
- Very thin images (approximately ≤ 1 mm) may need to be reconstructed to serve as source images for the sagittal and/or coronal reformatted images.
- Creation, use, and archival of these additional images are at the discretion of the supervising radiologist and/or departmental policy. Very large datasets may result from these additional reconstructions.

Radiation Dose Management

- AEC should be used whenever possible.
- Pay careful attention to the values selected to define the desired level of image quality (eg, Noise Index, Quality Reference mAs, Standard Deviation).
- Each manufacturer will have recommendations unique to their systems and system features. Be sure to work with your CT equipment manufacturer and a qualified medical physicist to ensure safe and appropriate operation of AEC systems.
- If more than one CT localizer radiograph is acquired, AEC systems from different manufacturers can differ with respect to which one is used to determine mA and/or kV settings. Please refer to individual manufacturer protocol instructions.

CTDI measurements and calculations

• Some manufacturers utilize a z-axis "flying focal spot", in which two unique projections are acquired at the same z-axis table position. When this technique is used, we identify it with **. The CTDIvol on the console accurately accounts for use of this feature.

Approximate Volume CT Dose Index (CTDIvol) Values

• Approximate values for CTDIvol are listed for three different patient sizes:

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Average Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23

The <u>approximate CTDIvol values</u> are for reference only and represent a dose to the CT Dose Index phantom under very specific conditions. The CTDIvol displayed on the scanner for a patient of a given size should be similar, but not necessarily an exact match, to those listed in the above table. The provided values are all based on the 32 cm diameter "body" CTDI phantom.

It is essential that users recognize that the CTDIvol values reported on the user console <u>prior to acquiring CT localizer radiographs on a particular patient</u> do not represent the CTDIvol that will be delivered during that patient's scan. CT systems rely on the CT localizer radiograph to 1) estimate the patient's size, 2) determine the tube current settings for each tube angle and table position that will yield the requested level of image quality, and 3) calculate the average CTDIvol for the patient over the prescribed scan range. Until the CT localizer radiograph is acquired, the reported CTDIvol is not patient-specific, but is based on a generic patient size.

The CTDIvol values provided here are approximate, and are intended only to provide reference ranges for the user to consider. They are for a routine CT of an adult's chest for the general indictations given at the beginning of this document. Other indications or diagnostic tasks may have different image quality and dose requirements, and hence reasonable ranges of CTDIvol may differ according to those requirements.

In this document, a small patient is considered to be approximately 50-70 kg (110-155 lbs), an average patient approximately 70-90 kg (155-200 lbs), and a large patient 90-120 kg (200-265 lbs). However, weight is not a perfect indication of patient size. A person's height, gender and distribution of weight across the body also must be taken into account. The thickness of the body over the area to be scanned is the best indication of patient size. Bodymass index (BMI) may also be considered:

- Underweight = BMI <18.5
- Normal weight = BMI of 18.5-24.9
- Overweight = BMI of 25–29.9
- Obesity = BMI of 30 or greater

It is recognized that the median (50th percentile) patient size for adults in the USA is larger than 70 kg. However, the 70 kg patient represents the "Reference Man", as defined by the International Commission on Radiation Protection (ICRP), upon which AEC systems and tissue weighting factors (used for effective dose estimation) are based.

INDEX OF ADULT ROUTINE ABDOMEN-PELVIS PROTOCOLS (by manufacturer)

<u>GE</u>

<u>Hitachi</u>

Neusoft

Philips

Siemens

Toshiba

LightSpeed

LightSpeed

ADULT ROUTINE CHEST CT (Selected GE scanners)

LightSpeed

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Discovery

SCOUT: AP S60-I400; scan from top of shoulder through mid-liver, if automatic exposure control is used. PA scout if manual mA is used.

BrightSpeed 16 /

BrightSpeed

GE (Without ASIR)	Ultra	16 Select	Lightspeed 16	Pro16	VCT	CT750 HD
Scan Type	Helical	Helical	Helical	Helical	Helical	Helical
Rotation Time (s)	0.5	0.8	0.5	0.5	0.4	0.4
Beam Collimation (mm)	10	20	20	20	40	40
Pitch	1.35	1.35	1.35	1.35	1.375	1.375
Speed (mm/rot)	13.5	27.5	27.5	27.5	55.0	55.0
kV	120	120	120	120	120	120
SmartmA min-max mA (ave mA)	No SmartmA	50 – 260 (160)	100 – 440 (260)	100 – 650 (270)	100 – 650 (500)	100 – 650 (500)
NI*	mA = 300	11.57	11.57	11.57	13.0	13.0
SFOV	Large	Large	Large	Large	Large	Large
RECON 1						
Plane	Axial	Axial	Axial	Axial	Axial	Axial
Algorithm	Stnd	Stnd	Stnd	Stnd	Stnd	Stnd
Recon Mode	Full	Full	Full	Full	Full	Full
Thickness (mm)	5.0	5.0	5.0	5.0	5.0	5.0
Interval (mm)	5.0	5.0	5.0	5.0	5.0	5.0
RECON 2						
Plane	Axial	Axial	Axial	Axial	Axial	Axial
Algorithm	Lung	Lung	Lung	Lung	Lung	Lung
Recon Mode	Full	Full	Full	Full	Full	Full
Thickness (mm)	5.0	5.0	5.0	5.0	5.0	5.0
Interval (mm)	5.0	5.0	5.0	5.0	5.0	5.0
RECON 3						
Plane	Axial	Axial	Axial	Axial	Axial	Axial
Algorithm	Stnd	Stnd	Stnd	Stnd	Stnd	Stnd
Recon Mode	Plus	Plus	Plus	Plus	Plus	Plus
Thickness (mm)	1.25	1.25	1.25	1.25	1.25	1.25
Interval (mm)	1.25	1.25	1.25	1.25	1.25	1.25

*The Noise Index value and the primary (RECON 1) image reconstruction thickness both strongly impact CTDIvol and patient dose. See: Kanal KM et al. Impact of Operator-Selected Image Noise Index and Reconstruction Slice Thickness on Patient Radiation Dose in 64-MDCT. *AJR* 2007; 189: 219-225.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Avg. Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23

ADULT ROUTINE CHEST CT (selected GE scanners)(continued)

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SCOUT: AP S60-I400; scan from top of shoulder through mid-liver, if automatic exposure control is used. PA scout if manual mA is used.

GE (Wit	h ASIR)	VCT	Discovery CT750 HD
	Scan Type	Helical	Helical
Rotat	tion Time (s)	0.4	0.4
Beam Collin	mation (mm)	40	40
	Pitch	1.375	1.375
Spe	eed (mm/rot)	55.0	55.0
	kV	120	120
SmartmA	min-max	100 – 650 (250)	100 – 650 (250)
	NI*	13.0 (DR 50%)	16.8
	SFOV	Large	Large
RECON 1			
	Plane	Axial	Axial
	Algorithm	Stnd	Stnd
F	Recon Mode	Full	Full
Thic	kness (mm)	5.0	5.0
Ir	nterval (mm)	5.0	5.0
	ASIR	SS50	SS50
RECON 2			
	Plane	Axial	Axial
	Algorithm	Lung	Lung
F	Recon Mode	Full	Full
Thic	kness (mm)	5.0	5.0
Ir	nterval (mm)	5.0	5.0
	ASIR	SS50	SS50
RECON 3			
	Plane	Axial	Axial
	Algorithm	Stnd	Stnd
F	Recon Mode	Plus	Plus
Thic	kness (mm)	1.25	1.25
Ir	nterval (mm)	1.25	1.25
	ASIR	SS50	SS50

^{*}The Noise Index value and the primary (RECON 1) image reconstruction thickness both strongly impact CTDIvol and patient dose. See: Kanal KM et al. Impact of Operator-Selected Image Noise Index and Reconstruction Slice Thickness on Patient Radiation Dose in 64-MDCT. *AJR* 2007; 189: 219-225.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Avg. Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23

ADULT ROUTINE CHEST CT (selected HITACHI scanners)

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SCANOGRAM: PA; scan from top of shoulder through mid-liver.

HITACHI	CXR4	ECLOS 16	SCENARIA 64
Scan Type	Volume	Volume	Volume
Rotation Time (s)	8.0	0.8	0.75
Detector Configuration	2.5 x 4	1.25 x 16	0.625 x 64
Pitch	1.25	1.0625	0.8281
Speed (mm/rot)	6.25	21.25	33.13
kV	120	120	120
mA	225	225	IntelliEC
Adaptive mA/IntelliEC	Yes	Yes	SD 12
SFOV	500	500	500
Prep Delay (s)	20	30	30

RECON 1

Series Description	Mediastinum	Mediastinum	Mediastinum
Туре	Axial	Axial	Axial
Filter	33	33	33
Thickness (mm)	5	5	5
Interval (mm)	5	5	5

RECON 2

Series Description	Lung	Lung	Lung
Туре	Axial	Axial	Axial
Filter	22	22	22
Thickness (mm)	5	5	5
Interval (mm)	5	5	5

RECON 3

- NEOONO			
Series Description	Thin for MPR	Thin for MPR	Thin for MPR
Туре	Axial	Axial	Axial
Filter	33	22	33
Thickness (mm)	2.5	1.25	1
Interval (mm)	1.25	0.625	0.5

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Avg. Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23

ADULT ABDOMEN & PELVIS ROUTINE (selected NEUSOFT scanners)

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SCOUT: PA, scan from top of shoulder through mid-liver.

NEUSOFT	Neuviz DUAL	Neuviz 16
Scan Type	Helical	Helical*
Rotation Time (s)	1.0	0.6
Collimation	2 x 2.5	16 x .75
kV	120	120
mA	265	316
Pitch	1.50	0.8631
FOV(mm)	400	300

RECON 1

Series Description	Chest	Chest*
Image Enhancement Filter/Display Mode	Body Standard (B)	SB
Thickness (mm)	5.0	3.0
Interval (mm)	5.0	3.0

RECON 2

Series Description	 Small RECON*
Image Enhancement Filter/Display Mode	 SB
Thickness (mm)	 1.50
Interval (mm)	 0.750

RECON 3

Series Description	 Lung*
Image Enhancement Filter/Display Mode	 EB
Thickness (mm)	 3.00
Interval (mm)	 1.00

^{*}ADAPTIVE FILTER is active prospectively and retrospectively.

METAL ARTIFACT REDUCTION can be activated prospectively or retrospectively (as needed).

Small	Patient
Avg.	Patient
Large	Patient

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
nt	50-70	110-155	6-11
nt	70-90	155-200	10-18
nt	90-120	200-265	13-23

ADULT ROUTINE CHEST CT (selected PHILIPS scanners)

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SURVIEW: PA; scan from top of shoulder through mid-liver.

PHILIPS	Brilliance 16 slice	Brilliance 64 slice	Ingenuity CT	Brilliance iCT SP	Brilliance iCT
Scan Type	Helical	Helical	Helical	Helical	Helical
Rotation Time (s)	0.5	0.5	0.4	0.33	0.33
Collimation	16 × 1.5 mm	64 × 0.625 mm	64 × 0.625 mm	64 × 0.625 mm	128 × 0.625 mm
Coverage (mm)	24	40	40	40	80
kV	120	120	120	120	120
mAs	140	140	140	125	125
Pitch	1.0	1.0	1.1	1.2	1.0
FOV (mm)	350–500	350–500	350–500	350–500	350–500
RECON 1					
Туре	Axial	Axial	Axial	Axial	Axial
Filter	B/C	B/C	B/C	B/C	B/C
Thickness (mm)	3	3	3	3	3
Increment (mm)	3	3	3	3	3
RECON 2					
Туре	Coronal	Coronal	Coronal	Coronal	Coronal
Filter	B/C	B/C	B/C	B/C	B/C
Thickness (mm)	3	3	3	3	3
Increment (mm)	3	3	3	3	3
RECON 3					
Туре	Axial	Axial	Axial	Axial	Axial
Filter	YA	YB	YB	YB	YB
Thickness (mm)	2	0.9	0.9	0.9	0.9
Increment (mm)	1	0.45	0.45	0.45	0.45
RECON 4					
Туре	Coronal	Coronal	Coronal	Coronal	Coronal
Filter	YA	YB	YB	YB	YB
Thickness (mm)	2	1	1	1	1
Increment (mm)	2	1	1	1	1

Approx. Weight (kg)		Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Avg. Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23

ADULT ROUTINE CHEST CT (selected SIEMENS scanners)

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TOPOGRAM: PA; scan from top of shoulder through mid-liver.

SIEMENS	Sensation 64	Definition (Dual source 64-slice)	Definition AS+ (128-slice)	Definition Flash (Dual source 128-slice)
Software version	VB30	VA34	VA44	VA44
Scan Mode	Spiral	Spiral	Spiral	Spiral
Rotation Time (s)	0.5	0.5	0.5	0.5
Detector Configuration	**64 × 0.6 mm (32 × 0.6 mm = 19.2 mm)	**64 × 0.6 mm (32 x 0.6 mm = 19.2 mm)	**128 × 0.6 mm (64 × 0.6 mm = 38.4 mm)	**128 × 0.6 mm (64 × 0.6 mm = 38.4 mm)
Pitch	1.4	1.2	1.2	1.2
kV*	120	120	120	120
Quality ref. mAs	100	110	110/65***	110/65***
CARE Dose4D	ON	ON	ON	ON
RECON 1				
Туре	Axial	Axial	Axial	Axial
Kernel	B31f	B31f	B31f/I31f***	B31f/l31f***
Slice (mm)	5	5	5	5
Increment (mm)	5	5	5	5
RECON 2				
Туре	Axial	Axial	Axial	Axial
Kernel	B70f	B70f	B70f/I70f***	B70f/I70f***
Slice (mm)	1.5	1.5	1.5	1.5
Increment (mm)	1.5	1.5	1.5	1.5
RECON 3				
Туре	Axial	Axial	Axial	Axial
Kernel	B31f	B31f	B31f/I31f***	B31f/I31f***
Slice (mm)	1.0	1.0	1.0	1.0
Increment (mm)	0.7	0.7	0.7	0.7
RECON 4				
Туре	Axial	Axial	Axial	Axial
Kernel	B70f	B70f	B70f/I70f***	B70f/I70f***
Slice (mm)	1.0	1.0	1.0	1.0
Increment (mm)	0.7	0.7	0.7	0.7

^{*} If scanner is equipped with automatic kV selection (CARE kV), this should be activated by selecting "On".

- For non-contrast-enhanced exams, a Reference kV of 120 and a "Dose saving optimized for" slider position of 2 is recommended.
- For contrast-enhanced exams, a Reference kV of 120 and a "Dose saving optimized for" slider position of 7 is recommended.
- For exams requiring both a non-contrast-enhanced and a contrast-enhanced scan, where the change in mean CT number of a region may be relevant to the diagnosis, it is important that the kV be the same for both scans. You can force CARE kV to use the same kV by linking the series. The optimization is then done by considering all linked acquisitions and their individual slider settings.

** Indicates that a z-axis "flying focal spot" technique is used to obtain twice as many projections per rotation as detector rows.

NOTE: CARE Bolus (optional) may be used to optimize the bolus timing. Set the ROI for monitoring scan in the aorta at the level of the diaphragm with triggering threshold of 120 HU, or use manual triggering.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Avg. Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23

^{***} With SAFIRE.

ADULT ROUTINE CHEST CT (selected TOSHIBA scanners)

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SCANOGRAM: Dual scano: PA and LAT; 500 mm above shoulders to below liver.

TOSHIBA	Aq32	Aq64	AqPRIME	AqPremium	AqONE
Scan Type	Helical	Helical	Helical	Helical	Helical
Rotation Time (s)	0.5	0.5	0.5	0.5	0.5
Detector Configuration	32 x 0.5	64 x 0.5	80 x 0.5	160 x 0.5	160 x 0.5
Pitch	Fast (1.41)	Fast (1.48)	Fast (1.388)	Fast (0.994)	Fast (0.994)
Speed (mm/rot)		13.5		18.75	39.36
kV	120	120	120	120	120
mA	^{SURE} Exposure	^{SURE} Exposure	SUREExposure	^{SURE} Exposure	^{SURE} Exposure
^{SURE} Exposure	Std (SD = 12.5)	Std (SD = 12.5)	Std (SD - 12.5)	Std (SD = 12.5)	Std (SD = 12.5)
SFOV	LFOV	LFOV	LFOV	LFOV	LFOV
Breath-hold	Inspiration	Inspiration	Inspiration	Inspiration	Inspiration
Prep Delay (s)	35	35	35	35	35

RECON 1

Туре	Axial	Axial	Axial	Axial	Axial
SURE IQ setting	Body Std Axial				
Thickness (mm)	5	5	5	5	5
Interval (mm)	5	5	5	5	5
DFOV (cm)	400	400	400	400	400

RECON 2

Туре	Axial	Axial	Axial	Axial	Axial
SURE IQ setting	Lung Std Axial				
Thickness (mm)	5	5	5	5	5
Interval (mm)	5	5	5	5	5
DFOV (cm)	400	400	400	400	400

VOLUME

Туре	Axial	Axial	Axial	Axial	Axial
SURE IQ setting	Body Std Volume				
DFOV (cm)	400	400	400	400	400

	REFORMAT 1	REFORMAT 2
Туре	Coronal	Sagittal
Thickness (mm)	4	4
Interval (mm)	4	4

^{*}The Sure IQ setting determines the reconstruction FC as well as other post-processing and reconstruction options, such as AIDR. The Sure IQ settings listed in this document refer to the manufacturer's default settings.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	6-11
Avg. Patient	70-90	155-200	10-18
Large Patient	90-120	200-265	13-23