

PVDOMICS Study Lung CT Protocol

DCC - Lung Imaging Core
Cleveland Clinic
Cleveland, Ohio



NHLBI Pulmonary Vascular Disease Phenomics Program

*Funded by the National Heart, Lung, and Blood Institute of the
National Institutes of Health with support from
the Pulmonary Hypertension Association*

Image Standardization

- The most important aspect of image standardization is that each participant undergoes the same imaging protocol
- CT technologist should verify that correct PVDOMICS protocol is used to acquire CT scan unless obtained as part of routine clinical care
- For research purposes, use scanning parameters provided by PVDOMICS LIC
- Refer to CT Technologist Instruction Form regarding imaging instructions

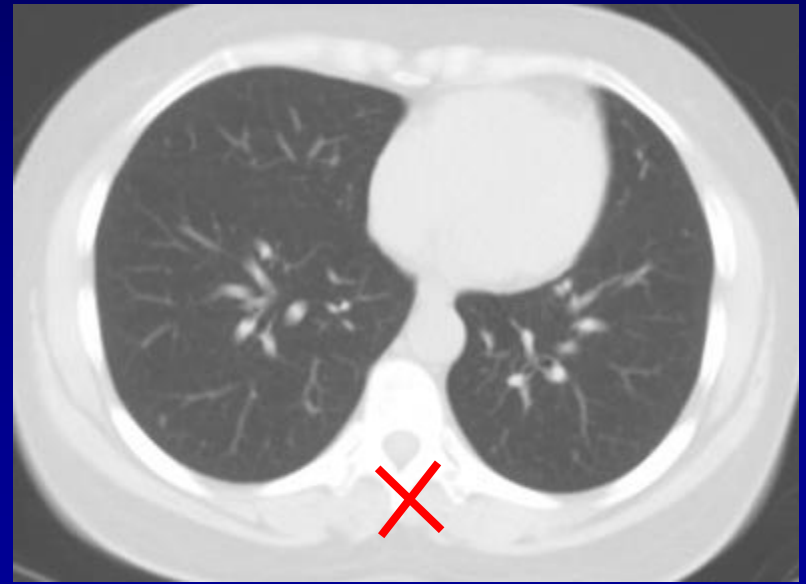
CT Imaging Protocol

PVDOMICS Study Lung Imaging Protocol

- 1 non-contrast CT scan from thoracic inlet to lung bases at maximal inspiratory effort

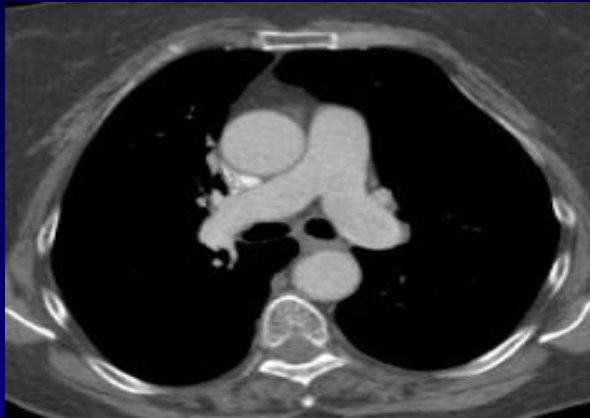


1mm slice thickness



10mm slice thickness

CT Imaging Options



Routine contrast
enhanced CT



CT pulmonary
angiogram (CTPA)



Non contrast CT

CT Technologist Instruction Form



Effective Date: 01/27/16

CT TECHNOLOGIST INSTRUCTION FORM

SIEMENS DEFINITION AS+, FLASH, & EDGE SCANNERS

It is important that the patient fully understands the breath hold and scanning procedure and that all concerns are addressed prior to performing the CT scan. Study coordinators will provide the effective **mAs** and DFOV settings. All other scan parameters are provided below in Table 1. If you do not have the appropriate baseline information, do not perform the CT scans. DO NOT repeat spiral scans for any reason, unless indicated as part of clinical evaluation which will be determined by local thoracic radiologist. Scouts may be repeated as needed.

Patient Positioning

- Place patient in a supine position, arms positioned comfortably above the head in a head-arm rest, lower legs supported.
- Using the laser positioning lights, line up the patient so the chest is (32-center (in the middle: left-right, up-down)) of the CT gantry.
- Move the table so the patient is in the correct position for a chest CT scan.

Scan Coverage

- CT scan must include the lungs and minimize additional exposure.
- Start the scan approximately 1cm above the apex of the lungs and stop it once the scan is through the base of the lungs as shown in figure 1.
- The DFOV should tightly fit the lung as shown in figure 2.

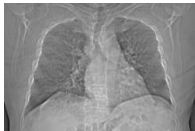


Figure 1.



Figure 2.



CT TECHNOLOGIST INSTRUCTION FORM

SIEMENS DEFINITION AS+, FLASH, & EDGE SCANNERS

CT Parameters

The following parameters must be implemented for the CT scans:

- Scout scans use default parameters (Site discretions on type and number of scouts, however must maintain ALARA principle)

Scanner	AS+/FLASH/EDGE
Scan Type	Spiral
Rotation	0.5
Time (s)	
Dose	128 x 0.5mm
Configuration	120
kV	120
Pitch	1.0
Dose Modulation	Off
Recon Algorithm	B35
Recon Algorithm 1	B360
Recon Algorithm 2	
Iterative Recon (noise reduction)	Do not use IRIS or SAPPHIRE
Thickness (mm)	1.0
Interval (mm)	0.8
Est. Scan Time (Sec) 30cm length	<10

Radiation Dose Selection

The BMI must be provided to the technologist to set the effective **mAs**.

- Ex small, small, medium or large effective **mAs** settings for the PVDOMICS scans are based upon the Body Mass Index (BMI).

Please use the table below to select the correct effective **mAs** setting based on the patient's BMI.

Effective mAs as a function of BMI

Body Size	BMI Range	Eff. mAs setting to be used
Large	>30	165
Medium	20 - 30	110
Small	15 - 19	90
Extra small	<15	60



CT TECHNOLOGIST INSTRUCTION FORM

SIEMENS DEFINITION AS+, FLASH, & EDGE SCANNERS

SCANNING:

Use these breathing instructions to perform:

- A practice breathing session
- Scouts - as needed - to position the FOV to cover the entire lung and as much soft tissue as possible
- Inspiratory CT scan

BREATHING INSTRUCTIONS:

- For this scan, I am going to ask you to take a couple of deep breaths in and out before we have you breathe all the way in and hold your breath.
- OK, let's get started.
- Take a deep breath in (watch chest to ensure a deep breath in)
- Let it out (watch chest to ensure air is out)
- Take a deep breath in (watch chest to ensure a deep breath in)
- Let it out (watch chest to ensure air is out)
- Now breathe all the way IN...IN...IN (watch chest to ensure a deep breath in as far as possible)
- Keep holding your breath - DO NOT BREATHE!
- Count 10 seconds (if practice) or scan!
- At end of scan or practice: Breathe and relax

Example of a Center-Specific Scanner Parameter

Center Specific Scanner Parameters	Institution – Center 99 -. Sample Medical Center
Scanner Make	GE
Scanner Model	Discovery CT750 HD
Scan Type	Helical
Rotation time (s)	<5
Detector Configuration	64 x 0.625
kV	120
mA/mAs	BMI setting
Pitch	1.0
Reconstruction Algorithm Standard	Standard
Reconstruction Algorithm Lung	Lung
Additional Image Filters	None
Iterative Reconstruction	Do not use
Dose modulation	Off
Thickness (mm)	1.0
Interval (mm)	0.8

- See your individual center's parameters provided in MOP Chapter 80 appendices
- http://qhsapps.ccf.org/pvdomics/open_web/MOP/PVD_MOP_TOC.htm

mAs and DFOV Settings

- **General Information**
- Must use effective mAs and display field of view (DFOV) settings.

Table 1 - Effective mAs as a Function of BMI

Body Size	BMI Range	Use mAs Setting
Large	>30	165
Medium	20 - 30	110
Small	15 - 19	90
Extra small	<15	60

- Do not perform the CT scans if you do not have the appropriate baseline participant and scanner parameter information
- DO NOT repeat spiral scans for any reason, unless part of clinical evaluation if determined by local thoracic radiologist
- Scout films may be repeated as needed.

Breath Hold Instructions

- Participant must fully understand the breath hold instructions
- Practice breath hold technique with participant
- Participant should understand scanning procedure
- Address participant's concerns prior to performing the CT scan

Breath Hold Instructions, continued

BREATHING INSTRUCTIONS:

- For this scan, I am going to ask you to take a couple of deep breaths in and out before we have you breathe all the way in and hold your breath.
- Ok, let's get started.
- Take a deep breath in (*watch chest to ensure a deep breath in*)
- Let it out (*watch chest to ensure air is out*)
- Take a deep breath in (*watch chest to ensure a deep breath in*)
- Let it out (*watch chest to ensure air is out*)
- Now breathe all the way IN...IN...IN (*watch chest to ensure a deep breath in as far as possible*)
- Keep holding your breath – DO NOT BREATHE!
- Count 10 seconds (*if practice or perform actual scan*)
- Breathe and relax (*at end of scan or practice*)

➤ Practice
breathing and
holding breath
with participant

Scan Coverage

- CT scan must include the lungs and minimize additional exposure
- Start scan slightly above the apex of the lungs and stop once the scan is through base of lungs



FOV

- The field of view should fit the lung and include some of the chest wall



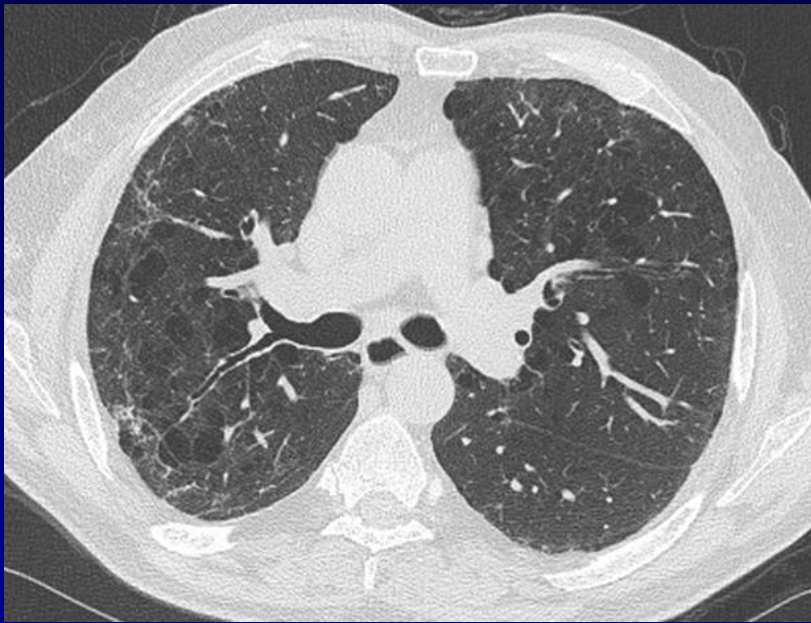
Participant Positioning

- Place patient in supine position, arms positioned above the head in a head-arm rest, lower legs supported
- Using laser positioning lights, line up the patient so the chest is iso-center (in the middle: left-right; up-down) of gantry
- Move table so participant is in correct position for a chest CT scan

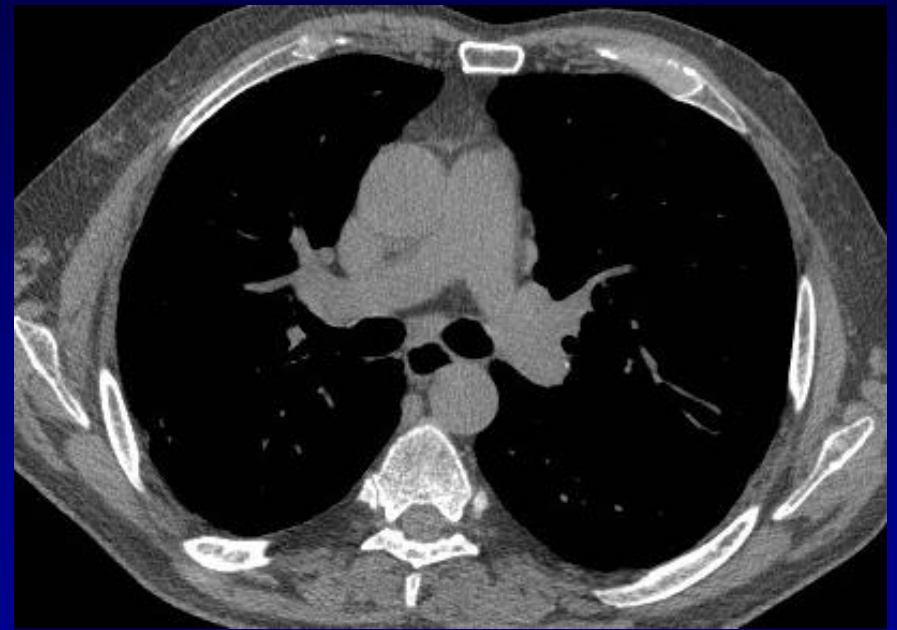
Post Processing

- After scan acquisition, CT technologist must reconstruct scan ensuring correct post processing algorithms/kernels
- Diameter Field of View (DFOV) should be set at smallest size that still includes entire lung field and chest wall & recons iso-centered
- Scan reconstruction identifiers should specify slice thickness and recon kernel
- Example of labeling scheme for PVDOMICS reconstructions:
 - 1.0mm slice thickness B30 kernel
 - 1.0mm slice thickness B60 kernel
- Important to only send these 2 scan reconstruction data sets through iUploader
- All PVDOMICS reconstructions must be archived and stored at local site

Lung Image Reconstructions



B60 Lung kernel



B30 Standard kernel

PVDOMICS Chest CT Steps per subject reviewed

1. Coordinator verifies that no CT scan has been performed on patient within last year and no thin section CT images are available for transfer to DCC lung imaging core
2. Coordinator provides scanner specs to CT technologist
3. CT technologist enters predefined settings into scanner
4. CT technologist performs scan using parameters and breathing instructions on PVDOMICS form
5. CT technologist performs post processing reconstructions and provides them to coordinator for transmission
6. CT technologist/coordinator records scan information onto Form 252-CT Data Transmittal Form printed from PVDOMICS webpage

Lung Imaging Core @ Data Coordinating Center

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