



NHLBI Pulmonary Vascular Disease Phenomics Program

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Chest CT Scanning, Data Transmission & Data Retrieval

Lung Imaging Core
Data Coordinating Center
Cleveland Clinic
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Lung Imaging Core



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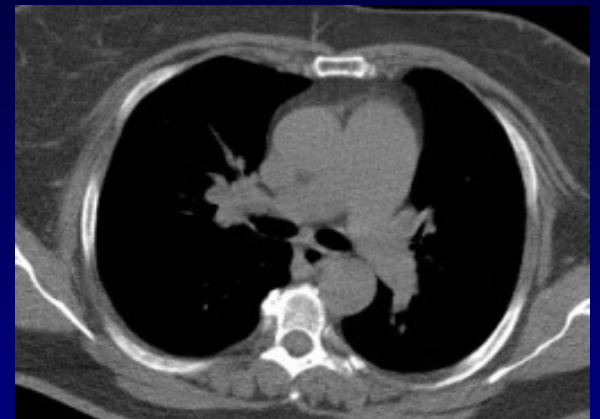
CT Protocol Options



Routine contrast
enhanced CT



CT pulmonary angiogram
(CTPA)
Group 4 (CTEPH)



Non contrast CT
*Group 3 (Lung Disease) &
Controls*

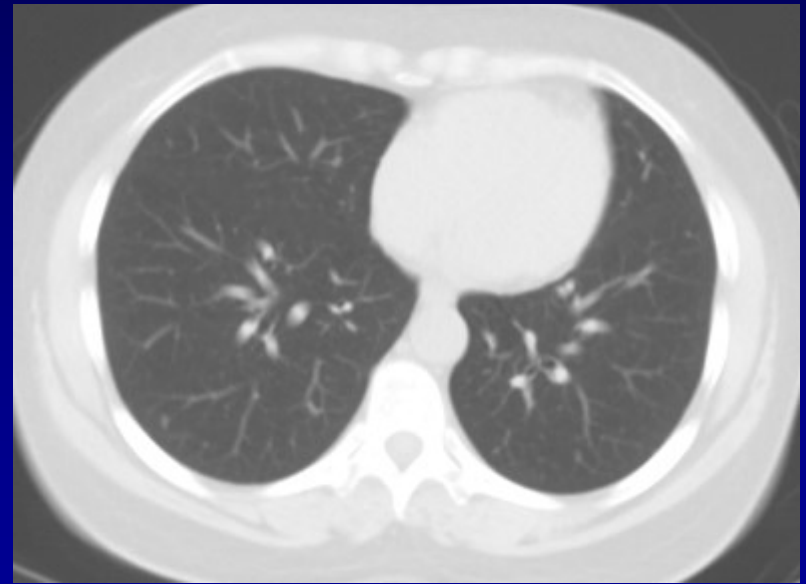


PVDOMICS Lung Imaging Protocol

- Preferred: Thin section 1mm non-contrast CT scan
- ***Acceptable: 3mm sections for all protocols



1 mm slice thickness



10mm slice thickness

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

Individual center parameters provided in MOP Chapter 80 appendices



PVDOMICS steps per participant

5 steps

1. Verify no thin section CT images available for participant within last year
2. Provide form to CT technologist to scan participant using predefined parameters and breathing instructions
3. Upload and transmit DICOM data via TeraRecon Intuition Uploader to DCC radiology server
4. Access individual PVDOMICS account to transfer de-identified Final Radiology Report to designated secure portal
5. Enter scan information onto CT data transmittal Form #252 or #253 and into PVDOMICS database



CT Technologist Specs and Instructions

PVDOMICS Chest CT Imaging - Specifications and Instructions Center 11 - Brigham and Women's

This MOP Section is for PVDOMICS Study Center 11-Brigham and Women's only. Print out this section and provide it to the CT Technologist prior to participant scanning. Also, have available the participant's BMI (calculated on Form 152) or provide measured height and weight closest to the day of this CT scan.

This section includes the following information:

General Information, Patient Positioning, Scan Coverage, Radiation Dose Selection (BMI) and Participant Breath Hold Instructions

General Information

- Study coordinators will provide the effective mAs using Table 1 and display field of view (DFOV) settings. All other scan parameters are provided below in Table 2.
- 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. Scout films may be repeated as needed.
- It is important that the patient fully understands the breath hold and scanning procedure and that all of the participant's concerns are addressed prior to performing the CT scan.

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 iso-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 slightly 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 fit the lung and include some of the chest wall as shown in Figure 2.

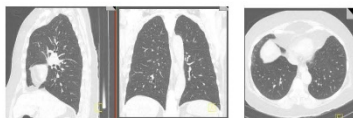


Figure 1.

Figure 2.

PVDOMICS Chest CT Imaging - Specifications and Instructions Center 11 - Brigham and Women's

Radiation Dose Selection

BMI must be provided to the technologist to set the effective mAs. Extra 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.

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

The following parameters must be implemented for performing chest CT scans at your center.

Center Specific CT Scanner Parameters

Scout scan uses default parameters. Use center discretion on type and number of scouts, however, must maintain ALARA principle.

Table 2 - Center-Specific Scanner Parameters

Center Specific Scanner Parameters	Center 11 - Brigham and Women's
Scanner Make	Siemens
Scanner Model	Somatom Dual Source
Scan Type	Spiral
Rotation time (s)	~0.5
Detector Configuration	64 x 0.6
kV	120
mAs/mAs	BMI setting
Pitch	1.0
Reconstruction Algorithm Standard	B35
Reconstruction Algorithm Lung	B60
Additional Image Filters	None
Iterative Reconstruction	Do NOT use
Dose modulation	Off
Thickness (mm)	1.0
Interval (mm)	0.8

PVDOMICS Chest CT Imaging - Specifications and Instructions Center 11 - Brigham and Women's

SCANNING:

Use these breathing instructions to perform the following:

- Conduct a practice breathing session with participant
- Take scout films - as needed - to position the FOV to cover the entire lung and as little soft tissue as possible
- Take inspiratory CT scan of participant

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)*



Chest CT Scanning

- Refer to CT Technologist Instruction Form regarding imaging instructions
- DO NOT repeat spiral scans for any reason

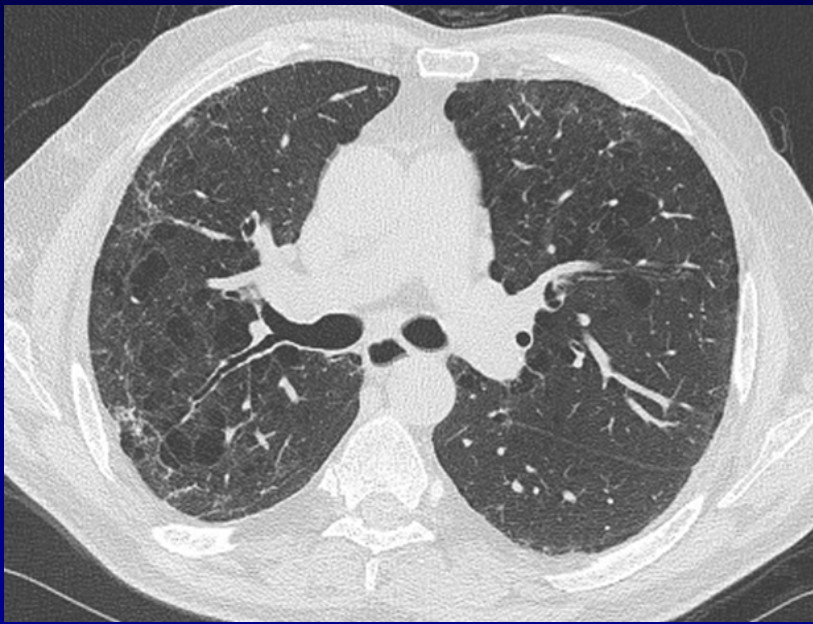


CT Image: Post Processing

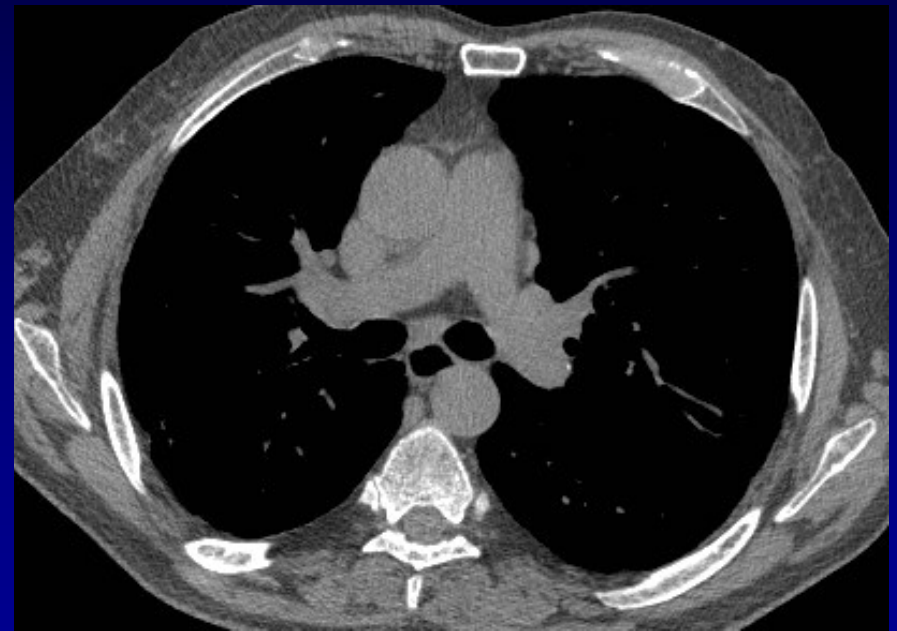
- CT technologist must reconstruct scan with identifiers specifying slice thickness and reconstruction kernel/algorithm
- Example of labeling scheme for PVDOMICS reconstructions:
 - 1.0mm slice thickness B30/Standard kernel
 - 1.0mm slice thickness B60/Lung kernel
- Please try to only send these 2 scan 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



iNtuition Uploader

- Purpose: Transfer Data to LIC
- Configured by DCC LIC administrators, TeraRecon and local study coordinators
- Software provided by CC/TeraRecon administrators



Uploader Configuration

Server Setup

User Name: * shared

Password: * *****

Group: *

Server: *

☒ Enable SSL ☒ Anonymize Log level: 3

Send Email To: *

Compress Method: ZIP Compress

Monitored Folder: *

Monitor Incoming DICOM Store

Store AET: * Port: 0

Store IP: 192.168.47.1

Retrieve From AQNet Server

Fetch: TR Derived Data Days: 0

Routing Data To PACS

AE: * Host: * Port: 0

☐ Route data to PACS when upload to AQNet server

OK Cancel





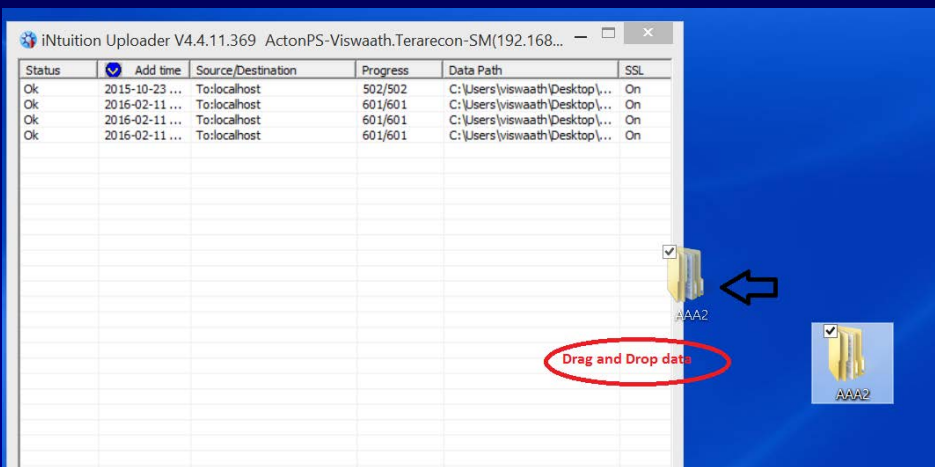
Data Anonymization and Assignment of ID

- Ascribe ID# to CT study before de-identification occurs
 - CT_id#_alphacode_testdate.pdf
- Assure research ID# matches true patient ID and store in local research database (including MRN #, Accession #, Name and DOB etc.)
- Essential for retrieval of patient information for clinical purposes

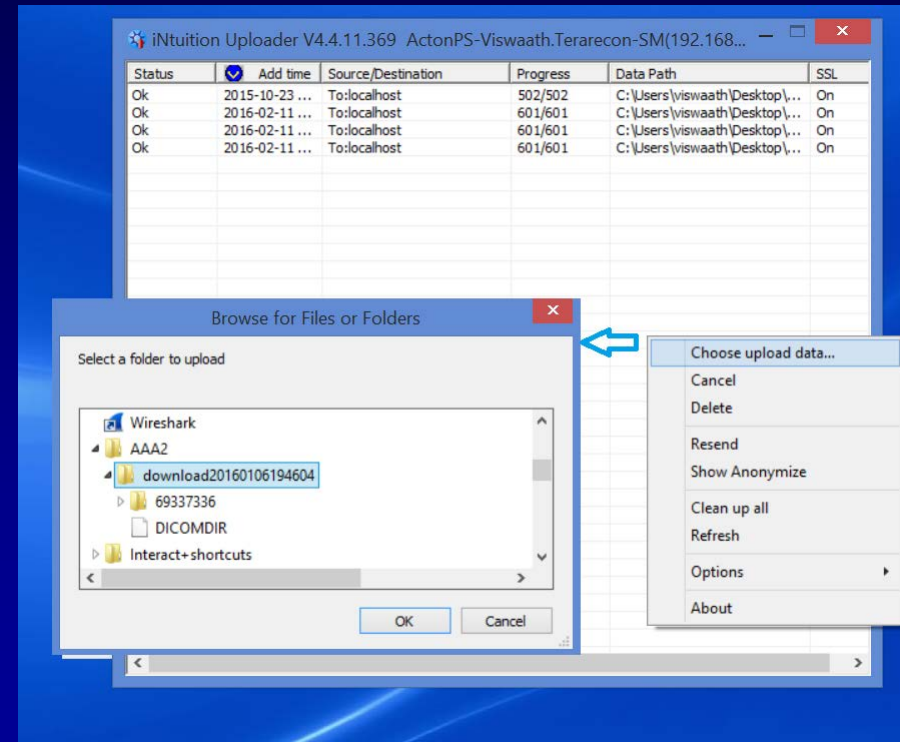


Uploading Data

Option 1



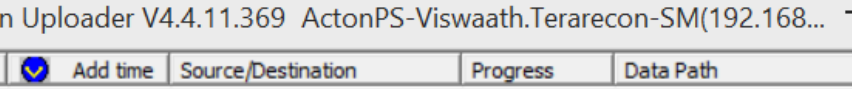
Option 2



Can be dragged from CT console, PACS, local drive or pre-anonymized CD

Browse to a folder to upload the data



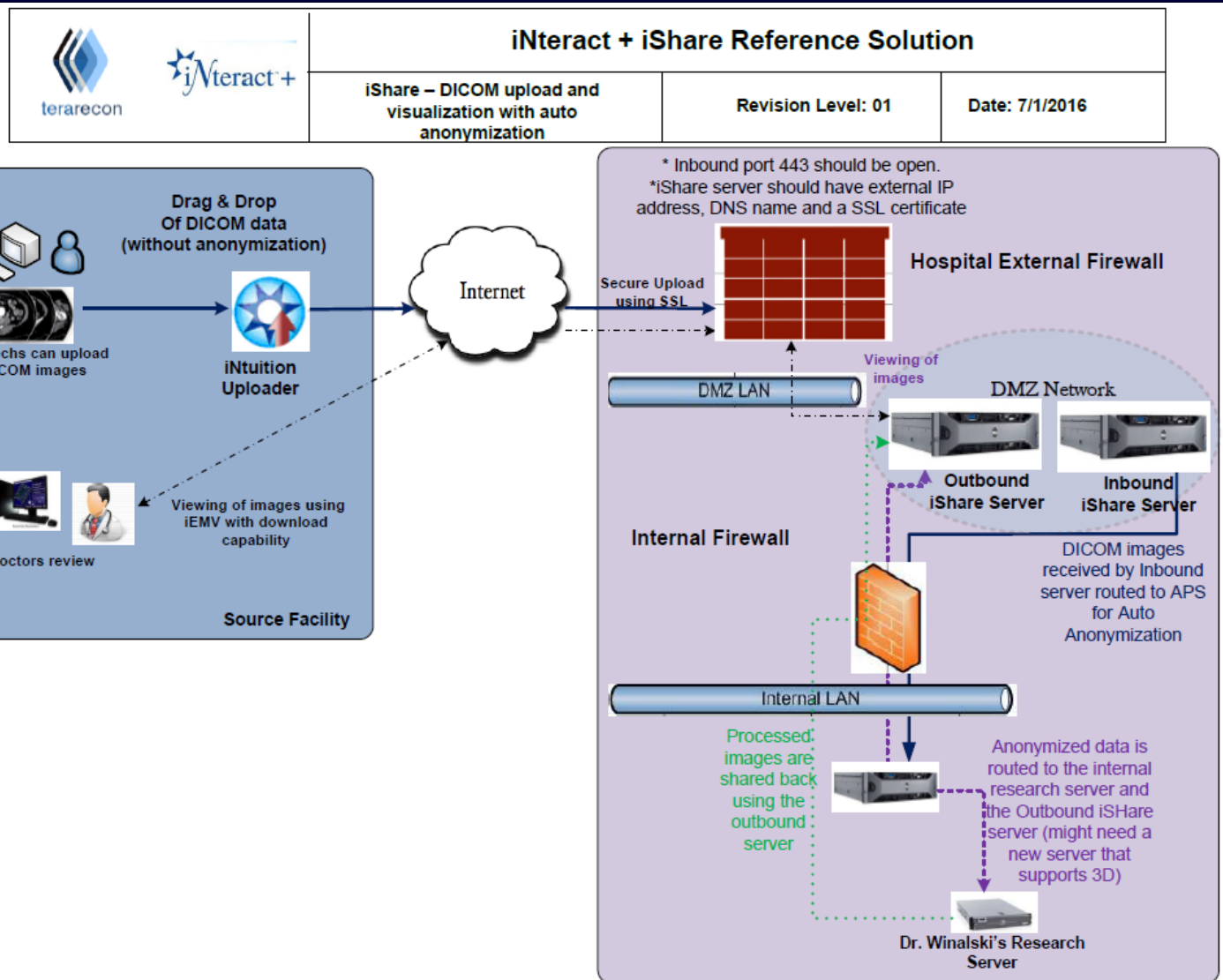
- 
- iNtuition Uploader V4.4.11.369 ActonPS-Viswaath.Terarecon-SM(192.168... —
- | Status | Add time | Source/Destination | Progress | Data Path | SSL |
|--------|----------------|--------------------|----------|-------------------------------|-----|
| Ok | 2015-10-23 ... | To:localhost | 502/502 | C:\Users\viswaath\Desktop\... | On |
| Ok | 2016-02-11 ... | To:localhost | 601/601 | C:\Users\viswaath\Desktop\... | On |
| Ok | 2016-02-11 ... | To:localhost | 601/601 | C:\Users\viswaath\Desktop\... | On |
| Ok | 2016-02-11 ... | To:localhost | 601/601 | C:\Users\viswaath\Desktop\... | On |



General Overview Digital Workflow

Obtaining, uploading and transferring data:

1. Technologist performs CT scan and saves DICOM in destination folder
2. Study coordinator performs 1-click removal of patient information than drags and drops DICOM file into iNtuition Uploader folder
3. Study coordinator electronically submits data
4. Secure digital transfer of data



Complete Anonymization

- VERY IMPORTANT- must remove all DICOM files containing patient information
- Intuition uploader will automatically remove PHI attached to images
- Additional/separate files containing PHI in patient folder must be removed manually



Processing Clinical Reports

- PLEASE INDICATE WHETHER SCAN WAS RESEARCH, CLINICAL OR HISTORICAL
- Final Radiology Report must be de-identified prior to transferring
- Print hard copy of report
- Black out all identifying information such as name, DOB, MRN, etc.
- Enter participant's PVDOMICS ID #, alphacode, date of CT scan on each page
- Scan and save as a pdf

Name: [REDACTED]

PVDOMICS ID#:

DOB: [REDACTED]

CT_XXXXXX_ac_MMDDYYYY

MRN: [REDACTED]

CHEST CT WITHOUT CONTRAST

Indication: Shortness of Breath

Technique: Spiral CT acquisition without contrast. 1 mm slice thickness.

Dose reduction techniques were employed.

CT Dose-Length Product: 245 mGy*cm

Comparison: None Available

RESULTS:

1. Lines, Tubes, and Devices: N/A

2. Lungs and Pleura: Patent central airways. No dominant nodules. No focal lung consolidations or effusions.

3. Cardiomediastinal silhouette: Heart and great vessels within normal size limits. No pericardial effusion.

4. Neck base: N/A

5. Thoracic lymph nodes: No significant mediastinal adenopathy.

6. Bones and Soft tissues: Mild degenerative changes of the thoracic spine.

7. Upper abdomen: No acute upper abdominal abnormalities.

IMPRESSION:

Normal Chest CT.



Transferring Clinical Reports

- File naming convention is:

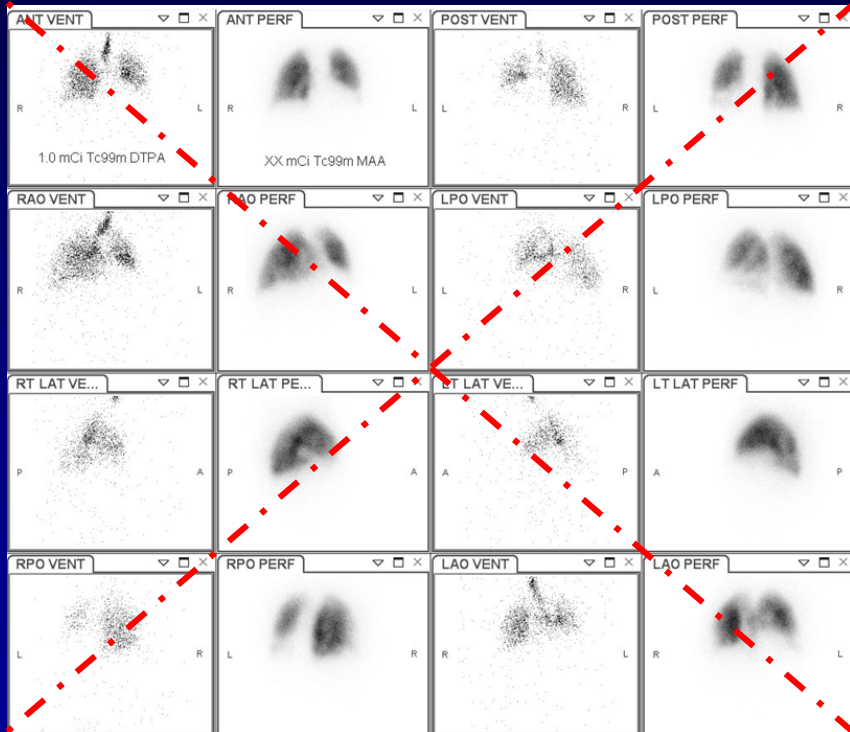
“CT_XXXXXX_ac_mmdyyy.pdf”

file content PVDOMICS id # alphacode test date file type

- Log in to SSH with previously assigned account name and password
- Drag and drop file into DCC's secure portal on SSH/WinSCP
- Include document transfer date on Form 252 (or 253)
- DCC will move file out of home directory for processing
- Please send DICOM data and emailed clinical report as close in time as possible with recorded dates for both

Ventilation Perfusion Imaging

VQ scan



- Not required if participant has accompanying CTA and CTA images are positive for CTEPH & provided to LIC
- Not required if V/Q has been performed within 4 years prior to enrollment
- Report only will be transmitted to LIC via secure DCC portal; V/Q images will not be transferred

Transferring VQ Reports

- Identical method to transmitting CT reports
- Final report must be de-identified, printed, re-identified with PVDOMICS ID #, scanned, saved as pdf and transmitted to DCC secure portal
- File name is:
“VQ_XXXXXX_ac_mmdyyy.pdf”



Conclusion

- Simple, efficient and secure method of data upload, transmission and network sharing via TeraRecon iUploader, iNtuition Server, and iShare
- Study coordinator and CT technologist work together with minimal post-scanning/processing effort
- Will ensure accurate transmission of DICOM for post processing data analysis at Lung Imaging Core which will be essential to phenotyping patients in PVDOMICS study



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