



CT TECHNOLOGIST INSTRUCTION FORM

MESA LUNG III/NON-SMOKERS

SINGLE NON-CONTRAST SCAN

SINGLE CONTRAST-ENHANCED DUAL-ENERGY SCAN

SIEMENS SOMATOM FORCE SCANNER

Effective Date: 09/06/2016

Rev: 1.4

Pg. 1 of 8

This form should be readily available at all certified MESA LUNG III Force scanners, or brought to scanner with each subject.

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 technologist with the PVS form which contains the mAs and DFOV setting (if baseline parameters are available) to use for this visit. All other scan parameters are provided below in Tables 1 and 2.

eGFR Monitoring

- eGFR must be measured on all subjects who have consented to having a contrast enhanced scan.
- This will be done POC at the CT suite unless your site has decided to measure it in a lab beforehand.
- **If eGFR is more than or equal to 60**, then you can proceed with the contrast enhanced lung scan.
- **If eGFR is less than 60**, then you will **NOT** perform the contrast enhanced lung scan. At this point, the coordinator will need to go onto PVS and change the subject scan type to non-contrast. They will print a new PVS form, discarding any other printed PVS forms and provide the new form to the technologists.

DO NOT perform any scanning until you have the correct PVS form in-hand.

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.



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Pg. 2 of 8

Scan Coverage

- CT scan must include the lungs, but **ONLY** the lungs. Non-contrast scan can be performed either craniocaudal or caudocranial. **Contrast-enhanced** scan should be completed **caudocranial** to help ensure no motion is present at the base of the lung.
- The DFOV should match the baseline value (*provided by coordinator prior to the scan; located on PVS form*). If this is the baseline, then the DFOV should be set as tight as possible to include only the lungs with no more than 2cm of non-lung tissue on either side. (see *Figure 1 and 2 for an example of a tight DFOV*)

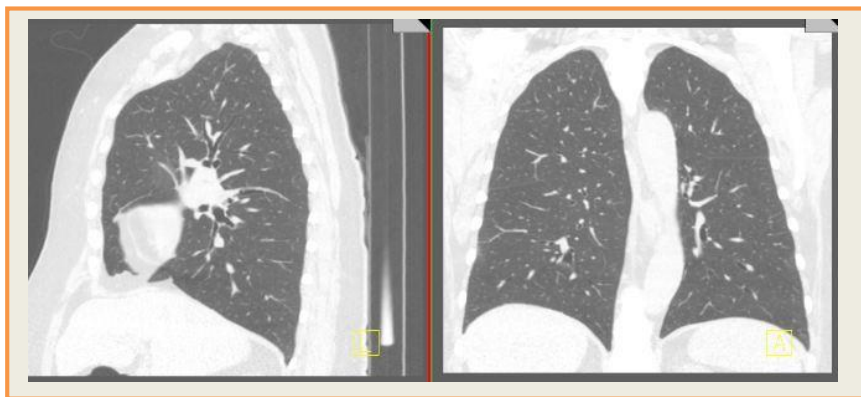


Figure 1

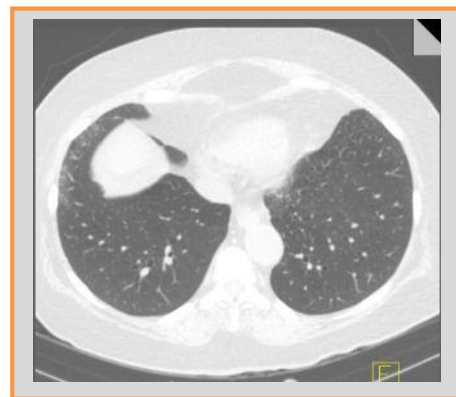


Figure 2



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Pg. 3 of 8

Non-contrast TLC CT Parameters

- The following parameters must be implemented for this CT scan.
See Table 1
- Scout scan uses default parameters (Site discretions on type and number of scouts, however must maintain ALARA principle)
- A scout scan should be performed at the appropriate lung volume prior to the lung scan
- **Spiral scans may NOT be repeated.**

Table 1: Perform one non-contrast scan of the lung at total lung capacity (TLC)

1mSv	Non-Contrast Scan TLC
Scanner	SOMATOM Force
Scan Type	Helical
Rotation Time (s)	0.25
Det. Configuration	192 x 0.6mm
kV	120 kV
Quality Ref mAs	36
Pitch	1
Care Dose4D	ON
Recon Algorithm	Qr40
Iterative Recon	ADMIRE 5
Reconstructions Thickness X Interval (mm)	R1: 0.75 X 0.5
Est. Scan Time (Sec) 30cm length	<5
CTDIvol (mGy)	2.4*
RAW DATA	SAVE RAW DATA**

* $2.4 \times 30\text{cm} \times 0.014 = 1.0\text{mSv}$ for a standard 75kg/25 BMI subject.

**Raw Data details and plan to be determined later



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Pg. 4 of 8

TLC Breathing Instructions (for non-contrast scan)

- These breathing instructions will be live-coached; NOT recorded.
- Scouts and CT scans must follow these breathing instructions to minimize radiation amount

Practice breathing with subject at least once prior to scanning.

SCANNING:

Use the breathing instructions to perform:

- A practice breathing session
- Scouts - as needed - to position the FOV to cover the entire lung and as little soft tissue as possible
- The Inspiration CT scan (TLC)

Inspiratory CT (TLC)

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 and hold it in (*watch chest to ensure a deep breath in as far as possible*)

Keep holding your breath – DO NOT BREATHE!

At end of scan or practice - Breathe and relax



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Rev: 1.4

Pg. 5 of 8

Contrast-enhanced CT Parameters

- The following parameters must be implemented for this CT scan.
See Table 2
- Scout scan uses default parameters (Site discretions on type and number of scouts, however must maintain ALARA principle)
- **Dual energy scans may NOT be repeated.**

Table 2

3.05mSv	Contrast Scan FRC
Scanner	SOMATOM Force
Scan Type	Helical (Dual Energy)
Rotation Time (s)	0.25
Det. Configuration	192 x 0.6mm
kV (A/B)	80/Sn150 kV
Eff. mAs (A/B)	210/117
Pitch	.55
Care Dose4D	ON
Contrast Injection	Rate: 4cc/sec; 50% CM/50% Saline
Contrast Solution Total	4cc/sec (17 sec delay + scan time) + 8cc (see contrast chart)
Recon Algorithm	Qr40
Iterative Recon	ADMIRE 5
Reconstructions Thickness X Interval (mm)	R1: 0.75 X 0.5; R2: 2.0 X 1.4
Reconstruction Energy (series)	A, B, and M
Est. Scan Time (Sec) 30cm length	<5
CTDIvol (mGy)	7.27*
RAW DATA	SAVE RAW DATA**

*7.27 x 30cm x 0.014 = 3.05mSv for a standard 75kg/25 BMI subject.

**Raw Data details and plan to be determined later



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Pg. 6 of 8

Contrast Administration

- **Contrast**

- Use Isovue (Iopamidol) 370mg/ml concentration.
- John's Hopkins has been approved to use Omnipaque (Iohexol) 350mg/ml
- Use a 50% contrast/50% saline mixture for injection (*see Table 3 for Contrast Solution chart*)
- Rate: 4cc/sec
- Delay time: 17 seconds
- The exact contrast mixture amount = rate (delay time + scan time) + 8cc (to ensure contrast is flowing during scan). **You must stop any extra contrast at the end of the scan.**
Example, 4cc/sec (17 sec delay + ~5sec scan time) + 8cc = ~96cc
 - See Table 3 for Contrast Solution chart
 - Scan time will vary and will be determined once the scan is set up.

- **Contrast Steps**

- You will need to have your scan set up prior to setting up and starting the injection.
- Scan should be set just below the base of the lung and end just above the apex.
- Use the scan time to set up the injection based on parameters above and using the Contrast Solution chart (Table 3).
- Flush the line prior to injection.
- Connect the injector to the patient. Ensure all air is out of the line first and there is no stop cock in the line which will rupture when injecting.
- **Set injection to use 50% contrast and 50% saline mix the entire time**
- Flush line manually with saline after the scanning is completed.

Contrast Solution = 50% Contrast and 50% Saline

Scan Time	Total Amount of Solution
1 – 1.99 seconds	82 cc
2 – 2.99 seconds	86 cc
3 – 3.99 seconds	90 cc
4 – 4.99 seconds	94 cc
5 – 5.99 seconds	98 cc

Table 3



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Pg. 7 of 8

- **Scan Steps**

- An automatic recording should be used for the breathing instructions. The recording should be 17 seconds (± 1 sec).
This should be practiced with the subject prior to scanning at least once.
- Start the injection and the scan simultaneously, keeping an eye on the pressure to ensure it looks good and has not peaked, indicating infiltration or the line bursting.
- The scan will start automatically following the 17 second breath hold instructions.

FRC Breathing Instructions (for contrast-enhanced scan)

- These breathing instructions should be recorded prior to the study.
See script on next page
- The recording should be 17 seconds long (± 1 second).
- Scouts and CT must follow these breathing instructions to minimize contrast and radiation amount

Practice breathing with subject at least once prior to scanning.

Things to stress:

- You will hear a recording of the instructions
- The recording tends to go a little quick, so follow along best you can. It will have you take a deep breath in and blow it out a couple times; these do not need to be long breaths, just fairly quick, deep breaths in and out before it has you take a deep breath in and slowly let it out.
- When you let the last breath out, it will be to the point you feel like it's a comfortable expiration and then you will stop breathing and hold it for about 5-10 seconds. It is crucial you stop breathing when the recording says to stop.

Technologists: You should play the recording for the subject prior to starting to have them practice at least once. Also, watch them closely during the scout (topogram) to ensure they are following correctly.



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Pg. 8 of 8

SCANNING

Use the breathing instructions to perform:

- A practice breathing session
- Scouts - as needed - to position the FOV to cover the entire lung and as little soft tissue as possible
- The Expiration CT scan (FRC)

Expiratory CT (FRC)

BREATHING INSTRUCTIONS:

Take a deep breath in...

Let it out...

Take another deep breath in...

Let it out...

Take one more deep breath in...

Now let it out and hold it out...

Stop breathing

After scan is complete:

You can breathe