ASEAN Movement in Radiology

# Report from the 2023 annual meeting of thoracic radiologists in Thailand: The development and reviews of the standards, guidelines, and advice concerning diagnostic radiology of thoracic disorders in Thailand

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The rising issues in practice related with thoracic diagnostic imaging in both private and public sectors were presented to a panel consisting of thoracic radiologist experts from all parts of Thailand in a meeting held on 20 October 2023 by the Royal College of Radiologists of Thailand (RCRT) in collaboration with the Foundation for Orphan and Rare Lung Disease (FORLD) at Asoke Conference Room on the fourth floor of Eastin Grand Hotel, Phaya Thai, Bangkok. The issues were grouped into 5 agendas: a post implementation review of the National HRCT Protocol, the safety and effectiveness of the diagnostic imaging, HRCT interpretation for suspected or at-risk or with known interstitial lung disease including the standard report of HRCT in patients with fibrotic lung disease, the recommended CT protocol for patients with thoracic malignancy in the public health universal coverage system, and a review of the guideline for determining fibrotic extent on HRCT.

## Agenda 1: A post implementation review of the National HRCT Protocol and a question-and-answer session, presented and moderated by Chayaporn Kaewsathorn.

The conference revisited the proceedings of the annual meeting held in 2022, during which HRCT protocols from ten different institutes were compared with the National HRCT Protocol. A comprehensive summary of this meeting has been documented in The ASEAN Journal of Radiology under the title "Report from the 2022 Annual Meeting of Thoracic Radiologists in Thailand: National HRCT Protocol and its Applications in 10 Major Institutes" [1]. The conference facilitated discussions on the additional adjustments made to the protocol in each institute, detailed in Table 1. From an overarching standpoint, each hospital demonstrated an average radiation dose lower than 7 mSv, with the exception of Burapha University. Burapha University is currently in the process of acquiring a new machine, anticipated to be operational within the next 6 months.

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**Table 1.** *The HRCT protocols practiced in ten institutes, in comparison with the National Protocol.*

| | Position/ respiration | National protocol | Songklanagarind Hospital | Siriraj Hospital | Chulalongkorn Hospital | Ramathibodi Hospital |
|---|---|---|---|---|---|---|
| **Scan coverage** | Supine/Inspiration | Whole chest | Whole chest | Whole chest | Whole chest | Whole chest |
| | Supine/Expiration | Whole chest | Whole chest | Whole chest | Whole chest | Whole chest |
| | Prone/Inspiration | Optional<br>Limit to ROI / whole chest | Optional Whole chest | Optional Whole chest | Optional Limit to ROI | Optional Limit to ROI |
| **Technique** | Supine/Inspiration | Volumetric | Volumetric | Volumetric | Volumetric and Sequential | Volumetric |
| | Supine/Expiration | Sequential / (optional) volumetric, ultralow dose | Sequential | Volumetric, dose not assessed | Sequential | Sequential / Volumetric, dose not assessed |
| | Prone/Inspiration | Sequential / (optional) volumetric at ROI, ultralow dose | Sequential / volumetric at whole chest, ultralow dose | Sequential (below carina) | Sequential | Sequential |
| **Collimation** | Supine/Inspiration | Thinnest (< 1.5 mm) | Thinnest (0.625 mm) | Thinnest (< 1.5 mm) | Thinnest (0.6 mm) | Thinnest (0.625 mm) |
| | Supine/Expiration | | | | | |
| | Prone/Inspiration | | | | | |
| **Rotation time** | Supine/Inspiration | Shortest (<0.5 s) | Shortest (0.33 s) | Shortest (<0.5 s) | Shortest (0.35 s) | Shortest (0.27 s) |
| | Supine/Expiration | | | | | |
| | Prone/Inspiration | | | | | |
| **Pitch** | Supine/Inspiration | Highest (>1) | Highest (>1) | 0.992:1 | 1.2 | 1.234 |
| | Supine/Expiration | | | | | |
| | Prone/Inspiration | | | | | |
| **Radiation dose** | Supine/Inspiration | 120 kVp<br>Auto mAs<br>(1-3 mSv) | 120 kVp<br>Auto mAs<br>(1-3 mSv) | 120 kVp<br>Auto mAs<br>(dose not assessed) | 120 kVp<br>Volumetric Auto mAs<br>Sequential 40-60 mAs<br>(2-4 mSv) | 120 kVp<br>Auto mAs<br>(dose not assessed) |
| | Supine/Expiration | 120 kVp<br>20-60 mAs<br>(<1mSv)<br>*100 Kvp, 40-60 mAs<br>(<1mSv) | 120 kVp<br>Auto mAs<br>(<1mSv) | 100 kVp<br>Auto mAs<br>(dose not assessed) | 100 kVp<br>40-60 mAs<br>(<1 mSv) | 100 kVp<br>20-60 mAs<br>(dose not assessed) |
| | Prone/Inspiration | 120 kVp<br>40-80 mAs<br>(<1mSv) | 120-100 kVp<br>Auto mAs<br>(<1mSv)" | 100 kVp<br>50 mAs<br>(dose not assessed)" | 100 kVp<br>60 mAs<br>(<1 mSv) | 100 kVp<br>40-50 mAs<br>(dose not assessed) |
| **Reconstruction** | Supine/Inspiration | 1. Axial, lung-window (high-spatial algorithm) ≤1.5 mm thickness overlap (30-50%)<br>2. Axial, mediastinal-window (low-spatial algorithm) ≤1.5 mm thickness overlap (30-50%)<br>3. Coronal, mediastinal window (low-spatial algorithm) ≤1.5 mm thickness contiguous | 1. Axial, lung-window (high-spatial algorithm) 1.0-1.5 mm thickness overlap (30-50%)<br>2. Coronal and sagittal, lung-window (high-spatial algorithm) 1.0-1.5 mm thickness overlap (30-50%)<br>3. Axial, mediastinal-window (low-spatial algorithm) 2.5-3 mm thickness<br>4. No coronal, mediastinal window | 1. Axial, lung-window (high-spatial algorithm) Inspiration 0.625 mm Expiration 1.25 mm thickness overlap (30-50%)<br>2. Axial, mediastinal-window (low-spatial algorithm) 1.25 mm thickness<br>3. Coronal, mediastinal window (low-spatial algorithm) 5 mm thickness contiguous<br>**estimate BW and HT before scan | 1. Axial, lung-window (high-spatial algorithm) 1.0-1.25 mm thickness overlap (30-50%)<br>2. Axial, mediasti-nal-window (low-spatial algorithm) 1.0-1.25 mm thickness overlap (30-50%)<br>3. Coronal and sagittal, mediastinal window, 5 mm thickness, 3 mm increments | 1. Axial, lung-window (high-spatial algorithm) 1.0 mm thickness overlap (30-50%)<br>2. Axial, mediastinal-window (low-spatial algorithm) 1.0 mm thickness<br>3. Coronal and sagittal, mediastinal window<br>4. Axial MIP, mediastinal window, 7 mm thickness, 3 mm increments<br>**estimate BW and HT before scan |

| | Position/ respiration | Rajavithi Hospital | Maharaj Nakorn Chiang Mai Hospital | Srinagarind Hospital | Thammasat University Hospital | Burapha University Hospital | MedPark Hospital |
|---|---|---|---|---|---|---|---|
| **Scan coverage** | Supine/Inspiration | Whole chest | Whole chest | Whole chest | Whole chest | Whole chest | Whole chest |
| | Supine/Expiration | Whole chest | Whole chest | Whole chest | Whole chest | Whole chest | Whole chest |
| | Prone/Inspiration | Optional<br>Whole chest | Optional<br>Limit to ROI | Optional<br>Whole chest | Optional<br>Whole chest | Optional<br>Whole chest | Optional<br>Limit to ROI |
| **Technique** | Supine/Inspiration | Volumetric | Volumetric | Volumetric | Volumetric | Volumetric | Volumetric and Sequential |
| | Supine/Expiration | Volumetric, not ultralow dose | Volumetric, not ultralow dose | Volumetric, dose not assessed | Volumetric, not ultralow dose | Volumetric, not ultralow dose | Volumetric, ultralow dose |
| | Prone/Inspiration | Volumetric at whole chest, not ultralow dose | Volumetric at ROI, not ultralow dose | Volumetric at whole chest, dose not assessed | Volumetric at whole chest, not ultralow dose | Volumetric at whole chest, not ultralow dose | Volumetric at ROI, ultralow dose |
| **Collimation** | Supine/Inspiration | Thinnest (< 1.5 mm) | Thinnest (0.6 mm) | Thinnest (< 1.5 mm) | Thinnest (0.625 mm) | Thinnest (0.5 mm) | Thinnest (< 1.5 mm) |
| | Supine/Expiration | | | | | | |
| | Prone/Inspiration | | | | | | |
| **Rotation time** | Supine/Inspiration | Shortest (<0.5 s) | Shortest (<0.5 s) | Shortest (<0.5 s) | Shortest (<0.5 s) | Shortest (<0.5 s) | Shortest (<0.5 s) |
| | Supine/Expiration | | | | | | |
| | Prone/Inspiration | | | | | | |
| **Pitch** | Supine/Inspiration | 1.2 | 1 | 1.2 | 1 | 1.4 | 1.2 |
| | Supine/Expiration | | | | | | |
| | Prone/Inspiration | | | | | | |
| **Radiation dose** | Supine/Inspiration | 120 kVp<br>Auto mAs<br>(3-4 mSv) | 120 kVp<br>110 mAs<br>(1-3 mSv) | 120 kVp<br>Auto mAs<br>(dose not assessed) | 120 kVp<br>Auto mAs<br>(1-3 mSv) | 120 kVp<br>Auto mAs<br>(10 mSv) | 120 kVp<br>Volumetric Auto mAs<br>Sequential 220 mAs<br>(4.1 mSv) |
| | Supine/Expiration | 120 kVp<br>Auto mAs<br>(2 mSv) | 120 kVp<br>65 mAs<br>(1-2 mSv) | 120 kVp<br>Auto mAs<br>(dose not assessed) | 120 kVp<br>Auto mAs<br>(1-2 mSv) | 120 kVp<br>150 mAs<br>(5 mSv) | 120 kVp<br>Auto mAs<br>(<1mSv) |
| | Prone/Inspiration | 120 kVp<br>Auto mAs<br>(2 mSv) | 120-100 kVp<br>110 mAs,<br>(1-3 mSv) | 120 kVp<br>Auto mAs<br>(dose not assessed) | 120-100 kVp<br>Auto mAs<br>(1-2 mSv) | 120 kVp<br>150 mAs<br>(5 mSv) | 120 kVp<br>Auto mAs<br>(<1mSv) |
| **Reconstruction** | Supine/Inspiration | 1. Axial, lung-window (high-spatial algorithm) 2.0 mm thickness overlap (30-50%)<br>2. Axial, lung-window, (high-spatial algorithm) 1.0 mm, interval 10 mm.<br>3. Coronal and sagittal , lung-window, (high-spatial algorithm) 2.0 mm thickness<br>4. Axial, mediastinal-window (low-spatial algorithm) 2.0 mm thickness<br>5. No coronal, mediastinal window | 1. Axial, lung-window (high-spatial algorithm) 0.7-1.0 mm thickness overlap (30-50%)<br>2. Coronal and sagittal, lung-window (high-spatial algorithm) 1-5 mm thickness<br>3. Axial, mediastinal-window (low-spatial algorithm) 1 mm thickness<br>4. No coronal, mediastinal window | 1. Axial, lung-window (high-spatial algorithm) 0.6-1.0 mm thickness overlap (30-50%)<br>2. Coronal and sagittal, lung-window (high-spatial algorithm) 1 mm thickness<br>3. Axial, mediastinal-window (low-spatial algorithm) 2.0 mm thickness<br>4. No coronal, mediastinal window | 1. Axial, lung-window (high-spatial algorithm) 1.0 mm thickness overlap (30-50%)<br>2. Coronal and sagittal, lung-window (high-spatial algorithm) 2.5 mm thickness<br>3. Axial, mediastinal-window (low-spatial algorithm) 2.5 mm thickness<br>4. No coronal, mediastinal window | 1. Axial, lung-window (high-spatial algorithm) 1.0 mm thickness overlap (30-50%)<br>2. Coronal and sagittal, lung-window (high-spatial algorithm) 3 mm thickness<br>3. Axial, mediastinal-window (low-spatial algorithm) 2.0 mm thickness<br>4. No coronal, mediastinal window | 1. Axial, lung-window (high-spatial algorithm) 1.0 mm thickness overlap (30-50%)<br>2. Coronal and sagittal, lung-window (high-spatial algorithm) 2 mm thickness<br>3. Axial, mediastinal-window (low-spatial algorithm) 1 mm thickness<br>4. Coronal and sagittal mediastinal window (thickness not provided) |

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## Agenda 2: A review of safety and effectiveness of the diagnosis of thoracic disorders using imaging.

### 2.1 Mass miniature chest radiography, presented by Chayaporn Kaewsathorn and moderated by Wiwatana Tanomkiat.

Image intensifier photofluorography or mass chest radiography is still in limited use in Thailand and image interpreters are general doctors, without the reliance on an illuminator and a magnifying machine to enlarge the image to facilitate an interpretation even in the contemporary healthcare practices. Therefore, the sensitivity, specificity, and accuracy cannot be compared with reports from other countries. Because the mass miniature chest image is the screen film radiograph, it needs to be digitized to store in the Picture Archive and Communication System (PACS) or its use in mass screening in public health can be limited. For the same reason, artificial intelligence (AI) for screening or triaging cannot be applied on the digitized mass chest. Moreover, in 1974, the World Health Organization (WHO) released the ninth report claiming that mobile mass radiography should be abandoned in the screening for tuberculosis [2].

***Participants' conclusion:*** The conference participants unanimously agreed that mass miniature chest radiography is not a recommended method in a medical check-up or a health screening. There should be a clear communication about the limitations of using mass miniature chest radiography in terms of sensitivity, specificity, and accuracy, which might not be effective enough and diseases could stay unnoticed.

## 2.2 The use of low-dose CT (LDCT) and Lung-RADS, presented by Nitra Piyavisetpat.

### LDCT

As CT scans have become more widely used in lung cancer screening nowadays, a meeting was convened to establish a common understanding regarding the definition of LDCT, responsibilities of the individuals in charge of LDCT, and the limitations and risks associated with LDCT.

***Definition of LDCT:*** Until the present days, there has not been an exact definition of how much radiation falls into the low-dose category. In practice, many institutes in Thailand follow the following:

- The low-dose quantity is defined as 10-30% of the standard-dose CT [3],
- The general aim of LDCT is to decrease the effective dose, calculated by multiplying the Dose Length Product (DLP) by a specific conversion factor of 0.0146. The DLP itself is derived from computed tomography dose index (CTDI) multiplying by scan length (in cm). To reduce the effective dose, changes can be made not only by lowering the tube current and tube voltage but also by limiting the scan length specific to the lungs.

***The use of LDCT:*** It is widely accepted that the use of LDCT could reduce the mortality rate, as indicated by numerous studies. According to the US Preventive Services Task Force guidelines, patients aged 50 years or older, with a smoking history of 20 or more pack years, and who are either current smokers or quit smoking less than 15 years ago, are considered at risk [4].

***Whether or not there should be a CT protocol guideline:*** In low-dose screening trials, the effective dose ranges from 0.2-2.36 mSv. In the National Lung Screening Trial (NLST), an average effective dose estimate is 2 mSv per CT, and in the Nelson trial the estimated effective dose is less than 2 mSv. Based on the National Diagnostic Reference Levels in Thailand 2023 [5], the DLP of standard non-contrast chest CT chest is 417 mGy.cm, which corresponds to an effective dose of approximately 6.09 mSv. Therefore, in Thailand, LDCT should be at least 50% lower than the standard non-contrast chest CT.

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***Possible dangers:*** The primary concern regarding LDCT is the potential harmful effects of radiation. Even though the radiation dose in LDCT is significantly lower than in standard chest CT, patients often require multiple CT scans, not only for initial screening but also for diagnostic evaluations of lesions detected during LDCT screening. This leads to cumulative radiation exposure. Furthermore, the lungs become more sensitive to radiation as individuals age, with a peak sensitivity typically occurring around 50-55 years. Smoking also amplifies the damage caused by radiation [6]. Therefore, the risk of radiation exposure is not negligible.

LDCT is generally considered inferior to standard dose CT in detecting lesions such as ground glass nodule and other mediastinal lesions, especially in the obese patients. It can also lead to false negative results, particularly for small cell lung cancer which is not generally detected at an early stage. Therefore, a negative LDCT result does not rule out the possibility of lung cancer.

In Thailand, there is widespread confusion regarding the use of LDCT for diagnostic purposes. Some decision-makers mistakenly believe that LDCT should be inexpensive due to its lower radiation dose, leading physicians to request LDCT to cut healthcare costs. However, achieving diagnostic quality with reduced radiation demands sophisticated, high-level CT scanners. These advanced machines are meticulously engineered to minimize radiation doses while ensuring diagnostic accuracy. Consequently, these high-quality CT scanners come at a significant cost. This misunderstanding poses challenges for radiologists using LDCT, potentially compromising the quality of diagnoses. Therefore, it is imperative for responsible individuals to educate decision-makers about the intricacies of LDCT technology and its associated costs.

***Participants' conclusion:*** The participants achieved the following:

1) In terms of the definition of LDCT, an effective dose is at least 10-30% of the standard-dose non-contrast chest CT,

2) The CT machine used to conduct LDCT should be the 16 slices model or newer, as this specific model offers sufficient image resolution to detect nodules even with reduced radiation,

3) Although the radiation dose in LDCT is low, multiple CT scans are performed in the screening group. Moreover, the peak sensitivity of lungs to radiation occurs between the ages of 50-55, and there is a synergistic effect with smoking. Hence, radiation harm cannot be disregarded. Patients entering screening programs should meet the specified screening criteria. Additionally, it is crucial not only to undergo low-dose CT screening but also to focus on smoking cessation,

4) LDCT has limitations in its interpretation across various aspects. The interpretation of other diseases using LDCT relies on the judgment of radiologists for deriving additional benefits,

5) LDCT screening for lung cancer is valuable for detecting slow-growing cancers, but it may miss rapidly progressing tumors between screenings. A negative low-dose CT result does not guarantee the absence of lung cancer and can yield high false-positive rates, particularly in areas with a high prevalence of tuberculosis and granulomatous infections.

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**Lung-RADS**

To ensure consistent interpretation based on Lung-RADS version 2022 [7], discussions were conducted regarding its application. Lung-RADS 2022 is intended for interpreting scans of patients meeting specific screening criteria, namely, those aged 50 years or older, with a smoking history of 20 or more pack years, and either current smokers or individuals who quit smoking less than 15 years ago. Conversely, the 2017 Fleischner Society guidelines should be applied to the general population with incidentally detected nodules [8].

***Participants' conclusion:*** All were in agreement with the established approach.

## Agenda 3: HRCT interpretation for suspected or at-risk or with known interstitial lung disease (ILD) by Wiwatana Tanomkiat, Chayanin Nitiwarangkul, Chayaporn Kaewsathorn, and Kanyarat Totanarungroj.

The increasing prevalence of lung fibrosis has prompted concerns among referring physicians regarding the adequacy of information provided in certain HRCT reports for subsequent clinical decision-making. Consequently, the delineation of key components within HRCT reports has been suggested for enhanced diagnostic interpretation.

Recommended topics and information for inclusion in an HRCT report:

- Date of scan and date of image comparison.
- Patient history/demographic data.
- Scanning technique (including image quality).
- HRCT findings, including details such as:
    - Changes in the lung volume,
    - Descriptive findings of lung fibrosis findings and distributions,
    - Disease extent (both global disease and fibrotic extents),
    - Other associated features.

- Impression details, including:
    - Identification of disease patterns (e.g., "UIP pattern," "probable UIP pattern," "indeterminate for UIP pattern," and "alternative diagnosis – specify the most likely disease/diagnosis if possible") as per the 2022 ATS/ERS/ARS/ALAT guideline [9],
    - Fibrotic extent and global disease extent,
    - Presence of radiological progression of the disease [9],
    - Other significant findings/associated findings.

**Additional clarifications:**

- Disease extent: fibrotic extent and global disease extent as determined in the administrative meetings of 2021, published in The ASEAN Journal of Radiology in December 2021 [10] and April 2022 [11,12], respectively.
- Presence of radiological progression indicating progressive pulmonary fibrosis (PPF): PPF refers to cases with certain underlying diseases (non-IPF ILD) causing pulmonary fibrosis, which meet the 2 in 3 criteria in the past year with no alternative explanation. Criteria include radiological characteristics indicating an increased extent or increased severity of lung fibrosis.

**HRCT of the lungs**

**Technique:** (including limitations (if any), e.g., poor image quality, motion artifact)
**History:**
**Comparison:**

**Findings:**
Lung volume: Increase/Decrease

Pattern: Honeycombing: Y/N
Traction bronchiectasis/bronchiolectasis: Y/N
Reticulations/GGO: Y/N
Distribution:
Axial: central/peripheral/diffuse
Craniocaudal: upper/mid/lower/diffuse

+/- Extent: Global disease extent % (nearest to 5)
Fibrotic extent % (nearest to 5)
Associated features:
Cysts (consider LAM, PLCH, LIP, and DIP)
Mosaic attenuation/air-trapping/ or three-density sign (consider HP)
Predominant GGO (consider HP, smoking-related disease, drug toxicity, and acute exacerbation of fibrosis)
Nodules (Y/N) >> random/ centrilobular/perilymphatic/ profuse centrilobular micronodules (consider HP or smoking-related disease)
Consolidation (consider organizing pneumonia, etc.)
Pleural plaques (consider asbestosis)
Dilated esophagus (consider CTD)

Pulmonary ossifications

Emphysema (centrilobular/paraseptal/panacinar)

Lymphadenopathy
Pulmonary artery dilatation/enlargement

Airway abnormalities; bronchiectasis

Bony structures; joint erosion

**Impression:**

- Findings suggestive of "UIP pattern", "probable UIP pattern", "indeterminate for UIP pattern", and "alternative diagnosis – specify the most likely disease/diagnosis if possible").
- Fibrotic extent and global disease extent
- Presence of radiological progression of the disease.
- Other significant findings/associated findings

**Figure 1.** *Example of detail in HRCT report in patients with suspected or at-risk or with known ILD.*

***Participants' conclusion:*** A shared understanding of the report guideline's purposes was affirmed among participants:

1. It is intended to be used with patients suspected of developing pulmonary fibrosis with an unknown cause, such as IPF or connective tissue disorder (CTD),
2. It aims for comprehensive information to enhance more effective patient treatment,
3. It is acknowledged that this guideline specifically pertains to reporting HRCT in patients with ILD and may not be universally applicable to all patient reports.

## Agenda 4: The CT protocol for cancer patients in the system under the Universal Health Coverage (UHC) by Wiwatana Tanomkiat and the panellists.

Because the National Health Security Office (NHSO) aims to elevate medical services, enhance the efficiency and medical service quality, reduce the waiting period to receive a computed tomography (CT) for cancer patients who are in the system under UHC by allowing cancer patients to receive CT in private health services. The NHSO asked for advice from the RCRT on a CT protocol that serves as a guideline to be employed in private health services that offer CT to eligible cancer patients in order to deliver quality CT that reaches the standard in terms of safety and optimal benefits for a treatment. Therefore, the CT protocol has been proposed to perform as a guideline for the private medical institutions to appropriately adopt and adapt.

***Participants' conclusion:*** During the discussion, diverse opinions regarding the CT protocol employed in each participant's institution were exchanged. Taking into account the well-being of patients, the efficiency of procedures, and the practical aspects involved, Table 2 was formulated.

**Table 2.** *shows the CT chest protocol for primary lung cancer and metastatic surveillance.*

| | | |
|---|---|---|
| **Phase** | - Lung cancer (first diagnosis) | - Pre-contrast at the tumor (optional)<br>- Venous |
| | - Lung cancer (follow-up)<br>- Surveillance for metastasis<br>- Surveillance for metastasis in extrathoracic soft tissue sarcoma (first diagnosis) | - Venous |
| | - Surveillance for metastasis in extrathoracic soft tissue sarcoma (follow-up) | - Low dose non-contrast |
| **Coverage** | Supraclavicular area to adrenal gland | |
| **Slice thickness** | ≤ 3 mm | |
| **Increment (optional)** | Less than slice thickness | |
| **Field of view** | Cover chest wall | |
| **Rotation time** | Shortest as possible | |
| **Scanning time** | Should be within single breath hold | |
| **Radiation exposure** | Automatic exposure control | |
| **Reconstruction** | Lung algorithm and soft tissue algorithm | |
| **Reconstruction** | High spatial lung window | Axial view (2-3 mm) |
| | Low-spatial algorithm/kernel for soft tissue window | Axial view (2-3 mm),<br>Coronal and sagittal views (3 mm)<br>Optional: MIP 5-7 mm |
| **Total radiation dose** | Recommendations regarding doses applied in chest CT without contrast media examination were formulated based on the National Diagnostic Reference Levels of Thailand in 2022. This included the reference levels of DLP <417 mGy.cm and CTDI <18 mGy, For CT chest with contrast media examination, recommendations were formulated, including the reference levels of DLP <665 mGy.cm and CTDIVOL <18 mGy. | |

## Agenda 5: A review of the guideline for determining fibrotic extent on HRCT by Phakphoom Thiravit.

The fibrotic extent of ILD in CTD patients could affect treatments such as using immunosuppressive drugs in patients with systemic sclerosis with fibrosis covering over 20% of the lung. For this reason, the use of HRCT to determine the fibrotic extent is crucial.

There are four popular methods in the determination of the fibrotic extent and the global disease extent, based on the different levels of lung parenchyma selected on HRCT:

*Method 1*: Using the 3 levels by Sanchez et al. [13],
*Method 2*: Using the 5 levels by Well et al. [14],
*Method 3*: Using the 5 levels by Goh et al. [15],
*Method 4*: Using the 6 levels by chest radiologists in Thailand [12]. This group modified the Method 3 by adding the 6th level, located below the diaphragm.

Chest radiologists from Siriraj Hospital conducted a comparative research study by applying methods 1, 2, and 4 to evaluate the fibrotic extent in IPF. The results revealed:

*Method 1* gave the highest mean fibrotic score or global disease extent score among the three methods,
*Method 2* gave the lowest mean fibrotic score or global disease extent score among the three methods,
*Method 4* gave the mean fibrotic score or global disease extent score in between the Method 1 and Method 4.

Moreover, AI was created to calculate the fibrotic score whose results linger between Method 2 and 4. However, the AI usage is still in its developmental stage.

***Participants' conclusion:*** Method 4 can be adjusted by removing the 4th level and relocating the last level to 5 centimeters above the posterior costophrenic angle (CPA). The additional coronal or sagittal view might be helpful to determine the fibrotic extent more accurately.

## Participant list:

### *Panellists*

| | |
|---|---|
| 1. Wiwatana Tanomkiat | Songklanagarind Hospital, Prince of Songkla University. |
| 2. Sitang Nirattisaikul | Songklanagarind Hospital, Prince of Songkla University. |
| 3. Chayaporn Kaewsathorn | Songklanagarind Hospital, Prince of Songkla University. |
| 4. Sutarat Tungsagunwattana | Central Chest Institute of Thailand, Department of Medical Services, Ministry of Public Health. |
| 5. Kittika Jiamjit | Central Chest Institute of Thailand, Department of Medical Services, Ministry of Public Health. |
| 6. Rungaroon Tangsrikertikul | Central Chest Institute of Thailand, Department of Medical Services, Ministry of Public Health. |
| 7. Thitiporn Suwatanapongched | Ramathibodi Hospital, Mahidol University. |
| 8. Warawut Sukkasem | Ramathibodi Hospital, Mahidol University. |
| 9. Chayanin Nitiwarangkul | Ramathibodi Hospital, Mahidol University. |
| 10. Nisa Muangman | Siriraj Hospital, Mahidol University. |
| 11. Kanyarat Totanarungroj | Siriraj Hospital, Mahidol University. |
| 12. Phakphoom Thiravit | Siriraj Hospital, Mahidol University. |
| 13. Krittachat Butnian | Siriraj Hospital, Mahidol University. |
| 14. Wariya Chintanapakdee | King Chulalongkorn Memorial Hospital, Chulalongkorn University. |
| 15. Itthi Itthisawatpan | King Chulalongkorn Memorial Hospital, Chulalongkorn University. |
| 16. Nitra Piyavisetpat | King Chulalongkorn Memorial Hospital, Chulalongkorn University. Department of Radiology, MedPark hospital. |
| 17. Juntima Euathrongchit | Maharaj Nakorn Chiang Mai Hospital, Chiang Mai University. |
| 18. Yuttaphan Wannasopha | Maharaj Nakorn Chiang Mai Hospital, Chiang Mai University. |
| 19. Panaya Tumsatan | Srinagarind Hospital, Khon Kean University. |
| 20. Wannaporn Soontrapa | Srinagarind Hospital, Khon Kean University. |

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|---|---|
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