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The report from the 2024 annual meeting of thoracic radiologists in Thailand: Advancements and consensus on standards, guidelines, and practices for thoracic disorders

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Figure 1. *(A) Engaging atmosphere during the comprehensive meeting discussion (B) Group photo of the panel captured post-meeting.*

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On 26 July 2024, a panel of thoracic radiology experts from across Thailand (Figure 1) convened to address key topics pertinent to thoracic diagnostic imaging within both the private and public sectors. Organized by the Royal College of Radiologists of Thailand (RCRT) in collaboration with the Foundation for Orphan and Rare Lung Disease (FORLD), the meeting took place in Asoke Conference Room on the fourth floor of Eastin Grand Hotel, Phaya Thai, Bangkok. The agenda covered five main topics:

(1) proposing a CT protocol and a report checklist for screening chronic obstructive lung disease (COPD), (2) suggesting reporting guidelines for chest imaging to screen for connective tissue disease-related interstitial lung disease (CTD-ILD), (3) revisiting the post-implementation accuracy of the proposed visual scoring method for quantifying global disease and fibrotic extents on high-resolution CT scans (HRCT), (4) establishing nationwide collaboration to define Dose Reference Levels (DRLs) for HRCT in Thailand, and (5) proposing a simple Thai terminology to educate patients about progressive pulmonary fibrosis (PPF).

Agenda 1: Proposing a CT protocol and a report checklist for screening COPD

presented by Warawut Sukkasem

According to the World Health Organization (WHO), chronic obstructive pulmonary disease (COPD) is a major public health issue of global concern and the fourth leading cause of death worldwide, causing 3.5 million deaths in 2021 [1]. While pulmonary function tests (PFTs) remain the gold standard for diagnosing Chronic Obstructive Pulmonary Disease (COPD), their use is limited in uncooperative patients or those with severe dyspnea who are unable to perform the test. CT scans offer greater sensitivity and specificity in diagnosing emphysema compared to PFTs [2]. The widespread availability of CT machines in all provincial hospitals enhances accessibility beyond that of PFTs [3]. Advances in CT technology now allow for a complete examination of the entire chest within just a few seconds, and comorbidities associated with COPD can also be demonstrated on CT scans [2]. During the meeting, a CT protocol (Figure 2) and a report checklist (Figure 3) for screening COPD were proposed.

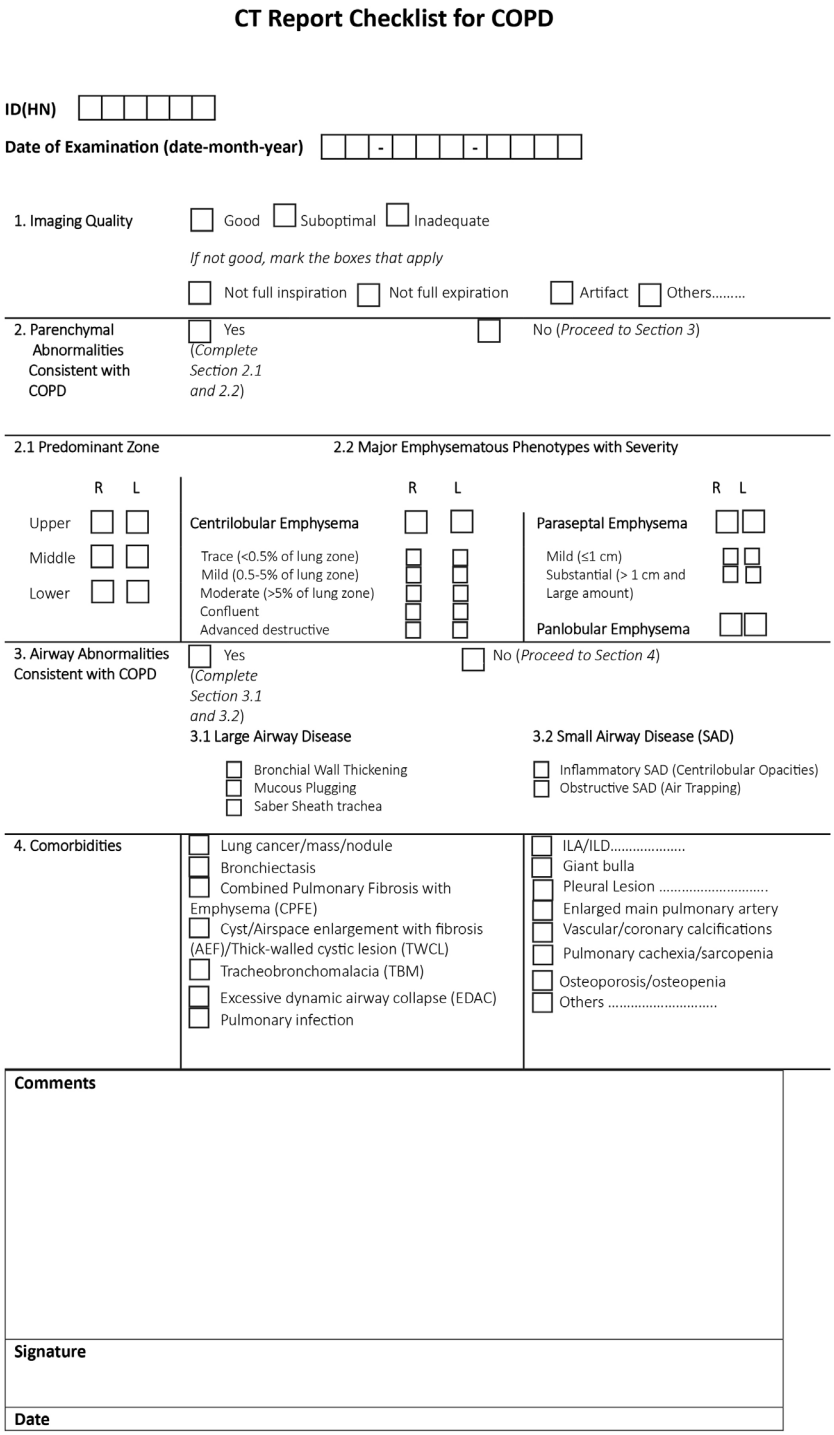
CT Protocol for COPD

Parameter	Supine Inspiratory CT	Supine Expiratory CT	Prone Inspiratory CT (Optional พิจารณาในรายที่สงสัย dependent density or ILA)
IV contrast examination	Noncontrast examination	Noncontrast examination	Noncontrast examination
Respiratory phase	Full inspiration	Dynamic Forced expiration (เพื่อประเมิน TBM or EDAC และเพื่อ quantitative assessment) End-expiration (optional) (10-20 mm interval)	Full inspiration
Detector configuration	≥ 16 detectors	≥ 16 detectors	≥ 16 detectors
Scan type, mode	Spiral (volumetric)	Spiral (volumetric)	Sequential (10-20 mm interval)
Rotation time (s)	As short as possible, usually no greater than 0.5 s	As short as possible, usually no greater than 0.5 s	As short as possible, usually no greater than 0.5 s
Pitch	Highest, ≥ 1	Highest, ≥ 1	Highest, ≥ 1
Acquisition collimation (mm)	≤ 1 mm	≤ 1 mm	≤ 1 mm
Tube potential (kVp)	120	100-120	120
Tube current (mAs)	40 mAs (low dose) up to 200 mAs (moderate dose) (Automated exposure control)	40 mAs up to 60 mAs (Automated exposure control)	40 mAs up to 80 mAs (Automated exposure control)
Reconstruction for visual assessment			
Algorithm	Sharp or high frequency kernel	Sharp or high frequency kernel	Sharp or high frequency kernel
Section thickness	0.625-1 mm	0.625-1 mm	0.625-1 mm
Interval	0.5-0.9 mm	0.5-0.9 mm (Dynamic forced expiration) 10 mm (end expiration)	10 mm
Field of view (FOV)	To cover the whole lung	To cover the whole lung	Optional: lower lung zone
Reconstruction for quantitative assessment (QCT)			
Algorithm	Neutral, smooth kernel	Neutral, smooth kernel	-
Section thickness	0.625-1 mm	0.625-1 mm	-
Interval	0.5-0.9 mm	0.5-0.9 mm (Dynamic forced expiration) 10 mm (end expiration)	-
Field of view (FOV)	To cover the whole lung	To cover the whole lung	-

เอกสารอ้างอิง:

1.) Lynch DA, Austin JHM, Hogg JC, Grenier PA, Kauczor HU, Bankier AA, Barr RG, Colby TV, Galvin JR, Gevenois PA, Coxson HO, Hoffman EA, Newell JD Jr, Pistolesi M, Silverman EK, Crapo JD. CT-definable subtypes of chronic obstructive pulmonary disease: a statement of the Fleischner Society. Radiology. 2015;277(1):192-205.
2.) https://www.rcrt.or.th/hrct-protocol-และ-checklist/

Figure 2. *A proposed CT protocol for screening COPD.*



CT Report Checklist for COPD

ID(HN) ☐☐☐☐☐☐

Date of Examination (date-month-year) ☐☐-☐☐☐-☐☐☐☐

1. Imaging Quality ☐ Good ☐ Suboptimal ☐ Inadequate

If not good, mark the boxes that apply

☐ Not full inspiration ☐ Not full expiration ☐ Artifact ☐ Others.....

2. Parenchymal Abnormalities Consistent with COPD ☐ Yes (*Complete Section 2.1 and 2.2*) ☐ No (*Proceed to Section 3*)

2.1 Predominant Zone

	R	L
Upper	☐	☐
Middle	☐	☐
Lower	☐	☐

2.2 Major Emphysematous Phenotypes with Severity

	R	L
Centrilobular Emphysema	☐	☐
Trace (<0.5% of lung zone)	☐	☐
Mild (0.5-5% of lung zone)	☐	☐
Moderate (>5% of lung zone)	☐	☐
Confluent	☐	☐
Advanced destructive	☐	☐

	R	L
Paraseptal Emphysema	☐	☐
Mild (≤1 cm)	☐	☐
Substantial (> 1 cm and Large amount)	☐	☐
Panlobular Emphysema	☐	☐

3. Airway Abnormalities Consistent with COPD ☐ Yes (*Complete Section 3.1 and 3.2*) ☐ No (*Proceed to Section 4*)

3.1 Large Airway Disease

☐ Bronchial Wall Thickening
☐ Mucous Plugging
☐ Saber Sheath trachea

3.2 Small Airway Disease (SAD)

☐ Inflammatory SAD (Centrilobular Opacities)
☐ Obstructive SAD (Air Trapping)

4. Comorbidities

☐ Lung cancer/mass/nodule
☐ Bronchiectasis
☐ Combined Pulmonary Fibrosis with Emphysema (CPFE)
☐ Cyst/Airspace enlargement with fibrosis (AEF)/Thick-walled cystic lesion (TWCL)
☐ Tracheobronchomalacia (TBM)
☐ Excessive dynamic airway collapse (EDAC)
☐ Pulmonary infection

☐ ILA/ILD.....
☐ Giant bulla
☐ Pleural Lesion .....
☐ Enlarged main pulmonary artery
☐ Vascular/coronary calcifications
☐ Pulmonary cachexia/sarcopenia
☐ Osteoporosis/osteopenia
☐ Others .....

Comments

Signature

Date

Figure 3. *A proposed report checklist for COPD after minor modifications.*

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Participants' conclusion: The meeting suggested that the slice thickness for CT scans should be 1.5 mm or less, rather than the previously suggested 1 mm or less, depending on the performance of the CT machine. All panel members concurred with the other CT parameters specified in the protocol and endorsed the proposed checklist, subject to minor modifications.

Agenda 2: Suggesting reporting guidelines for chest imaging to screen for connective tissue disease-related interstitial lung disease (CTD-ILD)

presented by Chayanin Nitiwarangkul

The increasing prevalence of lung fibrosis has raised concerns among referring physicians regarding the adequacy of information provided in certain HRCT reports for subsequent clinical decision-making. In response, HRCT report guidelines were established at the 2023 annual meeting of thoracic radiologists in Thailand and documented in The ASEAN Journal of Radiology under the title "The 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" [4]. In Thailand, the most common cause of interstitial lung disease (ILD) is connective tissue disease (CTD), with lung fibrosis being the leading cause of death among these patients [5]. Despite this, there are no clear guidelines for screening and follow-up imaging. Each imaging modality has its strengths and limitations:

Chest radiography is the most widely available and accessible imaging method [6]. However, its relatively low sensitivity (around 60-80%) [6] may make it less effective for early disease screening. Nonetheless, due to the limited accessibility of HRCT, chest radiography remains a useful tool for initial screening and for evaluating intra-thoracic complications in patients with CTD-related ILD.

HRCT is recognized as the gold standard for diagnosing interstitial lung disease (ILD), with a sensitivity exceeding 90% and specificity over 95% [7]. Despite its advantages in detecting subtle changes, monitoring disease progression, and providing detailed assessments of patterns, extent, and severity, limited accessibility and higher radiation doses compared to chest radiography remain challenges, particularly in Thailand. While ultralow-dose HRCT has been explored to reduce radiation exposure, its reduced image quality can compromise diagnostic accuracy [8, 9]. The 2023 guidelines from the American College of Rheumatology (ACR) and the American College of Chest Physicians (CHEST) conditionally recommend HRCT for initial screening and monitoring of ILD in patients with systemic autoimmune rheumatic diseases (SARDs) [10], although the proper HRCT protocol and ideal time interval for routine follow-up has yet to be determined.

Participants' conclusion: It is crucial to communicate clearly with treating physicians about the inadequacies of chest radiography in effectively detecting or characterizing ILD, which may result in conditions being undiagnosed or underestimated. Additionally, discussions need to address the radiation dose of CT scans, the proper timing and criteria for initiating screening, and determining the optimal frequency for follow-up screening should be conducted.

Agenda 3: Revisiting the post-implementation accuracy of the proposed visual scoring method for quantifying global disease and fibrotic extents on HRCT

presented by Phakphoom Thiravit

The meeting revisited the 2022 annual meeting publications, which outlined the recommended HRCT estimation methods for evaluating global disease and fibrotic extents of ILD in Thailand [11-13]. These methods are categorized based on anatomical HRCT levels. Method 1, proposed by Sanchez et al., utilizes three anatomical landmarks [14]. Method 2, introduced by Well et al., expands this to

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five levels for a more detailed assessment [15]. Method 3, introduced by Goh et al., also utilizes a 5-level system but with different anatomical reference points [16]. Method 4, developed by chest radiologists in Thailand, incorporates six anatomical levels by retaining the upper 5 levels from Method 3 and adding an additional level below the diaphragm, allowing a more comprehensive evaluation [13]. This progression demonstrates the evolution of HRCT estimation methods aimed at enhancing their accuracy and applicability in the ILD context, particularly addressing the disease's lower and basal lung predominance.

A follow-up publication in 2023 [4] evaluated the post-implementation effectiveness of these methods. This year's meeting facilitated discussions on the outcomes of these practices and any necessary adjustments to the methods.

Using all four methods, chest radiologists from Siriraj Hospital conducted a comparative study to evaluate the fibrotic extent in idiopathic pulmonary fibrosis [unpublished study]. The study found that Method 1 had the highest mean score for global disease or fibrotic extents among the four methods tested, while Method 2 yielded the lowest mean score. Method 3 produced scores that were intermediate between Methods 1 and 2. Comparisons between Methods 3 and 4 revealed that Method 4 generally reported 10-15% more fibrotic extent than Method 3. Since the increase in fibrotic extent is likely attributed to level 6 in Method 4, which contains less lung parenchyma but is a frequent site for pulmonary fibrosis, the researchers proposed a correction factor of 0.3 for the score at this level. This adjustment aims to align the scores from Method 4 with those of other methods.

Participants' conclusion: Further post-implementation review should be revisited in the next meeting to determine the necessity of modifying Method 4 by either removing level 4 (anatomical level between levels 3 and 5) or applying a correction factor of 0.3 to the score at level 6.

Agenda 4: Establishing nationwide collaboration to define DRLs for chest HRCT in Thailand

presented by Thitiporn Suwatanapongched

DRLs are established benchmarks for radiation doses in medical imaging aimed at optimizing patient safety, protecting against unnecessary exposure, and ensuring diagnostic efficacy [17-19]. In Thailand, the Department of Medical Sciences in the Ministry of Public Health published the national DRLs in Thailand 2023, providing comprehensive guidelines for various imaging modalities, including CT [20]. These guidelines serve as a primary reference for healthcare facilities to align their practices with national standards, minimizing radiation exposure while maintaining the diagnostic quality.

As chest HRCT plays a pivotal role in thoracic imaging, especially for diseases such as ILD and COPD [3, 7, 8, 10], establishing DRLs specific to chest HRCT is crucial. Although national DRLs for chest HRCT have been reported in various countries [21-26], no such benchmarks currently exist in Thailand. Implementing DRLs for chest HRCT in Thailand would help standardize practices, improve regulatory compliance, and enhance patient safety by minimizing cumulative radiation risks. Establishing DRLs requires addressing key factors, such as population-specific differences (e.g., adults vs. pediatric patients), and implementing simplified, size-adjusted benchmarks [17, 27, 28]. Discussions during the meeting underscored significant variability in practices across facilities, rapid advancements in CT technology, and the necessity of ongoing training for radiologists and technicians [19, 29]. By emphasizing continuous education and aligning with global best practices, this initiative aims to implement DRLs for chest HRCT in Thailand effectively. Such efforts will encourage long-term improvements in patient safety, diagnostic quality, and the standardization of thoracic imaging practices nationwide.

Participants' Conclusion: All participants agreed to collaborate in establishing and defining national DRLs for chest HRCT through the systematic collection of the computed tomography dose index volume (CTDIvol) and dose-length product (DLP) data, showing their readiness to contribute to this initiative.

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Agenda 5: Proposing a simple Thai terminology to educate patients about PPF

presented by Wiwatana Tanomkiat

PPF is a recently introduced condition in clinical practice [30], characterized by a progressive ILD phenotype involving worsening lung scarring (fibrosis) over time. It is commonly associated with patients who have CTDs with lung involvement. PPF underscores the importance of proactive monitoring and timely interventions to prevent disease progression to severe or end-stage lung fibrosis, thereby improving patients' quality of life.

Currently, no Thai terminology clearly represents this condition, and the abbreviation "PPF" may be difficult for Thai patients to understand. To address this, the meeting proposed the term **"Pod Khaeng"** (ปอดแข็ง), translated as "Pulmonary Cirrhosis," for use in patient education. This term simplifies communication and aligns with the widely recognized Thai terminology for hepatic cirrhosis (ตับแข็ง), which is commonly understood to represent end-stage liver fibrosis. Additionally, "pulmonary cirrhosis" was historically used to describe the pathology of usual interstitial fibrosis [31-33].

The proposal to use "Pod Khaeng" was also supported by several key similarities between pulmonary cirrhosis and hepatic cirrhosis:

Pathological process: Both conditions represent the final stage of various underlying diseases rather than being specific disease entities,
Dynamic progression: Both are chronic and dynamic processes that can worsen over time, with progression patterns ranging from slow to rapid deterioration,
Morphological similarities: Both share similar gross features, such as a reduction in the organ size and nodular surfaces (Figure 4),
Impact on life: Both significantly affect health, daily life, and life expectancy.

By linking "Pod Khaeng" to the familiar concept of hepatic cirrhosis, Thai patients are more likely to understand the condition compared to the previously proposed term "ภาวะปอดเป็นพังผืดชนิดลุกลาม" (a literal description of PPF). Using this terminology would enhance patient education, improve communication, and raise awareness among patients and their families. It may help bridge the gap between complex medical terminology and patient understanding, fostering better engagement and improved management. Furthermore, it could serve as an effective tool to promote smoking cessation, encourage ILD monitoring, and facilitate timely management to mitigate PPF, particularly in patients with CTDs.

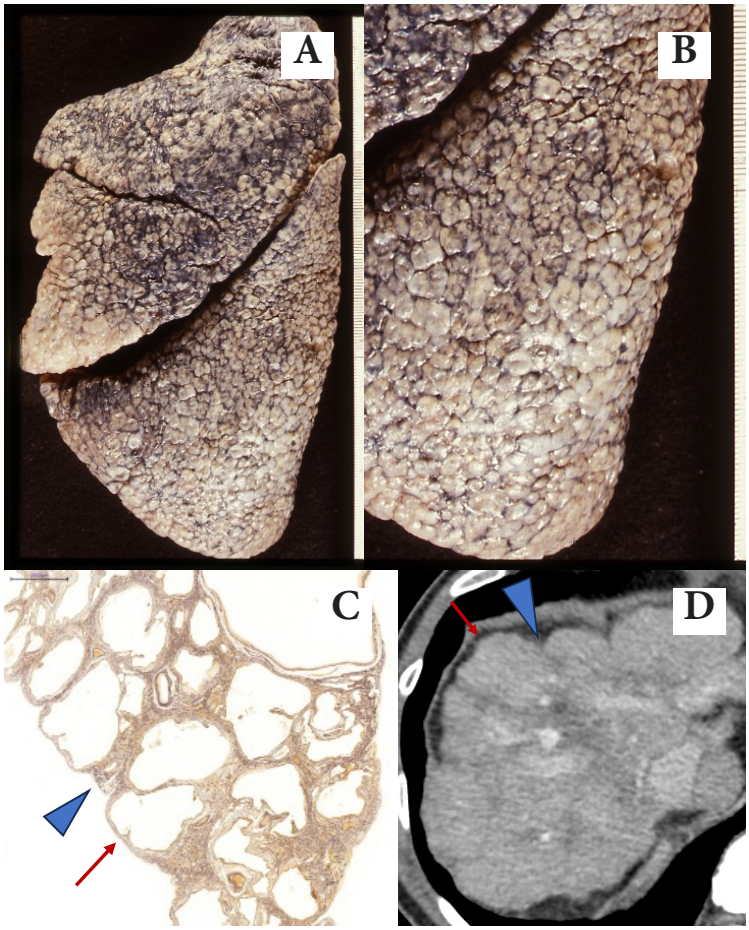

Figure 4. *Comparing pulmonary and hepatic cirrhoses; (A) Gross appearance of a lung with usual intersititial pneumonia (UIP) showing nodular surface similar to hepatic cirrhosis (B) Magnified gross surface and (C) cross section of the lung with UIP showing that the bulging nodules of the surface are the enlarged lobules (blue arrowhead) alternating with indented bands of fibrosis (red arrow) similar to (D) hepatic cirrhosis on CT; (Pictures A, B and C are courtesies of Dr. Tamiko Takemura).*

Participants' Conclusion: All participants agreed and suggested communicating with pulmonary physicians' societies to commonize the use of this term in patient education practice.

Participant list:

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Meeting recorder	Chayaporn Kaewsathorn, MD.
Reviewer	Wiwatana Tanomkiat, MD.

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