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Highlight

- Original Article
- Case Report
- ASEAN Movement in Radiology
- Memorial
- Acknowledgement of Reviewers

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From The Editor

The borders are ill-defined and the center is hazy

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The World Health Organization reclassifies cholera as a new major health emergency with intention to raise awareness and encourage global action due to rising cholera cases in various countries including Myanmar which subsequently crossed the border to Thailand. After the outbreak in Shwe Kokko, the city in Myanmar at the border, two cases were diagnosed in the near-by Mae Sot district, Tak Province in Thailand on 22 December 2024. The border was closed and cholera red zones were declared in four districts while surveillance and other proper measures were operated. A Thai health team was sent to Shwe Kokko on December 31, 2024, to assist in controlling the outbreak, delivering additional oral rehydration solutions and medicines to support Myanmar's healthcare workers in treating cholera. From the start of December last year until January 1, Shwe Kokko had 761 cases requiring hospitalization, Tak had 4 symptomatic and 3 asymptomatic cases. Up until the present, there has been no new case in Thailand [1].

New Year in Thailand started with two high-profile persons from China, one of whom was an actor and the other was a model, gone missing at the Thailand-Myanmar border with very similar circumstances. They received a WeChat message, confirming their selection for a film audition. They arranged their own trip to Thailand, made a last contact at the border expressing sadness, and lost contact. Family members reported the cases to the Chinese police and Chinese embassies in

both Thailand and Myanmar. They urged influential bloggers and media in China to spotlight the case to attract public attention in hopes of a swift resolution. Subsequently, Thailand and China planned to create a coordinated center dedicated to tracking missing individuals duped into travelling to neighboring countries. The center will enhance the exchange of vital information, targeting gangs operational in Thailand and abroad. This collaboration signifies joint determination to diminish the allure of Thailand as a transit hub for illegal activities, including call centre scams, human trafficking, and other transnational crimes while bolstering security measures at the borders. Through these efforts, Thailand and China aimed to create a safer environment for both residents and visitors alike, marking a significant stride forward in the fight against transnational crime [2].

The scenes of operation, the details of how the scams were operated, and the route of money transfer were revealed more clearly to the public when the Thai-British beauty queen lost 4 million Baht to a Cambodia-based scam gang. A woman suspect was approached to open a mule bank account and brought illegally into Cambodia to a building where a Chinese-led scam gang operated. In the building were 20 Thai people and mock offices of bogus Thai authorities who were actually scammers. The suspect had her face scanned in the process of opening the account and was paid 3,500 baht [3].

According to the Anti Online Scam Operation Center (AOC), the Thailand's 1441 Hotline one-stop service established in 2023 to combat cybercrimes by controlling the damages and simplifying the process to protect financial assets of victims, there were 1, 176, 512 reports from 1 November 2023 to October 2024, with 348, 600 accounts frozen and 19, 000 million Baht lost [4].

Above: A warning sign of being deceived into engaging in cybercrime at Thai-Myanmar border (picture credit: https://www.nationtv.tv/news/crime/378954530), Below: One of the typical compounds believed to host transnational crime adjacent to Thai borders at night time (picture credit: https://www.thailand-business-news.com/asean/myanmar/193222-thailand-halts-power-supply-to-myanmar-).

However, what was reported in Thai media seemed to be the tip of the iceberg. A Chinese newspaper estimated that the criminal scammer centers in Myanmar operated by Chinese investors could be more than 1, 000 and the victims of their operations could be more than 100,000 persons a day [5]. In 2023, Thai government rescued around 900 Chinese citizens from trafficking and Myanmar government extradited more than 31, 000 Chinese citizens suspected to be involved with cybercrimes to China.

The transnational crimes at the borders raised the debates on the government's potential opening of entertainment complexes and casinos, a move intended to boost tourism and generate significant revenue, that these establishments could act as conduits for laundering money. The absence of rigorous regulations and monitoring processes could inadvertently transform Thailand's casinos into attractive destinations for shady operators looking to 'clean' their money. If casinos are to open their doors, they should do so under strict scrutiny, with policies that include comprehensive background checks, financial monitoring, and collaboration with international agencies to track any suspicious capital flow [6]. This controversial decision of Thailand's government also sparks concerns over potential societal impacts such as erosion of traditional values, moral decay and negative influence on the youth's mindset. Lately, a telephone-based comprehensive survey conducted by the National Institute of Development Administration (NIDA), carried out over January 20-21, 2023, captured the views of 1,310 adults from diverse educational, income, and occupational backgrounds nationwide revealed a decided public disapproval of the Thai government's plans to establish a casino-entertainment complex and legalize online gambling [7].

Even though the border between southern Thailand and Malaysia is better defined, the Malaysian government would like to make it best to enhance security by building a 100-kilometer border wall to prevent illegally crossing the border [8]. Still, there is an issue related to folk. Many residents disagreed with the authorities' decision, saying the people on both sides of the border were like "brothers and sisters", and cross-border movements became a way of life for the community. It is estimated that nearly 500 children consisting of both Malaysian and Thai citizens cross the border daily from Thailand to attend school in Malaysia, according to local media reports. Residents on both sides of the border hope that the governments

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of Malaysia and Thailand will make it easier for them, and their children, to continue their living without interruption.

Transnational crimes across Thailand borders, Myanmar crisis and China's assertiveness in the South China Sea are urgent ASEAN issues awaiting regional solutions [9]. Another escalating cross-border issue affecting multiple nations and requiring ASEAN-wide cooperation is the worsening pollution crisis, characterized by hazardous PM2.5 levels. Bangkok and surrounding areas struggle with high PM2.5 levels, reaching up to 111 μg/m³ [10], more than 7 times surpassing the WHO safety threshold [11] in some areas. A significant contributor to PM2.5 pollution is agricultural burning in Thailand and its neighboring countries. Thai authorities have already initiated preventive measures, including penalties for agricultural burning, since November last year. However, the scale of the problem necessitates broader regional collaboration.

The hazy Bangkok on February 4, 2025 with the average PM2.5 of 61.5 μg/m³.

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Original Article

Efficacy of focused teaching on chest radiographs: Comparison among novice clinicians outside the radiologic field

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Abstract

Objectives: This study aimed to evaluate the effectiveness of focused teaching on the hidden areas in chest radiographs (CXR) for different elective radiology novice clinicians during an elective course.

Materials and Methods: A test including 30 CXRs was administered to various novice clinicians who undertook an elective radiology course at our institution before and after a focused teaching session on the hidden areas of chest radiographs. The effectiveness of focused teaching in the hidden areas was evaluated based on the difference between the pre-test and post-test scores. Improvement scores were compared among different groups of novice clinicians to evaluate their competence.

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Results: A total of 22 novice clinicians participated in the study. These included one extern, 5 emergency medicine residents, 10 internist residents, 2 Thai-graduated interns, and 4 foreign-graduated interns. There were no significant differences in the pre-test scores among participants' specialties. However, there was a significant difference in the participants' scores before and after X-ray teaching ($p < 0.001$). Using differences in the pre-test and post-test scores as an indicator of improvement, we discovered the improvement score differed significantly between the participant groups ($p = 0.04$). Nearly all participant groups showed significant positive improvement, except for the foreign-graduated interns, who showed no improvement.

Conclusions: Focusing teaching on the hidden areas in chest radiographs significantly positively impacts nearly all novice clinicians participating in the study, except the foreign-graduated Interns.

Keywords: Chest radiographs, Clinicians, Hidden areas, Medical students.

Introduction

Chest radiography is the most common radiological investigation in hospitals worldwide, employed not only for diagnosis but also for screening in many indications [1-2]. Half of the plain radiographic errors occur on a chest radiograph (CXR) [3], and nearly 80-90% of missed lung cancers are identified using CXRs [2, 4]. This can result in delayed or changed management, altered prognosis, complications, or increased mortality [4]. In real-life clinical settings, in some hospitals, general practitioners (GPs) and other physicians interpret CXRs and manage patients based on their interpretations. Radiologists are consulted only in problematic cases.

The literature demonstrates that GPs have only 77% to 80% sensitivity in detecting symptomatic lung cancer from CXRs [5], and different specialties have vary-

ing competencies in CXR interpretation and are generally less competent than radiologists [6-7]. Although there have been efforts to use artificial intelligence (AI) tools to improve performance, their generalizability is still limited, and the use of AI still requires the confirmation of radiologists [8].

Steps in reading radiographs include scanning, recognition, and decision-making. False-negative errors occurred for 30% during scanning, 25% during recognition, and 45% during decision-making [2]. Among CXR diagnostic errors, the most common are detection errors (81%), of which, the non-visualized lung nodule is the majority (40%) [3]. Both a systematic searching pattern and knowledge are crucial to avoid detection errors. Hidden areas are the major areas of non-visualized lesions in CXRs and have been recognized for a long time. The "7 Hidden Areas" include bilateral apices, bilateral hilar, retrocardiac, and subdiaphragmatic regions. These areas are important and must be emphasized in radiology education. Knowledge of the hidden areas and routine practice of a systematic searching pattern are two components that can improve detection errors.

Our prior study demonstrated that formal radiology education is beneficial even in a short period of time [9]. However, targeted teaching for specific learners would be more efficient. The competency of variable learners should be different and should be explored. Knowledge of the learner helps the teacher to educate more easily and effectively.

The objectives of our study were: 1) to investigate the impact of focused teaching on the Hidden Areas subject on the performance of novice clinicians in the test and 2) to compare the significant score improvement on the test among novice clinicians of different specialties (final-year medical students [EXT], interns, emergency medicine residents, and internist residents).

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Materials and methods

Population

This study retrospectively analyzed the pre-test and post-test scores of elective students and novice clinicians specialized in emergency medicine and internal medicine, who participated in the Hidden Areas teaching class during their elective period in our department between October 1, 2020 – September 30, 2021. There were 22 participants in this study, comprising 1 EXT, 5 emergency medicine residents, 10 internist residents, 2 Thai-graduated interns, and 4 foreign-graduated interns. Our study separated the interns according to their medical schools into 2 groups: 2 interns who graduated from Thai medical schools and the other 4 Thai interns who graduated from foreign medical schools. The study was approved by our institutional review board, No. HS036/2565. Inform consent was waived owing to the retrospective nature of the study.

Intervention and objective assessment

To assess the detection errors, we developed a 30-CXR test in digital JGP format, with patient identification removed. The set comprised 3 normal CXRs and 27 abnormal CXRs. Among these, 14 lesions were located in hidden areas, all confirmed by computerized tomography. An example of a Hidden Areas image is demonstrated in Figure 1. A 30-image quiz was chosen by a senior author (S.L.) with 30 years of experience. Participants were instructed to identify the lesion in a 30-image quiz within 30 minutes by drawing the lesion on the answer sheets, which had 30-CXR drawings. The other author (S.K.) examined and scored all the participants' answer sheets, blinded to participants' identifications as well as the state of the pre-test or post-test, to limit inter-rater variability. The scoring system is illustrated in Table 1. An example of the answer sheet and scores is shown in Figure 2.

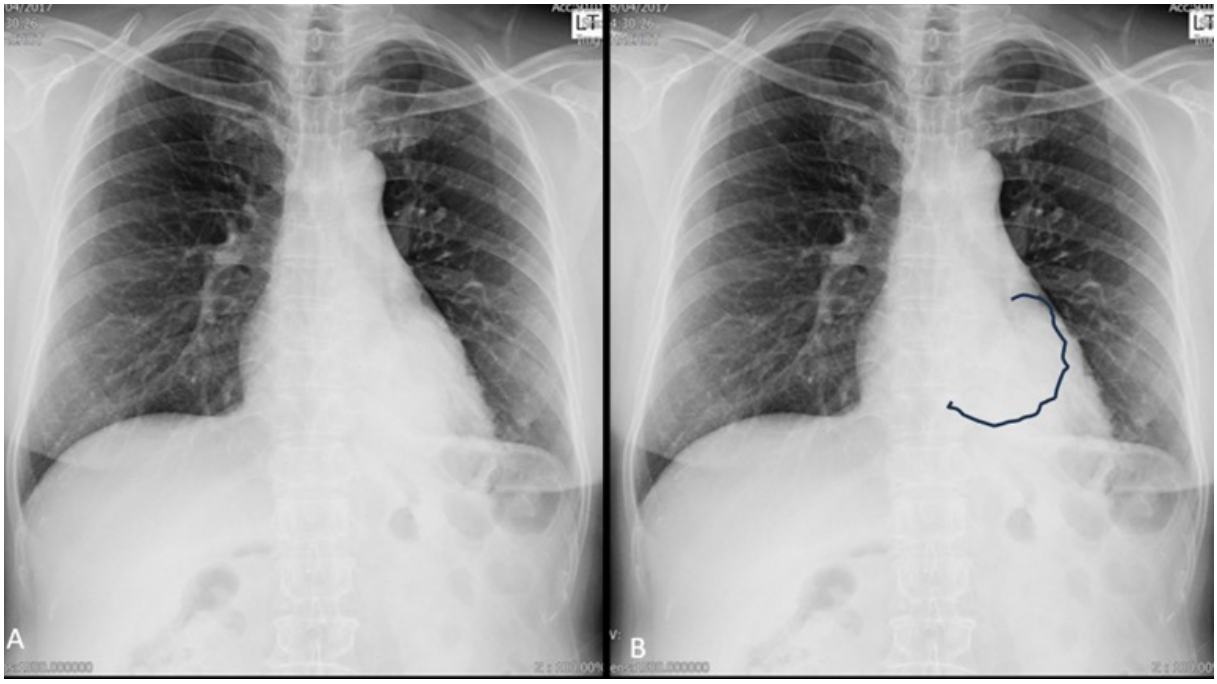

Figure 1. *(A) An example of a Hidden Areas lesion in the test set (B) The answer to the lesion indicated by a line outlining the lateral border of the left retrocardiac opacity.*

Table 1. *Scoring system.*

	complete	Partially complete	incorrect
area	10	5	0
size	10	5	0

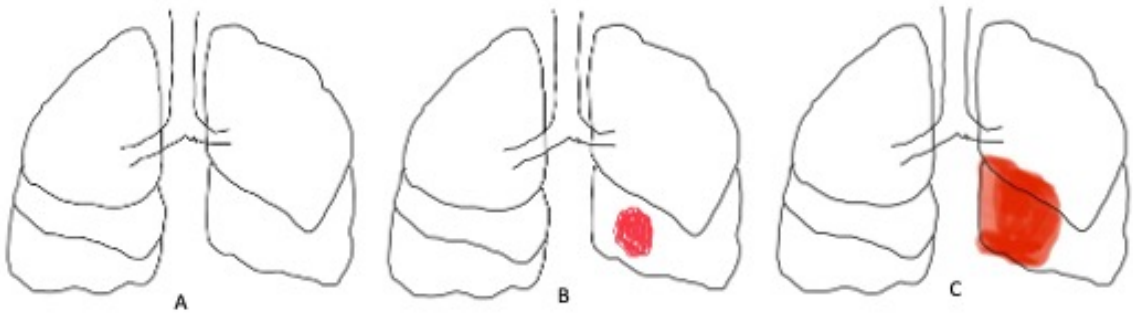

Figure 2. *(A) An example of the answer sheet; (B) The area in the answer is correct but the size is partially correct (score = 15). (C) The answer is completely correct (score = 20).*

The Hidden Areas teaching class was an integral part of our radiology elective course. It began with a pre-test consisting of 30 CXRs, followed by a brief lecture in Thai language on hidden areas supplemented with examples of hidden area lesions in CXRs by a single teacher (S.L.). The duration of the teaching was 15 to 20 minutes. After the lecture, the same test set was administered to the participants. Upon completing the test, a teaching radiologist (S.L.) provided the answers and discussed them in detail with the participants.

Statistical analysis

The data were analyzed using SPSS version 22. Residuals were examined and tested for the assumption of normality. A Wilcoxon signed ranks test was used to compare the mean rank of the pre- and post-test scores of each group, determining whether the improvement was statistically significant. A comparison of improvement scores between participants' groups was performed using the Kruskall-Wallis test. The Man-Whitney U test was used to compare the improvement scores between sexes. Lastly, the effect of participants' age on the improvement score was analyzed using linear regression analysis. A p-value of less than 0.05 was considered statistically significant.

Results

Demographic data, pre-test scores, posttest scores, and improvement scores are shown in Table 2. There were 11 males and 11 females in the study, with ages ranging from 24-32 years and a mean age of 28.64 years. The age distribution was as follows: five participants were 28 years old; three each were 24, 26, and 27 years old; two each were 25, 29, and 30 years old; one participant was 31 years old, and one was 32 years old. Demographic data for all groups did not show statistical differences.

There were no significant differences in the pre-test scores among participants specialties (Kruskall-Wallis test; Chi-square = 6.22, df = 4, p = 0.183). A significant difference was observed in the scores for participants before X-ray teaching (pre-test score, mean +/- SD = 133.64 +/- 28.50) and after X-ray teaching (post-test score, mean +/- SD = 162.50 +/- 41.74) (Wilcoxon signed ranks test; z = -3.29, n =22, p < 0.001). Using differences in the pre-test and post-test scores as indicators of improvements, we found that the improvement score (mean +/- SD = 28.86 +/- 32.91) differed significantly across the specialties (Kruskall-Wallis test; Chi-square = 10.04, df = 4, p = 0.04). All participants, except for the foreign-graduated interns, showed improvement in post-test scores. The foreign-graduated interns, however, showed a decline, as illustrated in Table 2. EXT showed more improvement than all other groups. However, there was no significant difference in improvement scores between the sexes of participants (Mann-Whitney U test; Z = -0.363, n = 22, p = 0.735). Additionally, using linear regression analysis to investigate the effect of the participant's age on the improvement score, the participant's age posed no significant impact (mean +/- SD = 27.36 +/- 2.26) on the improvement score (linear regression; F (1,20) = 0.058, p = 0.797).

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Table 2. *Demographic data, pre-test scores, post-test scores, and improvement scores.*

	Age (year) (mean ± SD)	Sex	Pre-test scores (mean ± SD)	Post-test scores (mean ± SD)	Improvement Scores (mean ± SD)
Extern	24	M: 1, F: 0	95	170	75a
Thai-graduated Interns	25.5 ± 0.71	M: 0, F: 2	132.5 ± 17.68	185 ± 56.57	52.5 ± 38.89a
Emergency Medicine Residents	28.2 ± 1.79	M: 1, F: 4	151 ± 14.32	175 ± 19.69	24 ± 8.94a
Internist Residents	28.1 ± 1.37	M: 7, F: 3	140.5 ± 21.66	178 ± 22.63	37.5 ± 32.43a
Foreign-graduated Interns	26.25 ± 3.86	M: 2, F: 2	105 ± 40.62	95 ± 39.79	-10 ± 20.89b

**SD = standard deviation, a & b = Kruskall-Wallis test results*

Discussion

Different types of GPs possess different learning abilities [7]. The current study shows that focused teaching on hidden areas has a significantly positive impact on almost all novice clinicians, except for the foreign-graduated interns. The foreign-graduated Interns comprised doctors who graduated from foreign medical schools in various countries. To practice in Thailand, they must pass all three steps of the Thai National License Examination steps and complete a one-year clinical clerkship in Thai hospitals. All four foreign-graduated interns in our study are Thai nationals undergoing clinical clerkship in our hospital and have not yet passed the final NL exam. Only one foreign-graduated intern showed a positive improvement; the others demonstrated negative results. The participants' background performance may explain the result. Our previous study demonstrated that participants with a high-performance background can acquire knowledge in a short learning period better than those with a low-performance background [9]. This group may have a low-performance background, and a short learning period may be insufficient for them to acquire optimal knowledge. In addition, Pavlov et al. demonstrated that a task that is too difficult results in significantly reduced engagement among participants [10]. Prior knowledge and the teaching approach, including time and methods, are crucial factors [11]. This group requires more time, additional tools, and possibly different learning methods [12]. Tailoring the difficulty level of the learning materials to match each student is effective [13]. The usefulness of various learning resources is perceived differently by participants at different levels. Wu et al. demonstrated that an independent self-learning method can improve radiology knowledge in elective students and lead to positive student perceptions of the elective experience [14]. The learning environment is also an important factor that should be considered [15]. A standardized radiology curriculum should be implemented in all institutions and countries [16]. Further focused research is required in this group.

Among the groups showing positive improvement, EXT and Thai-graduated interns, who were fresh GPs, exhibited more improvement than emergency medicine and internist residents. A possible explanation could be that participants

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with extensive knowledge may find it challenging to acquire new information and may be less open to new ideas [17]. These residents have already chosen their career paths; radiology is not their primary focus. Consequently, they might pay less attention to radiology than GPs who have not yet made a definitive decision and are eager to explore various specialties.

Interestingly, the pre-test scores of all groups showed no statistical difference. There are a few reasons to explain this phenomenon. Firstly, lesion detection in the hidden areas is inherently challenging, focusing on teaching this subject. When a test is overly difficult, it may fail to effectively differentiate between participants effectively and could lead to frustration, decreasing motivation [18]. Secondly, all of these participants had undergone a formal radiology education for over a year, and the retention of radiology knowledge may be relatively short. Our prior study also observed short retention of radiology knowledge in 5th-year and 6th-year medical students [9].

The major limitation of this study was the small number of participants. Larger-scale studies should be conducted to validate our findings. We tested only detection skills, so the 1-minute time limit for each image was deemed appropriate. It can simulate real clinical practice, where physicians do not spend much time on CXR interpretation. The patient's history was not provided, which is an important part of CXR interpretation [7]. However, a prior study revealed that reading with or without history does not affect the detection [19]. Future studies incorporating all three skill sets, including detection, interpretation, and decision-making, would better mimic real-life settings. As part of the nature of the test, the participants were aware that there must be more pathological cases than in their routine practice, as well as a memory effect. The lack of a control group is also a significant limitation. Students who took the pre-test and post-test without teaching may experience score improvement. We did not collect data on participants' experience in CXR interpretation, which was an important factor. The test set was in the JPG format, which was not as high quality in resolution as our routine radiology practice. Lastly, our study was performed in a single institution and cannot be generalized.

Conclusion

Detection errors in reading CXRs are significant and should be emphasized in radiology education. The formal radiology curriculum should prioritize teaching the hidden areas of radiograph interpretation. Focused teaching in these areas significantly positively impacts nearly all novice clinicians in this study, except for the foreign-graduated intern group. Given that learners have varying learning abilities, targeted teaching tailored to individual needs is likely to be more effective.

Conflict of Interest

All authors declare that there is no conflict of interest.

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Case Report

Pseudomesotheliomatous lung cancer mimicking malignant pleural mesothelioma: A case report

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Abstract

Pseudomesotheliomatous lung cancer (PML) is an uncommon type of primary lung cancer that mimics malignant pleural mesothelioma (MPM); however, data on this specific presentation remain scarce. We reported a 47-year-old Thai female presenting with right-sided chest pain, progressive dyspnea, and weight loss for three months. A computed tomography scan revealed extensive circumferential nodular pleural thickening and multiple irregular pleural-based masses affecting the right hemithorax, along with multiple foci of calcified pleural plaques in the bilateral hemithoraces. These findings raised a concern for malignant pleural mesothelioma with past asbestos exposure. However, a pleural biopsy later confirmed adenocarcinoma of the lung through immunohistochemical studies (positive for thyroid transcription factor-1 and negative for calretinin). Despite receiving five cycles of chemotherapy, her condition deteriorated, and she died

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approximately ten months following the initial diagnosis. In conclusion, PML with pleural plaques is rarely reported, and immunohistochemistry staining is imperative for an accurate diagnosis.

Keywords: Adenocarcinoma, Lung neoplasms, Malignant, Mesothelioma.

Introduction

Pseudomesotheliomatous lung cancer (PML) is a rare type of primary lung cancer that primarily involves the pleura and is characterized by the absence of significant intrapulmonary lesions [1]. First described by Harwood et al. in 1976, PML is a distinctive variant of primary lung cancer, marked by extensive pleural growth that mimics the clinical and radiological features of malignant pleural mesothelioma (MPM) [2]. MPM, the most common primary malignancy of the pleura, is almost exclusively linked to asbestos exposure [3]. Even minimal exposure to asbestos fibers poses a significant risk of developing MPM [4].

Most cases of PML are adenocarcinoma, and they can be indistinguishable from MPM, making immunohistochemical analysis crucial for accurate diagnosis [5,6]. Both PML and MPM carry a poor prognosis, primarily due to late-stage diagnosis and limited treatment options [4,6].

While a direct causal link between asbestos exposure and PML has not been definitively established, asbestos exposure is a recognized risk factor for pleuropulmonary malignancy, including lung cancer and MPM [6,7]. A thorough assessment of asbestos exposure remains essential for guiding diagnosis and management. In this case report, we presented a patient with PML and calcified pleural plaques, findings that may suggest prior asbestos exposure. This further complicates the differentiation between PML and MPM. This case underscores the importance of immunohistochemical studies, particularly regarding the use of markers such as thyroid transcription factor-1 (TTF-1) and calretinin, in distinguishing PML from MPM, given their overlapping clinical and radiological characteristics.

Case summary

A 47-year-old previously healthy Thai woman presented with a three-month history of right-sided chest pain, progressive shortness of breath, and unintentional weight loss. Upon initial examination, her physical examination and vital signs were unremarkable. However, a chest radiograph revealed multiple pleural-based masses in the right hemithorax (Figure 1A).

Subsequent contrast-enhanced computed tomography (CT) of the thorax revealed concentric nodular pleural thickening and lobulated pleural masses with heterogeneous enhancement along the right pleura (Figure 1 – B-C). Calcified pleural plaques were identified bilaterally at the anterolateral chest walls and along both hemidiaphragms (Figure 2). No discrete pulmonary nodules or masses were evident (Figure 3). These findings thereby raised suspicion of the primary pleural tumor, namely MPM. The patient had no history of smoking or significant past medical histories except for dyslipidemia. In addition, there was no recorded family history of cancers or chronic lung diseases. Her occupation as a housewife was noted; however, the medical records did not document her detailed occupational history or information about potential past asbestos exposure such as a history of para-occupational or environmental exposures.

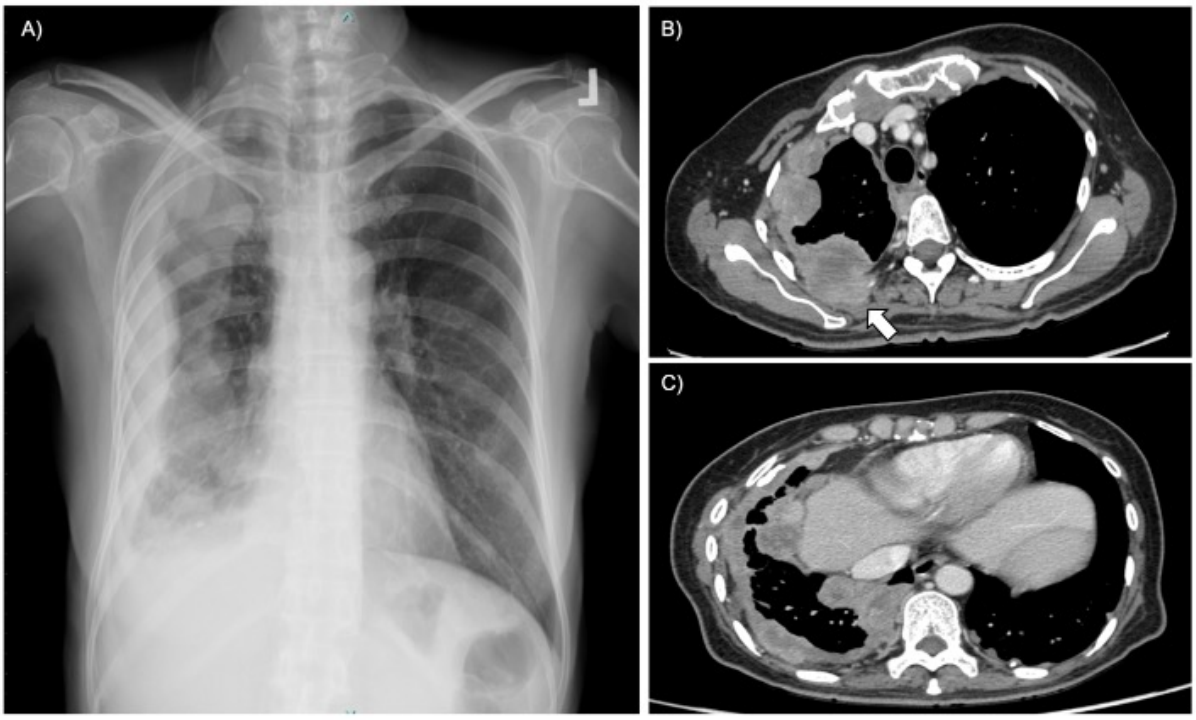

Figure 1. *Initial chest imaging of the patient, A: Chest radiograph showing extensive lobulated pleural masses in the right hemithorax, B-C: Axial contrast-enhanced chest CT images at the upper and lower thoracic levels (mediastinal-window setting) demonstrating concentric nodular pleural thickening and lobulated pleural masses with heterogeneous enhancement, including extension to the posterior chest wall muscles (arrow in B).*

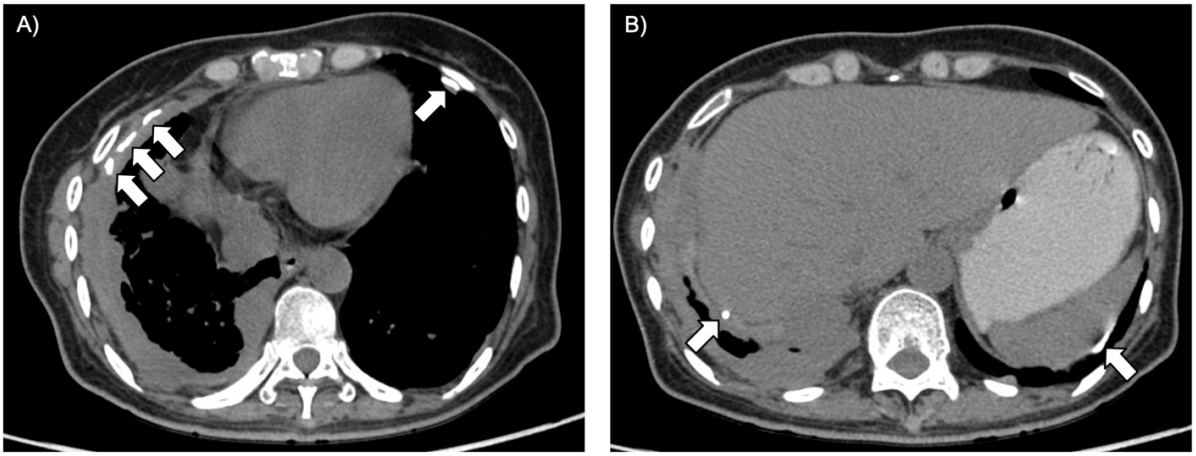

Figure 2. *Axial non-contrast chest CT images (mediastinal-window setting) showing calcified pleural plaques (arrows) at the anterolateral aspect of the bilateral chest walls (A) and along both hemidiaphragms (B).*

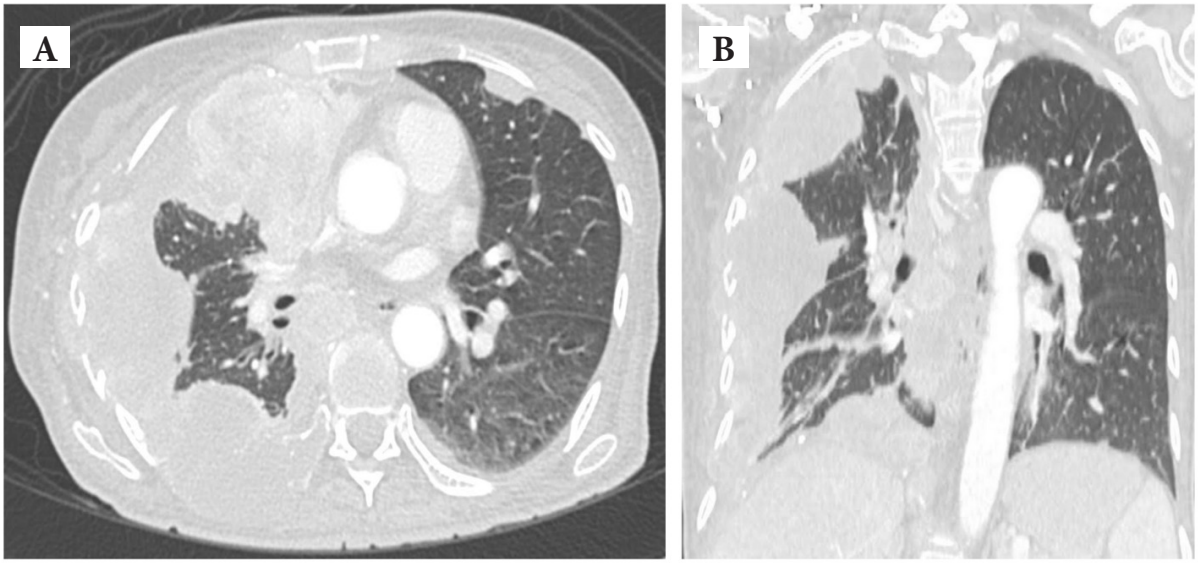

Figure 3. *Axial (A) and coronal (B) contrast-enhanced chest CT images (lung-window setting) demonstrating the absence of discrete pulmonary nodules or masses.*

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The patient underwent an ultrasound-guided biopsy of the right pleura. Histopathological findings revealed few atypical glandular structures in the stroma alongside scattered malignant cells in an epithelioid appearance. Mucin staining was negative. Importantly, further immunohistochemistry staining confirmed adenocarcinoma of the lung, with positive markers for thyroid transcription factor-1 (TTF-1) and AE1/AE3, while displaying negativity for calretinin. Meanwhile, serum tumor marker levels were within normal limits, including CEA, CA 125, and CA 19-9.

After the diagnosis, the patient received chemotherapy consisting of carboplatin and gemcitabine. However, CT imaging after five cycles of the treatment revealed disease progression, demonstrating a significant interval increase in the size of pleural masses, as well as mediastinal adenopathies and bone destructions at the right 5th and 8th ribs due to adjacent tumor invasion. Correspondingly, a whole-body bone scan demonstrated radioactivity uptake at multiple ribs, suggesting bony metastasis. The CT scans of the brain and abdomen revealed no significant abnormalities. The patient had been under palliative care until her demise, approximately ten months following the initial diagnosis.

Ethical approval for this case study was waived by the institutional review board, considering its nature as a case report of a single patient. In addition, we have de-identified all patient details.

Discussion

This case report presented the patient with PML. PML is a rare form of lung cancer that primarily involves the pleura. According to a 10-year retrospective study in the United Kingdom, individuals with PML are typically older (median age of 67), predominantly male, and 95% are current or former smokers [6]. Unlike prior reports, this patient was relatively young and had never smoked. Upon diagnosis, the patient presented with advanced disease, which contributed to suboptimal treatment outcomes, with a survival duration of 10 months. This poor prognosis aligns with previous literature, which reports a median survival duration of 8 months (ranging from 0.5 to 14 months) [6]. Additionally, a case series involving seven PML cases found survival durations ranging from 2 to 12 months, with no improvement in patients who underwent chemotherapy or radiation [5].

Given the absence of documented occupational history, tuberculosis, significant thoracic injury, surgery, or radiation, the presence of calcified diaphragmatic pleural plaques may suggest prior asbestos exposure [4]. Thus, the nodular concentric pleural thickening with calcified pleural plaques, particularly on the lower chest walls and diaphragm, strongly suggests MPM with prior asbestos exposure in this patient [3, 8]. However, it is important to note that nodular pleural thickening can also be seen in metastatic carcinoma, particularly adenocarcinoma [8]. Similarly, the presence of pleural plaques in patients with pleural masses does not necessarily indicate MPM. In a PML case series, pleural plaques were found in 60% of cases (12/20), with five detected radiologically [7]. Studies have highlighted the potential link between asbestos exposure and PML. One study found that approximately 80% of PML patients had a history of asbestos exposure [6], while another demonstrated elevated asbestos concentrations in lung tissues of PML patients [7]. Additionally, a retrospective study in Japan identified pleural plaques in 12.8% of primary lung cancer patients [9]. However, data from compensation claims or occupational health studies may influence the characteristics of the study population. This suggests that, despite its rarity, PML should be considered a

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differential diagnosis alongside MPM. Kobayashi et al. highlighted the challenge of distinguishing the radiological features of PML from MPM, as both can present with fissure involvement, pleural effusion, and hilar or mediastinal lymphadenopathy [5]. Given the overlap in radiological and clinical features, tissue diagnosis is essential for confirmation.

The histopathological examination of this patient indicated adenocarcinoma, which needs further careful differentiation from epithelioid mesothelioma due to overlapping histological features [10]. Immunohistochemical analysis is thereby crucial for distinguishing between these two entities, with TTF-1 and calretinin as the key markers. TTF-1 immunostain, which is a lung-specific marker, showed a positive result in this patient. Importantly, calretinin, which is a specific marker associated with epithelioid mesothelioma, was negative. Previous literature has also consistently reported negative calretinin staining in cases with PML [5,6,11]. As a result, the diagnosis in this patient was, in turn, adenocarcinoma of the lung, the predominant subtype of PML [5,6]. Notably, adenocarcinoma typically occurs in the peripheral lung. Hence, it has been proposed that PML might originate from the subpleural region and spread via subpleural lymphatic systems or through fibrous pleural thickening [1,2].

To our knowledge, this was the first case report of PML coexisting with pleural plaques in Thailand. Diaphragmatic pleural plaques were a critical finding as they are potentially linked with prior asbestos exposure. Nonetheless, some limitations of this case study should be mentioned. Firstly, as this case dates back to 2008, despite our best efforts, lacking a clear history of asbestos exposure from the patient or her close relatives poses a challenge in linking PML and asbestos exposure in this patient. Secondly, the unavailability of histopathological and immunohistochemical images due to storage expiration restricts their visual presentation in this report, as we could only acquire the written pathological reports.

In conclusion, this case study highlights the CT manifestations of PML, a rare but life-threatening thoracic neoplasm that closely mimics MPM. Additionally, the presence of pleural plaques in this patient, potentially linked to past asbestos exposure, further complicates differentiation from MPM. Therefore, immunohistochemical studies, particularly markers like TTF-1 and calretinin, are essential for accurately distinguishing between these two conditions.

Conflict of Interest and source of funding: none declared.

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Case Report

Pulmonary Langerhans cell histiocytosis in a young adult with a history of vaping and smoking: A case report

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Abstract

Pulmonary Langerhans cell histiocytosis (PLCH) is a rare interstitial lung disease characterized by the proliferation of Langerhans cells, typically associated with smoking. It accounts for 3%-5% of adult diffuse lung diseases, although the true prevalence may be higher due to asymptomatic cases and diagnostic challenges. Recently, e-cigarette use (vaping) has emerged as a potential contributing factor in PLCH. We report the case of an 18-year-old male with a history of heavy nicotine vaping and prior light smoking who presented with pneumothorax and diffuse cystic lung lesions. Lung biopsy confirmed PLCH through CD1a and S100 positivity. Smoking cessation led to symptomatic and functional improvement, although long-term outcomes remain uncertain. This case highlights vaping as a possible risk factor for PLCH, distinct from traditional smoking, and underscores the need for further research into vaping-related pulmonary diseases. A multidisciplinary approach is essential for the diagnosis and management of PLCH.

Keywords: Cystic lung disease, Pneumothorax, Pulmonary Langerhans cell histiocytosis, Smoking, Vaping.

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Introduction

Langerhans cell histiocytosis (LCH) is a rare disease characterized by the abnormal proliferation of dendritic-cell-related histiocytes, known as Langerhans cells, which destructively infiltrate tissues. The etiology of LCH remains unknown. LCH peaks in incidence during the first year of life and decreases in frequency thereafter, rarely occurring in individuals over the age of 20 [1]. From neonates to the elderly, LCH can involve any organ; however, the lungs are notably affected in both adults and children [1]. Additionally, children with extrapulmonary LCH who later develop pulmonary Langerhans cell histiocytosis (PLCH) are often smokers [2].

PLCH is part of a group of rare lung diseases and may account for about 3%-5% of all adult diffuse lung diseases [3] The actual prevalence might be higher due to asymptomatic cases, spontaneous remissions, and difficulties in identifying advanced forms [4]. PLCH is often characterized by the presence of Langerhans cells with eosinophilic cytoplasm and irregular nuclei, expressing markers such as CD1A, S100, and langerin (CD207) [5]. These cells form granulomas and contribute to the destruction of lung tissue [6].

Clinically, PLCH presents with symptoms ranging from cough and dyspnea to spontaneous pneumothorax. Diagnosis typically involves imaging studies and biopsy with microscopic examination. Treatment options vary based on disease extent and severity, including smoking cessation, corticosteroids, and, in severe cases, systemic therapies like chemotherapy. Despite treatment, PLCH can lead to significant morbidity due to progressive lung damage [2].

Given the rarity and complexity of PLCH, early recognition and appropriate management are crucial [7]. The diagnosis of PLCH can be challenging due to its nonspecific clinical presentation and radiologic findings, which often overlap with other cystic lung diseases. Histopathological confirmation via lung biopsy is frequently required to establish a definitive diagnosis [8].

Management of PLCH is complex, primarily involving smoking cessation, which can lead to disease stabilization or regression. However, in cases of progressive disease despite tobacco abstinence, treatment options are limited and may include chemotherapy agents such as cladribine or cytarabine [9].

As research continues to advance our understanding of LCH, a multidisciplinary approach remains essential to improving outcomes for affected patients.

While numerous case reports on pulmonary Langerhans cell histiocytosis (PLCH) have been documented, only one patient with a history of predominant e-cigarette use was reported [10]. Here, we add this case to contribute to the understanding of this potential association.

Case summary

An 18-year-old man, lived in rural area of southern Thailand, with a history of heavy, everyday nicotine vaping for 4 years and prior cigarette smoking for 3 years (totaling a 7 pack-year smoking history), with no underlying disease or history of trauma, presented with a sudden onset of dyspnea. He reported progressive severity of coughing over the previous 2 months and then presented with acute dyspnea which was sent to the emergency room.

Initial physical examination showed decreased breath sounds in the right lung, and a chest radiograph revealed a large pneumothorax in the right lung and numerous tiny, irregular-shaped cysts diffusely present in both lungs. Emergency intercostal drainage of the right chest was performed. Further CT scans of the chest and abdomen were performed, revealing diffuse, symmetrical, numerous, small, irregular-shaped cysts in both lungs, with no abdominal mass detected (Figure 1). A bone scan showed increased radiotracer uptake at the right scapula and right sacroiliac joint, raising suspicion for disease involvement.

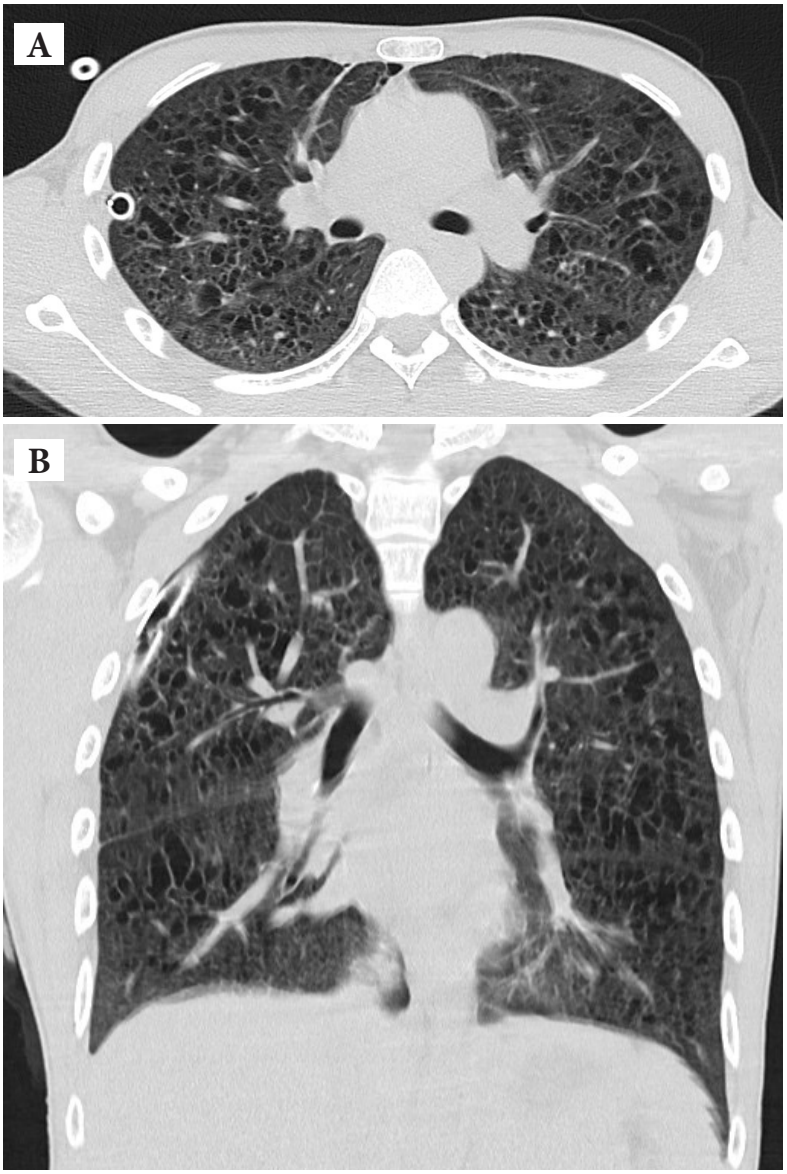
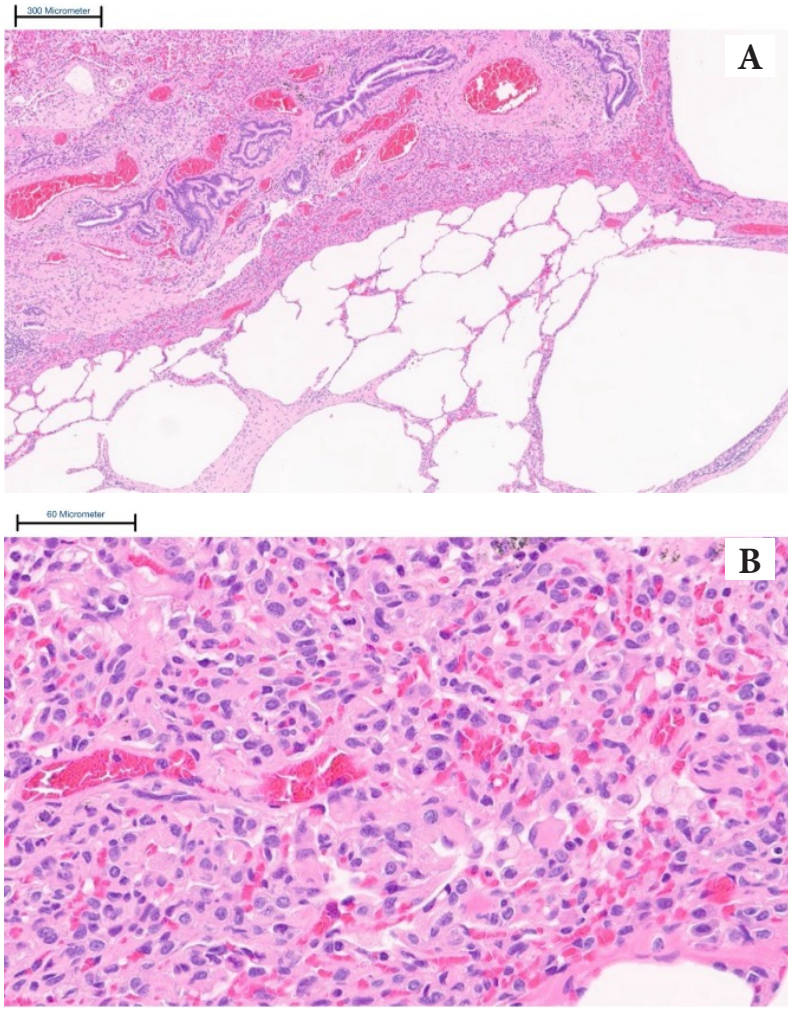


Figure 1. *(A) Axial CT shows bilateral diffuse ground glass opacities and multiple bizarre-shaped lung cysts, proven pulmonary Langerhans cell histiocytosis. The percutaneous chest drainage tube in right hemithorax is also seen. (B) Coronal non-contrast CT shows bilateral diffuse ground glass opacities and multiple bizarre-shaped lung cysts predominantly in mid and upper lung zones with relatively spared costophrenic angles, proven pulmonary Langerhans cell histiocytosis. The percutaneous chest drainage tube in right hemithorax is also seen.*

The specimen received for pathologic evaluation was a wedge biopsy specimen from the right middle lobe. Gross examination revealed multiple cystic spaces in the lung parenchyma. Microscopic examination revealed scattered aggregates of Langerhans cells with surrounding cystic changes (Figure 2A). The Langerhans cells are large and have convoluted nuclei, abundant eosinophilic cytoplasm, and an indistinct border (Figure 2B). The aggregates are admixed with eosinophils and lymphocytes. The remaining lung parenchyma revealed chronic inflammation and interstitial fibrosis. The pleura is unremarkable. Immunohistochemical stains are positive for S100 (Figure 2C) and CD1a (Figure 2D). The histologic and immunohistochemistry profiles support the diagnosis of Langerhans cell histiocytosis.



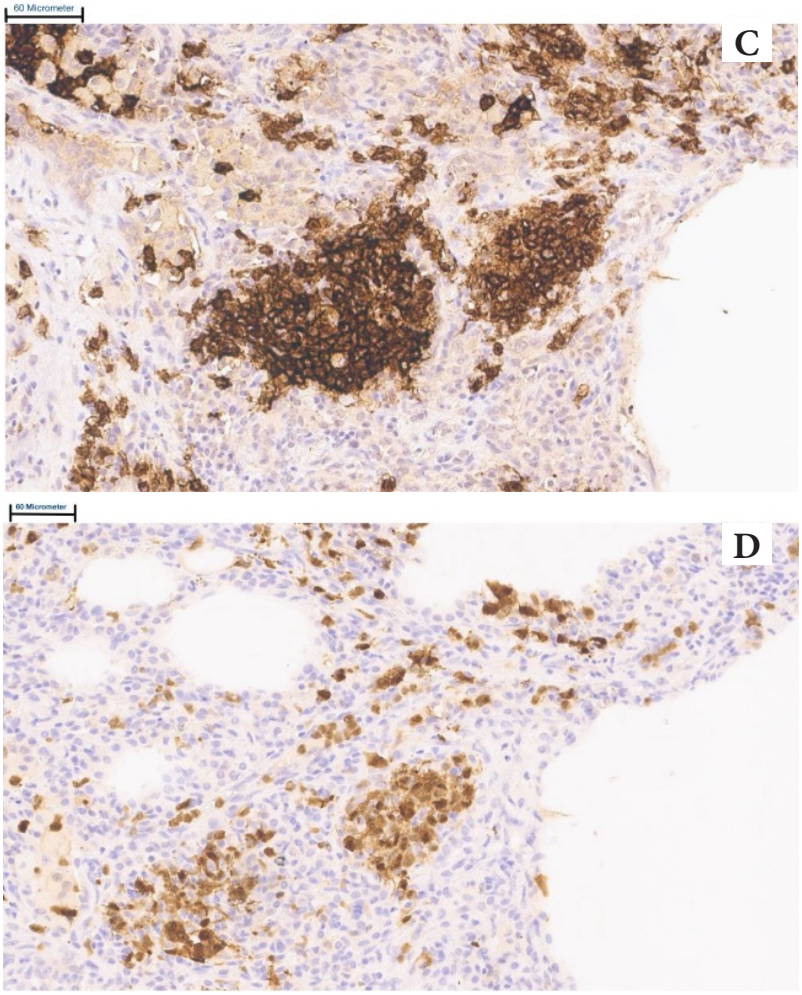


Figure 2. *Microscopic examination, (A) H&E section (100x) showing aggregates of Langerhans cells with cystic changes, (B) H&E section (400x) showing large Langerhans cells with convoluted nuclei and abundant eosinophilic cytoplasm, (C) S100 immunostaining showing cytoplasmic and nuclear positivity in Langerhans cells (400x), and (D) CD1a immunostaining showing membranous positivity in Langerhans cells (400x).*

After smoking cessation for 2 months, the symptoms of cough and phlegm improved markedly, and lung function tests also demonstrated improvement; however, there was no follow-up CT.

Discussion

Over 90% of PLCH patients are current or former smokers, with an average smoking history of 27 pack-years [11]. In contrast, our patient had a relatively low smoking exposure of 7 pack-years over 3 years prior to transitioning to vaping. However, the patient's history of prolonged and unspecified vaping raises the possibility of its contribution to the development of PLCH.

From our search, there is only one case report on nicotine vaping-associated PLCH [10] that also described a patient with a prior history of cigarette smoking who engaged in heavy, daily nicotine vaping. However, that patient also used marijuana regularly, both in edible and combustible forms. In contrast, our case involves a patient with a history limited to cigarette smoking and nicotine vaping, which may provide a clearer association between vaping and the development of PLCH.

In Vaping Product Use-Associated Lung Injury (EVALI), common CT findings include ground-glass opacities (GGO), consolidation, and patterns of organizing pneumonia (OP), which can be diffuse or lower-lobe predominant, often sparing subpleural or lobular regions. However, multiple parenchymal cysts are atypical but possible and may overlap with PLCH findings. In this case, the lung findings showed diffuse GGO without consolidation or an OP pattern, which, although not definitive, makes PLCH the more likely diagnosis [7].

While the strong association between smoking and PLCH has been known for some time, the mechanism remains unclear. Previous studies propose that smoking leads to the accumulation of CD1a+ cells in the lungs. Granulocyte-macrophage colony-stimulating factor (GM-CSF), produced by normal bronchiolar epithelium, plays an important role in the proliferation and differentiation of Langerhans cells [12].

Other smoking-related factors contributing to airway diseases include the production of the connective tissue growth factor (CTGF), transforming growth factor-beta (TGF-β1), the platelet-derived growth factor (PDGF)-A and -B, and

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CCL20 in the airway walls [13]. Osteopontin, a glycoprotein with chemokine activity, induces the chemotactic recruitment of macrophages, monocytes, and dendritic cells, including Langerhans cells [14].

E-cigarettes, or vaping, were invented in 2003 by a Chinese pharmacist and became widely used by 2011, with over 7 million users globally [15]. In 2019, the Centers for Disease Control and Prevention (CDC) announced an "Outbreak of Lung Injury Associated with the Use of E-Cigarette or Vaping Products" [16]. The CDC reported 805 patients with lung injuries linked to e-cigarette or vaping products. Among these, 69% were male, with a median age of 23 years. Of the 63% of patients who used substances in e-cigarettes or vaping products in the 30 days preceding the symptom onset, 76.9% reported using Tetrahydrocannabinol (THC)-containing products, and 56.8% reported using nicotine-containing products.

Nicotine, a substance found in all tobacco products since its introduction in 1492, has been studied extensively. The smoking history of PLCH patients, averaging 27 pack-years, implies a total nicotine exposure of approximately 270 milligrams, assuming an average cigarette contains 10-12 mg of nicotine [17]. E-cigarettes, with varying concentrations of nicotine ranging from 0-24 mg/ml in cartridges to up to 100 mg/ml in refill fluids, may provide substantial nicotine exposure [18]. Our patient, although unaware of the exact nicotine concentration in the e-cigarettes used, reported heavy daily vaping, raising concerns about its potential role in stimulating Langerhans cell-related pathogenesis.

In addition to nicotine, other smoking-related substances, vitamin E acetate, found in THC-containing e-cigarettes or vaping products, has also been associated with lung injury. Inhalation of this compound interferes with the normal lung function, though its role in PLCH remains unclear [19]. Notably, while lung injuries related to vaping typically manifest within 30 days of exposure, PLCH patients often have a much longer history of tobacco use, with a median duration of approximately 20 years.

Conclusion

In summary, while e-cigarette use has grown globally, especially among adolescents, its association with pulmonary diseases remains an area of active research. The spectrum of clinical and pathological diagnoses related to vaping continues to expand. In this case report, the patient was definitively diagnosed with PLCH, but the mechanism remains unclear. Future studies on the correlation between PLCH, other cystic lung diseases, and e-cigarette use would be of significant interest.

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ASEAN Movement in Radiology

Report on the 32nd Annual Scientific Meeting of Hong Kong College of Radiologists

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Abstract

Dr. Siwat Bhumiwat reported on his attendance, research presentation, and presentation in the young fellow forum, at the 32nd Annual Scientific Meeting of the Hong Kong College of Radiologists (HKCR), supported by the HKCR Education and Research Fund and the Radiology Society of Thailand (RST), on November 23rd-24th, 2024. The information of the meeting, the ceremony for graduated radiologists, the presentation of Thailand's residency training system, research, and the healthcare system in the young fellow forum, information of scientific exchange between countries, as well as social events and further collaboration were summarized and described.

Keywords: Asian Oceanian School of Radiology (AOSOR), Genitourinary imaging, Hong Kong College of Radiologists (HKCR), Oncology, Oncologic imaging, Radiology Society of Thailand (RST).

The exchange of young radiologists from the Hong Kong College of Radiologists (HKCR) in China and the Royal College of Radiologists of Thailand (RCRT), and the Radiological Society of Thailand (RST) in Thailand have attended their congresses starting in 2001. The collaboration is based on a voluntary nature despite the lack of a contract or memoir of understanding (MOU). During 24 years of affiliation, there were seven intersocietal activities with six young radiologists from Thailand obtaining HKCR's sponsorships to attend HKCR annual congresses and two young radiologists from Hong Kong granted with RCRT-RST's sponsorships to attend the RCRT-RST congresses.

In 2024, the author was selected to receive the Education and Research Fund of the HKCR, as a young radiologist from Thailand to attend the 32nd Annual Scientific Meeting of the HKCR, held in the Hong Kong Academy of Medicine Jockey Club Building, on November 23rd-24th, 2024.

The selected fellows were strongly encouraged to submit an abstract and participate in the young fellow forum, as well as invited to join the social event of The Royal College of Radiologists and Hong Kong College of Radiologists 24th Joint Ceremonies for the Admission of New Fellows, and the Twentieth Hi Hung Chiu Lecture and Dinner of the College on the November 23rd, 2024. The conference was held by the Hong Kong College of Radiologists, which comprises radiologists, clinical oncologists, and nuclear medicine physicians under the theme of artificial intelligence (AI) and medico-legal issues, clinical interventional radiology practice, and hepatobiliary malignancies.

The author presented a case report about the first day of the colocolonic intussusception of the descending colon in an expecting patient in her second trimester, who presented with right lower quadrant pain, mimicking the presentation of acute appendicitis [1]. In this case, the intussusception in the left side of the abdomen causes proximal gut obstruction. It is suspected that the pain in the right upper and right lower quadrants which the patient experienced could be from the marked dilatation of the cecum, ascending, and transverse colon, of which the symptom greatly mimics acute appendicitis. Intussusception in

pregnancy is extremely rare and most of the literature reports the leading points, as the cause of the event. According to the literature reviews, there are various causes of intussusception, which can be categorized, as follows; 1) post-operation, including Roux-en-Y gastrojejunostomy and gastric bypass surgery, 2) parasitic infections with a case report of Ascaris infection, 3) tumors both benign and malignant, including lipoma, heterotopic/ectopic pancreas, endometriosis, Meckel's diverticulum, GIST, and adenocarcinoma of the colon, and with 4) associated syndromes, including Peutz-Jeghers Syndrome and Lynch Syndrome (Figure 1).

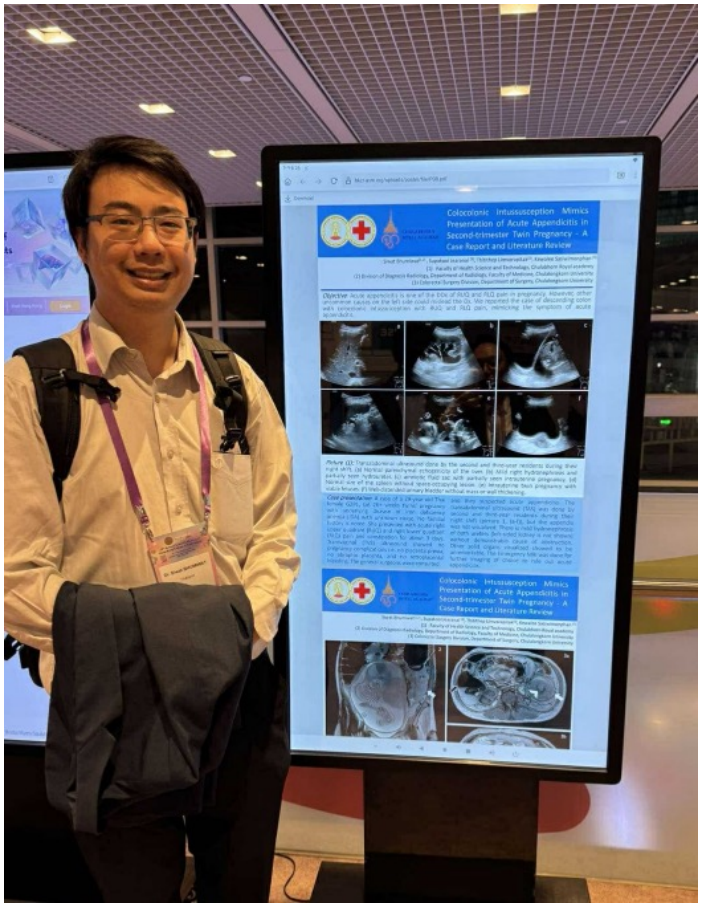

Figure 1. *Dr. Siwat Bhumiwat presenting his E-poster presentation about the Colocolonic Intussusception mimic presentation of acute appendicitis in a woman in her second-trimester twin pregnancy which was a case report in combination with literature reviews.*

The young fellow forum was in the afternoon of the second day of the conference, during which there were outstanding representatives from many countries in Asia and special administrative regions of China, including Hong Kong, Chinese Taipei, Macau, Malaysia, South Korea, Thailand, and India. Each representative was given seven minutes of presentation and another seven minutes for the question-and-answer session. Each fellow was asked to choose training systems, a healthcare policy, and advancement of one's interest or research. For Thailand, the author presented briefly all three, firstly about the training system, including the Introduction of Medical schools in Thailand, the establishment of the RCRT, the training center for residency of diagnosis radiology, fellowship training, which greatly varies in each country as many other Asian countries usually have five to six years of residency training. The second item of presentation dealt with cancer screening and treatment policies in Thailand, consisting of the leading causes of death in Thailand, cancer, government service plans and policies, and the recent technology of Proton Center. Lastly, the author presented his ongoing research of the genitourinary system about prostate cancer and transgender imaging, which many fellows found interesting as Thailand is famous for being friendly with the LGBTQ+ community, and the author promoted the upcoming 29th RCRT and 61st RST annual conference, under the theme of The Art and Science of Radiology: Bridging Knowledge and Practice, on March 20th-22nd, 2025. Since the author had just finished his training as an exchange fellowship member, granted by the European Society of Urogenital Radiology (ESUR) and the European School of Radiology (ESOR), to study in the genitourinary system in Cantonal Hospital of Freiburg, University of Freiburg, Switzerland, under the supervision of Professor Harriet Thoeny, he was kindly asked to promote the ESOR scholarship in the young fellow forum, for young radiologists from Asia to be able to gain precious scholarships in the future (Figures 2 and 3).

Figure 2. *Dr. Siwat Bhumiwat presenting his topic about Recent Advance in Radiology Technology in Thailand, on November 24th, 2024, at 16.36-16.50, in the young fellow forum; the picture was taken by Dr. Everlyn Ho, immediate past president of Asian Oceanian Society of Radiology (AOSR).*

Figure 3. *Dr. Siwat Bhumiwat presenting his topic about Recent Advance in Radiology Technology in Thailand, on November 24th, 2024, at 16.36-16.50, in the young fellow forum; the picture was taken by Dr. Everlyn Ho, immediate past president of Asian Oceanian Society of Radiology (AOSR).*

After all of the fellows had presented their interesting research, training systems in their countries, or health care systems, fellows, along with the former president of the Hong Kong College of Radiologists, as well as honorable guest speakers, were gathered for the interactive sharing session about the further potential research collaboration, along with a discussion about obstacles in conducting research, funding, and development of new knowledge. Surprisingly, all the countries shared similar problems of excessive workloads demanded of universities and public radiologists with as high as sixty-to-seventy computed tomography (CT) results per one radiologist per day, with lower salaries for researchers compared with the private practitioners with a huge difference in ratio as high as five to six times in salaries. Also, they are faced with abundant documents and paperwork despite an inadequacy of research and development funding. Contact information methods, including WhatsApp and cards, were exchanged between the fellows and the honorable guest speakers, for further collaboration and exchange of novel knowledge in the future. The author exchanged contact information with Dr. Barry Bar Wai Wo (Oncologist, specialist in GU cancer), from Hong Kong, and Dr. Cheen Leng Lee (Oncologist), from Malaysia, for further education and research collaboration (Figures 4 and 5).

Figure 4. *An interactive sharing session between young fellows from every country; Dr. Siwat Bhumiwat (second seat from the left side), sharing his experience on conducting research in Thailand, as well as the obstacles in performing research in Thailand.*

Figure 5. *A group picture of the young fellow forum with Dr. Lilian Leong (Founding President and Senior Advisor, HKCR), Dr. Everlyn Ho (Immediate past president of the AOSR), Professor Joseph Lee (Past President of ARRS), Dr. Danny Cho (Vice President of HKCR and AOSR), and Dr. WL Poon (Warden of HKCR).*

For the social event (Figures 6-9), the author was invited to the Twenty-fourth Joint Ceremonies for Admission of New Fellows, where all of the radiologists, clinical oncologists, and nuclear medicine physicians who newly obtained their fellowship in Hong Kong, and the radiologists who had just passed the final FRCR examination from the Royal College of Radiology (RCR), gathered to receive the certificate of radiology from Dr. Ivan Wong, the president of HKCR and Dr. Katherine Halliday, the president of RCR, respectively. Families of recent graduated radiologists were able to attend the ceremony, making the atmosphere amicable and joyful. Later on, Professor Gilberto Ka-kit LEUNG, the president of the Hong Kong Academy of Medicine, was invited to deliver an intriguing and resourceful speech on the recent advancement in artificial intelligence (AI) and the potential usefulness of AI in the field of medicine and radiology in the Twentieth Ho Hung Chiu Lecture. In the evening of the first day, there was the Dinner of the College, where all of

the selected fellows from every country were invited to join. This event allowed radiologists to meet and make friends for the potential collaboration in education and research in the future. I was arranged to join the "Joule table", where I met Dr. Vince Vardhanabhuti, a Thai and Hong Kong radiologist, who worked at University of Hong Kong (HKU). His study focused on Radiogenomic and Oncoimaging, which could be a potential conjoint research endeavor between Hong Kong and Thailand in the future. The author also met an old friend, Dr. Benjamin Leong, from Macau, who used to visit King Chulalongkorn Memorial Hospital (KCMH) in Bangkok, Thailand, and discussed the knowledge and education system between Macau and Thailand.

In conclusion, this event and opportunity offered the author not only a wonderful experience and cutting-edge knowledge in radiology and oncology but also an insightful training and government policies of cancer screening, diagnosis, and treatment, from which he acquired collaboration and friendships with outstanding fellows and radiologists in Asian countries. The author would like to express sincere gratitude to the RST and the HKCR for the precious opportunity and hopes to join the working group and correspond with conference attendees in education and research in the near future.

Figure 6. *A group photo before the certificate ceremony, from left to right, Dr. Siwat Bhumiwat, Dr. Benjamin leong (Council Member of the Macao Radiological Society) and Dr. Alta Lai (Honorary Secretary of HKCR as well as the moderator in the Young Fellows Forum), respectively.*

Figure 7. *Dr. Katharine Halliday, the president of RCR, giving the speech for the recently passing RCR examination radiologist.*

Figure 8. *A group photo of the Joule table in the Dinner of the College, where the invited speaker, outstanding fellows, and leading radiologists in Asia, joined the dinner together; Dr. Siwat Bhumiwat, standing on the far left) with next to him, Dr. Vince Vardhanabhuti.*

Figure 9. *Dr. Everlyn Ho (left), immediate past president of AOSR, and Dr. Siwat Bhumiwat (right), in the Young Fellow Forum.*

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ASEAN Movement in Radiology

AIR Pneumo, a project to standardize chest radiograph interpretation of occupational lung diseases in Thailand and ASEAN countries: Challenges and future trends

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Abstract

This article compiles multiple operations to establish the standard for experts in interpreting chest radiographs of pneumoconiosis, based on the International Labour Organization's (ILO) classification standards in Asia under the name 'AIR Pneumo.' The project began in Thailand and expanded to other countries, especially in the ASEAN region. It has been supported by the National Institute for Occupation Safety and Health (NIOSH). A memorandum of cooperation was signed to maintain the training standards of the program at an international level and to address the shortage of NIOSH B Readers in the region. The training courses and examinations have been organized in Thailand. The transition from film-based radiographs to digital imaging presents a future challenge for AIR Pneumo's operations, which aligns with the World Health Organization's policy to eliminate pneumoconiosis.

Keywords: AIR Pneumo, Chest radiography, ILO classification, NIOSH B Reader, Pneumoconiosis.

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To eliminate silicosis in workplaces by 2030 in line with the International Labour Organization (ILO) and the World Health Organization (WHO)'s Global Programme for the Elimination of Silicosis (GPES) [1], Thailand established the National Programme for the Elimination of Silicosis (NPES) in 2001. In 2006, the Asian Intensive Reader of Pneumoconiosis (AIR Pneumo) was established as an academia-based quality assurance program for physicians' proficiency in reading chest radiographs for pneumoconiosis [2]. By the end of 2019 before the 1st Covid-19 pandemic, AIR Pneumo had successfully conducted its training and examination programs in several countries [3]. Originally, the Central Chest Institute of Thailand (CCIT) was the only institution that could accommodate candidates for the AIR Pneumo training and examination programs. In 2016, it was expanded to the Philippines, Indonesia and Vietnam.

Besides contributing to the expansion of AIR Pneumo's operations across various ASEAN countries, the CCIT has also maintained the high standards of AIR Pneumo's trainers through collaborations with the National Institute for Occupation Safety and Health (NIOSH), part of the Centers for Disease Control and Prevention (CDC) of the Department of Health and Human Services (HHS) of the United States of America (U.S.) to contribute to the prevention of occupational injuries and diseases in both Thailand and the U.S.

NIOSH's Respiratory Health Division (RHD) conducts the NIOSH B Reader Program and offers monthly examinations at Morgantown, WV, NIOSH facility. The NIOSH B Readers are specialized physicians trained and certified to classify findings of pneumoconiosis on chest radiographs using the ILO classification system. Typically, to be a certified NIOSH B Reader, one has to take the examination at NIOSH facility or other NIOSH-administered sites in the United States. When the Memorandum of Understanding Between the CCIT, Department of Medical Services, Ministry of Public Health of Thailand and the NIOSH, CDC, Department of Health and Human Services of the U.S. was initiated, the 2-days training course was offered by NIOSH and the B Reader examination has been administered in Thailand. As a result, this has increased accessibility and decreased incurred costs, making more physicians available to classify radiographs for pneumoconiosis in Thailand and overseas countries.

AIR Pneumo Program: Objectives

1. To develop experts in reading radiographs of pneumoconiosis according to the standards set by the ILO
2. To train and enhance the knowledge of physicians working in fields related to occupational lung diseases, enabling them to accurately interpret radiographs of occupational lung diseases in line with the ILO classification standards
3. To assess experts and provide certification by the Asia Regional Cooperation Committee, the "AIR Pneumo Committee"
4. To facilitate the exchange of knowledge, insights, and experiences among experts both within and outside the country, particularly in the Asian region
5. To create a network of academic collaborations on occupational lung diseases between Thailand and other countries in the Asian region
6. To establish a standard for experts in Thailand and the Asian region that aligns with international standards

Standards for Experts in Interpreting Chest Radiographs for Occupational Lung Diseases

To standardize the interpretation of chest radiographs as accurately as possible, the ILO developed a classification system for reading chest radiographs to detect pneumoconiosis (ILO classification) [4]. This system aims to improve the quality of chest radiograph reading and maintain the expertise of physicians in using the ILO classification standards.

To ensure that experts maintain high competency in using the ILO classification, the U.S. NIOSH developed the B Reader certification program in 1974 [5].

Based on ILO classification standards, a training for reading chest radiographs of pneumoconiosis is conducted by NIOSH, a U.S. government agency responsible for research and recommending protection measures against occupational hazards. However, to become a certified B Reader, one must travel to the United States to take the exam, which makes it difficult for medical personnel in developing countries in the ASEAN region to access this expertise.

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Establishing a regional standard for experts in interpreting occupational lung disease radiographs in Asia addresses the region's shortage of B Reader experts. This initiative aims to reduce diagnostic issues and complaints regarding unreliable diagnoses.

Project Implementation:
Establishment of the AIR Pneumo Committee in 2006 [3].
To continuously implement and develop the training and examination program for pneumoconiosis radiograph experts to meet international standards, the CCIT under the Department of Medical Services, Ministry of Public Health, in collaboration with the Bureau of Occupational and Environmental Diseases, Department of Disease Control, and the Faculty of Medicine, Fukui University, Japan, serves as the core organization in establishing international cooperation and networks across Asian countries. The ILO supported the initiative, establishing the AIR Pneumo Committee in 2006. Professor Yukinori Kusaka from the Faculty of Medicine, Fukui University, Japan, was the founding chairman. Currently, the committee includes experts from Japan, Brazil, India, Indonesia, and Thailand.

The AIR Pneumo Committee operates through international cooperation as follows:

1. CCIT, Department of Medical Services, Ministry of Public Health of Thailand
2. Scientific Committees on Respiratory Disorders, International Commission on Occupational Health (SCRD, ICOH)
3. Japan Society for Occupational Health (JSOH), Research Group for Occupational Lung Diseases (RG-OLD)
4. The Association of Occupational and Environmental Diseases of Thailand (AOET), Research Group for International Cooperation in Occupational Health
5. Bureau of Occupational and Environmental Diseases, Department of Disease Control, Ministry of Public Health of Thailand
6. Asian Pacific Society of Respirology (APSR)
7. ILO
8. Workmen's Compensation Fund, Social Security Office of Thailand

Collaboration between Experts from Various Institutes and Organizations within the Country

To maintain the high standards of expertise among trainers in the program, the CCIT, through its Radiology Department, has assembled a group of expert trainers to read radiographs of occupational lung diseases according to the ILO classification standards in Thailand. These trainers passed the NIOSH B Reader certification examination in 2004 and now serve as trainers and advisors for the program in Thailand.

The group comprises highly respected experts from various organizations, including the Department of Medical Services, the Faculty of Medicine at Prince of Songkla University, Chulalongkorn University, and Mahidol University. This collaboration ensures that the training program is supported by a wealth of experience and knowledge, contributing to the development of skilled professionals in occupational lung diseases.

Fostering Collaboration between Organizations and Agencies in ASEAN Countries

In 2014, the CCIT, through its Radiology Department, organized an international collaboration meeting among ASEAN countries to develop expertise in reading chest radiographs of occupational lung diseases (pneumoconiosis) according to the ILO classification standards. "The ASEAN Conference for the Development of National Readers for ILO Classification" meeting was held from July 28th -30th in Chiang Mai, Thailand [3].

Representatives from ASEAN countries attended the conference, including Brunei, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Thailand, and Vietnam. The meeting concluded that enhancing the ability of physicians to interpret radiographs of occupational lung diseases (pneumoconiosis) is essential for effective surveillance and prevention of these diseases. The training programs can be organized through regional cooperation among ASEAN countries, with support from international organizations, notably the ILO. The CCIT serves as the primary organization for conducting trainings and has developed plans to expand training initiatives to other regional countries. This collaboration aims to

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strengthen the region's ability to manage occupational lung diseases and improve diagnostic accuracy across ASEAN.

Development of the Workshop Training and Expert Certification Program for Reading Chest Radiographs of Pneumoconiosis According to ILO Standards in the Asian Region (Asian Intensive Reading of Radiographs of Pneumoconiosis)

1. In 2004, the first training and certification exam for reading chest radiographs of pneumoconiosis according to the ILO standards (NIOSH B Reader certification) was held in Thailand. This event resulted from the collaboration between the Department of Disease Control, the ILO, and Professor Yukinori Kusaka from the Faculty of Medicine, Fukui University, Japan. The CCIT sent three physicians to attend the training, and all three successfully passed the evaluation. In total, there were nine certified physicians in Thailand. Prior to this, training courses based on the ILO classification for radiologists and occupational medicine physicians had been conducted by NIOSH since 1995 and in 2002. These sessions focused on educating and training physicians in reading radiographs without certification as NIOSH B Readers.

2. The CCIT, through its Radiology Department, organized a meeting with NIOSH B Readers (certified in 2004) in Thailand with support from the AIR Pneumo committee and ILO. At that time, nine certified experts from various organizations in Thailand participated, including specialists from the Faculty of Medicine at Chulalongkorn University, Mahidol University, Prince of Songkla University, and the CCIT, as well as radiologists from Rajavithi Hospital and Lerdsin Hospital. This group collaborated to develop a curriculum, determine the course content, and plan the first AIR Pneumo workshop in 2008. An introductory ILO classification training course was organized in 2007. Afterward, the CCIT became the only institution capable of organizing trainings and certification for the AIR Pneumo program, which has been held biennially. By 2018, the CCIT had conducted

the sixth training program in Thailand, with participants from be yond ASEAN countries, including Bhutan, Hong Kong, India, and Taiwan, among others.

However, in 2020, the COVID-19 pandemic disrupted the ability to hold training sessions in Thailand. The AIR Pneumo program was eventually resumed in 2023 as the seventh training session.

Expansion of AIR Pneumo Training Program and Evaluation of Experts to the ASEAN Region

1. We expanded the AIR Pneumo training program outside of Thailand for the first time in the Philippines. The ILO/AIR Pneumo Training Workshop on the Asian Intensive Reading of Radiographs of Pneumoconiosis was held in Manila, the Philippines from July 26th-28th, 2016.

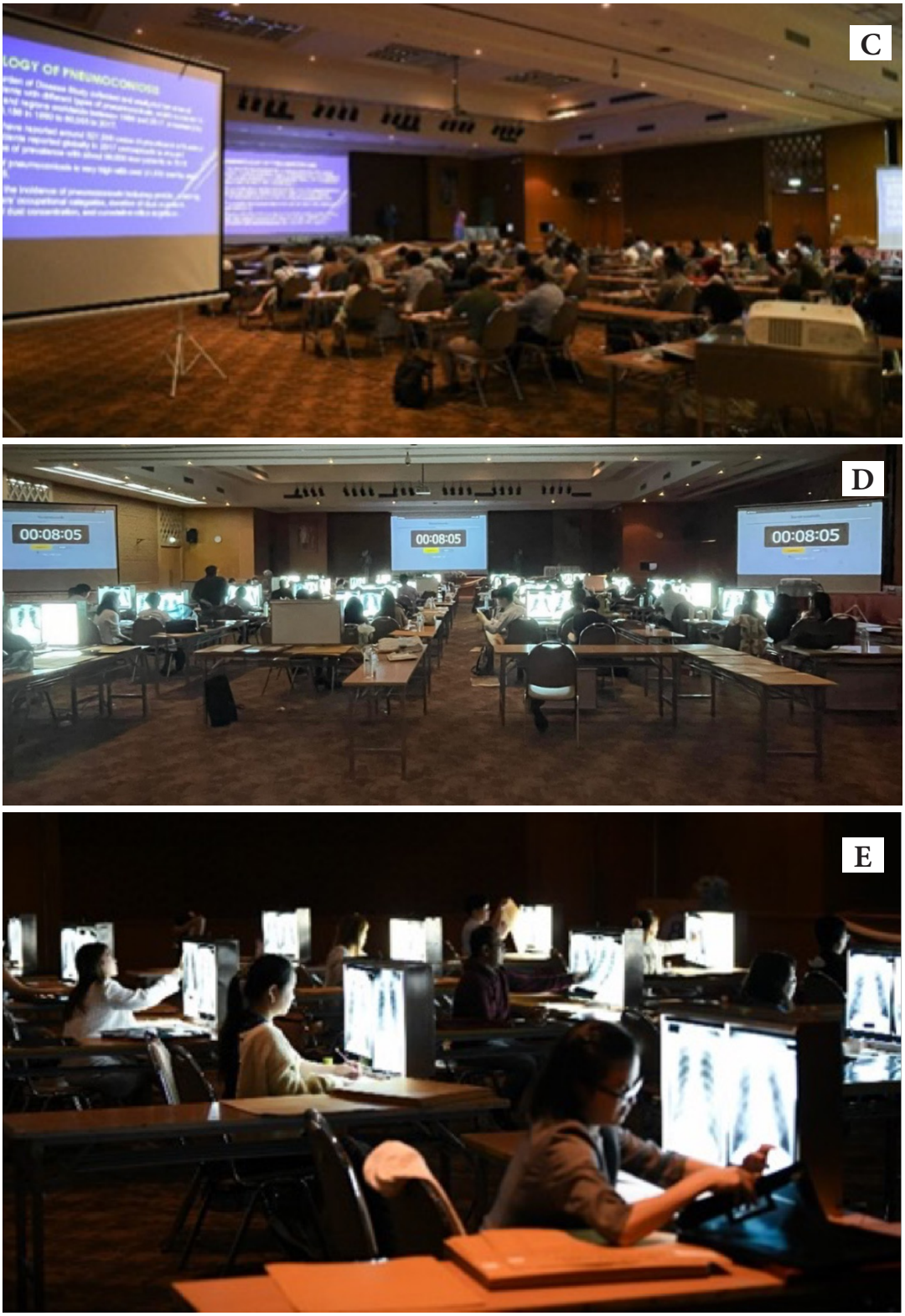
2. In 2018, we expanded the training and examination program to Indonesia for the first time. The workshop was held at Universitas Indonesia-Persahabatan Hospital, and later extended to Universitas Indonesia-Depok Hospital, in collaboration with the Indonesian Society of Respirology (ISR) and the Indonesian Occupational Medicine Association (IOMA). Several more training and evaluation sessions were organized in Indonesia afterward.

3. In 2019, we expanded the training and evaluation program to Vietnam for the first time, held from September 16th -19th.

By the end of 2020, before the training programs were paused due to the COVID-19 pandemic, the AIR Pneumo project had successfully conducted 26 training and evaluation sessions in various countries, including India, the Philippines, Vietnam, Indonesia, Brazil, Japan, and Thailand. Thailand has undertaken the AIR Pneumo training program for the 7th time, while Indonesia hosted it for the 6th time in 2023.

Collaboration with the NIOSH, U.S.

To maintain the standards for NIOSH B Readers in Thailand, the CCIT, through its Radiology Department, with support from the Department of Disease Control and ILO, has been coordinating with NIOSH, U.S., to organize continuous NIOSH B Reader trainings and certification examinations in Thailand since 2004. Currently, the CCIT is the only primary institution in Thailand that conducts assessments and renewals for NIOSH B Reader experts. The most recent certification was held in 2019, marking the fourth session of this evaluation.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AIR Pneumo Training Workshop:
(A) the instructors and trainees of the 6th Workshop, held at the CCIT, Thailand on 19th-21stDecember 2018,
(B) the 5th Indonesian Workshop, held at the Persahabatan Hospital, Jakarta. on 29th-31st January 2023,
(C) the 7th Workshop in Thailand, held at the CCIT on 6th-8th December 2023,
(D) the atmosphere in the room during the practical training session at the CCIT, Thailand,
(E) the atmosphere in the examination room for certifying experts in the AIR Pneumo program in Thailand,
(F) the instructors and trainees of the 7th Workshop in Thailand.

The Achievements in Terms of Both Quantity and Quality:

I. AIR Pneumo Training and Examination

a. **Course Content: Asian Intensive Reading of Radiographs of Pneumoconiosis according to ILO Classification**

1. Pneumoconiosis in Thailand
   Reference documents [6,7]
   - Medical and Health Data Repository, Ministry of Public Health of Thailand
   - Data Center, Department of Industrial Works, Ministry of Industry of Thailand
2. Introduction to ILO Classification of Radiographs of Pneumoconiosis and AIR Pneumo Training Project.
   - Overview of ILO Classification and AIR Pneumo Project
3. Basic Principles and Quality in Chest Radiography
   - Understanding the basic principles behind chest radiography and grading the quality of the images.
4. Review of ILO Standard Radiographs & Recording in the Reading Sheet
   - In-depth examination of the ILO's standard radiographs and proper documentation of readings.
5. Review of Additional Symbols
   - Understanding additional symbols used in the interpretation of radiographs.
6. Review of Pleura Abnormalities
   - Interpretation of pleural abnormalities visible in radiographs.
7. Review of Small Rounded and Irregular Opacities
   - Interpretation of small opacities and irregular patterns within the lung tissue.
8. Review of Large Opacities
   - Review and understanding of large opacities found in chest radiographs.

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9. Self-Practice of X-Ray Film Reading and Recording Results (30 Films)
   - Participants will practice reading 30 radiographs within 90 minutes (3 minutes per film). This will help trainees build confidence and skill in reading pneumoconiosis films according to ILO standards and systematically recording the results on a form.
   - The session will involve providing answers, reviewing results, and resolving questions with the assistance of the instructors.

     Reference materials for practice:
     - "ILO Classification of Radiographs of Pneumoconiosis Handbook (Revised Edition, 2000)" [Certified Translation]
     - Guidelines for the Use of the ILO International Classification of Radiographs of Pneumoconioses (Revised Edition 2011)
     - Guidelines for the Use of the ILO International Classification of Radiographs of Pneumoconioses (Revised Edition 2022)

b. Certification of Experts Through the ILO Classification Radiograph Evaluation

To establish a standard for interpreting radiographs of pneumoconiosis, the AIR Pneumo Committee organizes practical exams based on the ILO Classification. These exams are managed and supervised by a committee from Japan.

c. AIR Pneumo Expert Certification

It is certified by the Chair of the AIR Pneumo Committee.

d. Eligibility for Examination:

1. Specialists in AIR Pneumo seeking a certification renewal
2. Radiologists, pulmonologists, and occupational medicine specialists who have completed the AIR Pneumo training program

e. Examination:

- **Number of Films for Evaluation:** 60 films in 3 hours [8,9].
- **Answer Sheets:** These will be sent for evaluation, and AIR Pneumo Japan will return the results.

f. Grading:

- **New Candidates:** Must achieve at least 60% to be awarded the AIR Pneumo Expert Certification (Asian Intensive Reader of Pneumoconiosis). The certification is valid for 4 years (extended to 5 years starting in 2018).
- **Renewal Candidates:** Must score at least 80% to maintain their status as an AIR Pneumo expert.


AIR Pneumo

No. 1-01
Date. 20.12.2008
Expiry. 31.12.2013

CERTIFICATION

This is to certify that

Taro Tamura, M.D.

has successfully completed AIR Pneumo Training Course and examination confirming competence on the application of the ILO 2000 International Classification of Radiographs of Pneumoconioses.

Chair, AIR Pneumo Committee
Research Groups, Japan Society for Occupational Health
Association of Occupational and Environmental Diseases, Thailand
Chest Disease Institute, Ministry of Public Health, Thailand
Bureau of Occupational and Environmental Diseases, Ministry of Public Health, Thailand

The Asian Intensive Reader of Pneumoconiosis Project (AIR Pneumo) has been established with an aim to upgrade skills of specialists in developing countries on the application of the ILO International Classification of Radiographs of Pneumoconioses and to contribute to the implementation of the ILO/WHO Global Program for Elimination of Silicosis (GPES).

Certificate of Expertise in AIR Pneumo on interpretation of pneumoconiosis chest x-rays according to the ILO standards in the Asian region.

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Table 1. *The number of new trainees who passed the evaluation examination per evaluation. session (n= 265 participants).*

Time/Year	Thais	Others	Total
1st /2008	23/24 (96%)	4/5 (80%)	27/29 (93%)
2nd /2010	20/21 (95%)	2/3 (67%)	22/24 (92%)
3rd /2012	13/14 (93%)	3/3 (100%)	16/17 (94%)
4th /2014	22/24 (92%)	7/9 (78%)	29/33 (88%)
5th /2016	19/21 (91%)	12/13 (92%)	31/34 (91%)
6th /2018	22/22 (100%)	26/37 (70%)	48/59 (81%)
7th /2023	59/62 (95%)	6/7 (86%)	66/69 (96%)
Total	**178/188 (95%)**	**60/77 (78%)**	**238/265 (90%)**

The CCIT has organized training sessions to enhance the knowledge of doctors working with occupational lung diseases, enabling them to accurately interpret chest X-rays of occupational lung diseases according to the ILO classification. Until 2023, the Institute has conducted expert evaluation exams in Thailand 7 times, with 265 doctors participating in the trainings and 238 individuals successfully passed the evaluation exams to become certified experts, resulting in a pass rate of 90%. The certification is endorsed by the chairperson of the AIR Pneumo Committee (Asian ILO) in Japan. The training and evaluation involved both local and international experts, fostering the exchange of opinions, knowledge, and experiences. The number of new trainees and those who passed the examination is demonstrated in Table 1. Regarding others, the number of new trainees from countries in Asia and Africa was 77. The details were shown in Table 2.

Table 2. *The number of new trainees from various Asian countries per evaluation session (n=77 participants).*

Year	2008 1st	2010 2nd	2012 3rd	2014 4th	2016 5th	2018 6th	2023 7th	Total
Japan	2	1	-	-	-	-	-	3
China	1	-	1	-	-	-	-	2
Republic of Congo	1	-	-	-	-	-	-	1
India	-	1	-	-	1	7	-	9
Hong Kong	-	-	1	-	1	-	-	2
Pakistan	-	-	1	-	-	-	-	1
Taiwan	-	-	-	-	-	3	-	3
Mongolia	-	-	-	-	-	-	-	2*
Bhutan	-	-	-	-	1	-	-	1
Indonesia	-	-	-	5	7	17	1	30
Malaysia	-	-	-	-	2	9	3	14
Philippines	-	-	-	1	1	-	-	2
Vietnam	1	1	-	-	-	-	-	2
Cambodia	-	-	-	2	-	1	-	3
Laos	-	-	-	-	-	-	-	1
Brunei	-	-	-	1	-	-	-	1
Total	**5**	**3**	**3**	**9**	**13**	**37**	**7**	**77**

**no data of time to participate*

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In cooperation with the AIR Pneumo Committee, for the development of experts in interpreting pneumoconiosis chest X-rays according to the standards of the ILO in the ASEAN region. The Institute has supported training programs in various countries, including the Philippines, Indonesia, and Vietnam. A total of 289 individuals participated in the trainings, and 211 individuals successfully passed the evaluation and received the AIR Pneumo expert certification, resulting in a pass rate of 73% (Table 3).

Table 3. *The number of new trainees who passed the evaluation examination held in ASEAN countries (n=289 participants).*

Month/Year	Country	City	Passed/Participant (Individual)(%)
07/2016	Philippines	Manila	20/21 (95%)
02/2018	Indonesia	Jakarta	34/40 (85%)
02/2019	Indonesia	Jakarta	34/43 (79%)
08/2019	Indonesia	Jakarta	20/36 (56%)
09/2019	Vietnam	Hanoi	38/55 (69%)
02/2020	Indonesia	Jakarta	32/39 (82%)
01/2023	Indonesia	Jakarta	14/26 (19%)
10/2023	Indonesia	Jakarta	19/29 (66%)
Total			**211/289 (73%)**

II. NIOSH B Reader Examination in Thailand

The CCIT, in collaboration with the NIOSH of the U.S., has organized the NIOSH B Reader certification examination in Thailand to maintain the standard of experts, trainers, and consultants in Thailand and the ASEAN region at an international level every four years since 2004, totaling four times. Currently, there are 16 NIOSH B Readers in the ASEAN region, with 15 from Thailand and 1 from Indonesia. As of May 25th, 2022, there are 88 international NIOSH B Readers worldwide.

The pass rate for new exam takers is 27%, with 21 out of 79 new exam takers passing. The pass rate for re-examinees is 67%, with 26 out of 39 re-examinees passing. The overall pass rate is 43%, with 59 successful attempts out of 137 total attempts (Table 4).

Table 4. *The number of participants who took the NIOSH B Reader expert evaluation examination in ASEAN Countries from 2004 to present (n=137 sessions).*

Time/year	Passed/Participants		Total
	Thais	Others	
1st /2004	9/20 (45%)	-	9/20 (45%)
2nd /2011			12/19 (63%)*
3rd /2015	20/26 (77%)	2/5 (40%)	22/41 (54%)
new examinees	6/17 (35%)	1/4 (25%)	7/21 (33%)
re-examinees	14/19 (74%)	1/1 (100%)	15/20 (75%)
4th /2019	15/24 (63%)	1/33 (3%)	16/57 (28%)
new examinees	4/ 7 (57%)	1/31(8%)	5/38 (13%)
re-examinees	11/17 (65%)	0/2 (0%)	11/19 (58%)
**no data to classify new examinee or re-examinee*			
Total: new examinees	**19/44 (43%)**	**2/35(6%)**	**21/79 (27%)**
Total: re-examinees	**25/36 (69%)**	**1/3 (33%)**	**26/39 (67%)**
		Total	**59/137 (43%)**

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All achievements were initiated by the quality assurance of the AIR Pneumo course, including all selected films that have already been published [3, 8, 9, 10, 11, 12].

Challenges and Future Trends

Currently, traditional film-based X-rays are being phased out and replaced by digital imaging systems for interpreting chest X-ray images. The transition from film to digital technology requires careful preparation in several areas, including resources, equipment, digital image examples for training and examinations, and personnel who are experts in the technology. Ensuring that the system meets the standards and remains effective is a challenge for AIR Pneumo, as it strives to update its training and examination systems in line with current technological advancements.

The NIOSH B Reader Program has now updated its training and examination system from the film-based method for interpretating pneumoconiosis to a digital image-based approach. The most recent examination in Thailand was successful when conducted on 17th-20th December, 2024 (the official exam results have not yet been announced). However, due to work station limitations, the program could not accommodate all interested candidates or those needing certifications as experts.

This situation requires us to acknowledge and address the need for improvement in the training and examination systems for AIR Pneumo in the future. It poses a challenge, requiring careful preparation and potentially the redesign of training and examination systems to keep pace with the rapidly changing technologies.

Acknowledgments

The AIR Pneumo project consumed a lot of work, research, and education. Still, its training and examination programs would not have been possible without support from many individuals and organizations. Therefore, we would like to extend our sincere gratitude to all of them, but the list here is not exhaustive. First of all, we are grateful to Yukinori Kusaka (Emeritus Professor, University of Fukui, Japan; Former Chair and founder of AIR Pneumo Project, Professor Narufumi Suganuma (Kochi University, Japan; Present Chair), Dr. Igor Fedotov, and our friends from many countries as list below:

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Second, we would like to express our sincere gratitude towards volunteer experts who devoted their time and knowledge in the training programs as lecturers. Finally, we would like to thank all the participants of the AIR Pneumo training and examination programs.

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Memorial

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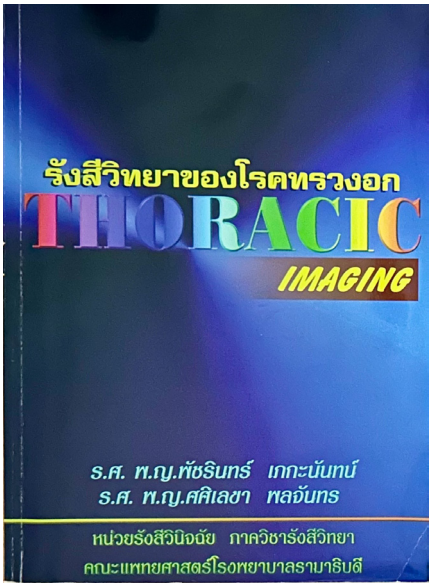
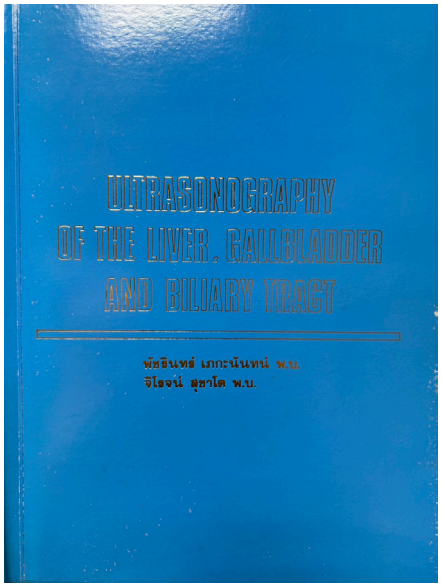
Emeritus Clinical Professor Patchrin Pekanan, 1950-2025.

On January 9, 2025, Emeritus Clinical Professor Patchrin Pekanan, the first author of the first article in the first issue of The ASEAN Journal of Radiology, passed away at the age of 74 years. She was born on June 14, 1951 and graduated from the Faculty of Medicine Ramathibodi Hospital, Mahidol University in Bangkok, Thailand.

As an instructor in Department of Radiology, the Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Dr. Patchrin Pekanan is remembered by her colleagues, both radiologistss and radiographers as a dedicated professional who was always ready and available. She skilfully practiced different modalities, including ultrasonography, fluoroscopy, CT, MRI, and angiography, across a wide range of systems such as abdominal, urogenital, neuro, and thoracic systems, stepping in whenever there was a shortage of radiologists.





The book on thoracic imaging co-edited by Professor Patchrin Pekanan and the book on hepatobiliary ultrasound co-authored by her, among others.

As a consultant for caring physician, Professor Patchrin Pekanan is remembered as an enthusiastic radiologist. She provided valuable insights during weekly clinical-radiological conferences, offering expert advice on neurological, abdominal, and urogenital systems.

To her junior radiologists and assistants, Dr. Patchrin is remembered as a very reliable senior in both personal and professional aspects.

As a teacher, Professor Patchrin Pekanan is remembered by her residents as a kind and considerate mentor. She led a daily conference every morning to supervise her students in a group setting in addition to providing one-by-one and face-to-face guidance during routine services.

To her teachers, Dr. Patchrin constantly expressed her gratitude through her actions. When her department held a retirement meeting to honor Professor Tavi Boonchoti, a chest radiologist who was her teacher and the former head of the department, she coordinated the publication of a 381-page book, which was presented in the meeting.

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To the Radiological Society of Thailand, Professor Patchrin is remembered as a practical and active member. When the executive committee decided to transform the "Thai Journal of Radiology", the society's official journal in Thai language, to be the English version titled "The ASEAN Journal of Radiology", her work was featured on the first page of the first inaugural issue of the first volume.

To her nephew and two nieces, the very much beloved Aunty Patchrin is remembered as a very supportive and amicable relative.

Ms. Patchrin Pekanan is remembered by her class mates in medical school as a cheerful and beautiful lady who had never shown any sign of worries, disappointment or anger on her face.

To others she associated with along her journey, Dr. Patchrin is remembered as a lively and positive lady. She loved flowers and almost always appeared in colorful dresses. She loved playing tennis even in her very last period of life.

Krisna Dissaneevate, M.D.
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Wiwatana Tanomkiat, M.D.
President, Radiological Society of Thailand (RST)

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Acknowledgement of Reviewers

Reviewer acknowledgement, 2024

Wiwatana Tanomkiat, M.D.

Editor-in-Chief
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