



Effectiveness of CT Scan Thorax Parameters in Diagnosing Pulmonary Tuberculosis at the Radiology Department of Siti Rahmah Islamic Hospital Padang

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ABSTRACT

A chest CT scan is an imaging modality used for early detection of suspected abnormalities in the thoracic region, complementing conventional chest radiography. CT produces cross-sectional images that support pathological investigation and evaluation of previous diagnoses. Standard chest CT protocols generally cover the area from the lung apex to the costophrenic sinuses, with a slice thickness of 2.5 mm, soft tissue window width of 350 and level of 50, and lung window width of 1500 and level of -700. However, at the Radiology Department of RSI Siti Rahmah Padang, the scan area extends from the 5th cervical vertebra (C5) to 2 inches (5 cm) inferior to the xiphoid process, using a slice thickness of 5–10 mm. The mediastinum window is set at width 400 and level 40, while the lung window ranges from width 1500–1800 and level -200 to -300. This study aimed to determine the effectiveness of these CT parameters in the clinical management of pulmonary tuberculosis (TB). Conducted in June 2025, the research used a descriptive qualitative design with two radiology specialists as informants. Data were collected through literature review, observation, interviews, and documentation, and analyzed comparatively by aligning field findings with theoretical references through data reduction, presentation, and conclusion drawing. Results showed that the scan range from C5 to 5 cm below the xiphoid process provides adequate thoracic visualization in pulmonary TB cases, ensuring full depiction of the apical region and lung parenchyma, although extension to the suprarenal area is recommended. A 5 mm slice thickness effectively supports multiplanar reconstruction and lesion distribution analysis. The mediastinum and lung window settings enhance visualization of fibrotic areas and parenchymal abnormalities, confirming the effectiveness of these parameters in diagnosing pulmonary TB.

Keywords: Chest CT Scan, Slice Thickness, Scan Area, Window Setting.

INTRODUCTION

Diagnostic radiology is a branch of medicine that uses various imaging modalities to help diagnose diseases, monitor disease progression, and evaluate treatment outcomes. The main modalities include conventional radiography (X-



ray), CT scan, MRI, ultrasound (USG), fluoroscopy, and nuclear medicine (Caesar, 2025).

Pulmonary tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, which primarily attacks lung tissue and is transmitted through airborne droplets when the patient coughs, sneezes, or talks, causing symptoms such as chronic cough lasting more than two weeks, hemoptysis, fever, night sweats, weight loss, and shortness of breath. To date, Indonesia remains one of the countries with the highest TB burden in the world, ranking second after India, with an estimated 1.09 million TB cases per year. In 2024–2025, the Ministry of Health of the Republic of Indonesia reported that more than 880,000 TB cases had been detected, with several provinces on the islands of Java, North Sumatra, and South Sulawesi as the provinces with the highest number of cases, indicating that pulmonary TB remains a major public health issue and a significant challenge in the national TB elimination program (WHO, 2026).

A chest CT scan plays an important role in establishing a diagnosis of pulmonary tuberculosis because it can detect lung abnormalities more sensitively and specifically than chest X-rays, especially in cases of atypical tuberculosis, smear-negative tuberculosis, tuberculosis in immunocompromised patients, and for assessing the extent and activity of the disease. CT scans can identify characteristic findings such as segmental consolidation, centrilobular nodules and tree-in-bud patterns, cavities, mediastinal lymphadenopathy, and pleural thickening, thereby helping to distinguish between active and inactive TB, detect complications, and evaluate treatment response; Recent studies and systematic reviews indicate that CT scans, including low-dose CT, have high sensitivity and specificity in detecting pulmonary TB and are highly beneficial as a follow-up examination when chest X-ray and bacteriological examination results are inconclusive (Naseer, 2025).

According to Romans (2011), the technique for performing a chest CT scan in patients with pulmonary TB begins with the apex of the lung to the costophrenic sinus with the patient in a feet-first, supine position on the examination table

with both arms raised above the head so as not to interfere with the thoracic area. The scan is performed while the patient is inhaling. A slice thickness of 2.5 mm is used to obtain images with good image quality, with window settings for soft tissue window width 350 and window level 50, while for lung window width 1500 and window level -700, voltage 120 kV, and current strength 100 mA.

According to Ardina et al. (2025) in their study entitled "Evaluation of Non-Contrast Chest CT Scan Examination with Clinical Pulmonary Tuberculosis at the Radiology Installation of Al Ihsan Provincial Hospital, West Java," it is explained that in a chest CT scan examination with clinical pulmonary TB, the patient is positioned supine on the examination table with their feet first. The scan area starts from the lung apex to the diaphragm, and the raw data reconstruction is axial 1 mm with a mediastinum window and lung window. The parameters

used were window width 1500 HU, window level -500 HU, slice thickness 0.75 mm, FOV 512 mm, kVp 100, mA 130, and gantry tilt none. For the imaging results, 30 images were printed, where the imaging results were reconstructions with a slice thickness of 3 mm without any parts of the object showing abnormalities being cut off, namely: Topogram, 10 axial window mediastinum sections at a window width of 400 HU and a window level of 40 HU, 10 coronal lung window sections with a window width of 1200 HU and a window level of -599 HU, 10 sagittal lung window sections with a window width of 1200 HU and a window level of -599 HU.

At the RSI Siti Rahmah Padang radiology facility, no special preparations were made for patients undergoing chest CT scans for pulmonary tuberculosis prior to the examination. Patients were asked to change into special examination gowns and remove any metal/iron objects. The patient was then positioned supine on the examination table with the head first. The scan was performed while the patient was fully inspired and holding their breath. The scan area ranged from C5 to 2 inches or 5 cm inferior to the xypoides process using the mediastinum window and lung window. For the mediastinum window for axial sections, a slice thickness of 5-10 mm is used with the upper limit at the sternal notch (lung apex not cut) and the lower limit at the supra-renal. For coronal sections, a slice thickness of 5 mm is used, with slices parallel to the mid-axillary line (MAL) of the body. If there is a mediastinal tumor, an additional sagittal section is made, with a window width of 400 and a window level of 40. For the lung window, axial sections use a slice thickness of 5-10 mm with the upper limit at the sternal notch (lung apex not cut) and the lower limit at the end of the costophrenic sinus. For coronal sections, a slice thickness of 5 mm is used, and a sagittal thickness of 5 mm is used if necessary as an additional section. For the window settings, the window width is 1500 to 1800 and the window level is -200 to -300. The film format is 5x5/5x6, with the image enlarged (zoomed) optimally. Based on these differences, it is necessary to conduct research on the Effectiveness of Thoracic CT Scan Examination Parameters with Clinical Pulmonary TB at the Radiology Department of Siti Rahmah Islamic Hospital in Padang in 2025.

METHOD

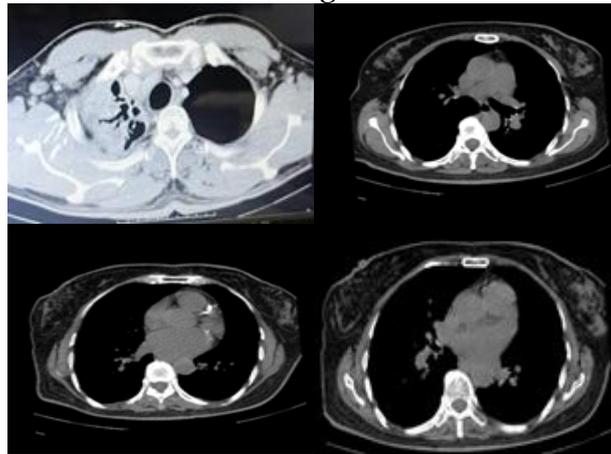
This type of qualitative research with descriptive methods. conducted in the radiology installation of RSI Siti Rahmah Padang in June 2025 regarding chest CT scans in patients with clinical tuberculosis using a scan area starting from cervical 5 to 2 inches or 5 cm inferior to the xypoides process with a slice thickness of 5-10 mm for the mediastinum window, which is a window width of 400 and a window level of 40, and the lung window with a window width of 1500 to 1800 and a window level of -200 to -300. The researcher then reconstructed the scan area starting from the lung apex to the costophrenic sinus, with a slice thickness of 2.5 mm, and window settings for soft tissue with a window width of 350 and a window level of 50. while for the lung window, the width is 1500 and the level is -700. The interview method is structured by using an interview guide where all questions are the same for all research informants. Data processing uses

the data triangulation method to obtain data validity, namely by combining various data with existing sources, data analysis is carried out when data collection takes place interactively.

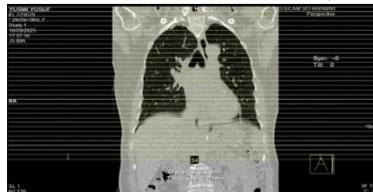
RESULTS

A non-contrast chest CT scan was performed for clinical pulmonary tuberculosis on Wednesday, June 17, 2025, on a patient named Mrs. Y., aged 65, at the Radiology Department of RSI.Siti Rahmah Padang.

Here are the results of the axial slice images



Coronal Iris Topogram with Window Width 1500, Window Level -200



Coronal CT-Scan image of the thorax with lung window (WW 1500, WL -200) in a patient with suspected pulmonary tuberculosis at the Radiology Department of Siti Rahmah Islamic Hospital in Padang. The examination was performed with a slice thickness of 5 mm. The lung window is used to highlight the details of the lung parenchyma, bronchi, and areas of infiltrative lesions or cavities that may indicate an active infectious process.

Table 1. Results of Interviews with Radiology Specialists

No	Question	Informant 1's Answer	Informant 2's Answer	Conclusion
1	Purpose of Chest CT Scan Examination in Patients with Suspected or Clinically	For early detection of pulmonary TB lesions by assessing the extent and distribution of	To help detect lesions and assess how extensive they are	For early detection of pulmonary TB lesions by assessing the extent and distribution of pulmonary lesions and helping to assess the number of cavities,

No	Question	Informant 1's Answer	Informant 2's Answer	Conclusion
	Diagnosed Pulmonary TB	pulmonary lesions and helping to assess the number of cavities, nodules, infiltrates, or consolidations.		nodules, infiltrates, or consolidations and the extent of lesion spread.
2	What are the important aspects assessed in a chest CT scan in patients with suspected or diagnosed pulmonary TB?	number of cavities, nodules, infiltrates, or consolidations	Lung parenchyma pattern and lesion spread	number of cavities, nodules, infiltrates, or consolidations, pattern of lung parenchyma, and extent of lesion spread
3	Is the use of the area from C5 to the xyphoid process sufficient for a chest CT scan in patients with suspected or diagnosed pulmonary TB?	That is sufficient because the apical part is not cut and all of the lung parenchyma is visible, although it should be extended to supra renal.	It is sufficient to show the overall picture and evaluate TB.	The use of a wide field from C5 to the xyphoid process is sufficient for a chest CT scan in patients with suspected or diagnosed pulmonary TB.
4	Does the use of 5 mm slice thickness enable clear visualization of axial, sagittal, and coronal sections on chest CT scans in clinical pulmonary TB?	With a slice thickness of 5 mm, it can show a smaller diagnostic image.	Can show more detailed and clear results	The use of a 5 mm slice thickness clearly shows axial, sagittal, and coronal sections on chest CT scans with clinical pulmonary TB.
5	What sections are used in a chest CT scan examination	Axial coronal and sagittal, and at a minimum,	Axial coronal and sagittal	Axial coronal and sagittal

No	Question	Informant 1's Answer	Informant 2's Answer	Conclusion
	of patients with suspected or diagnosed pulmonary TB?	axial sections must be used for printing.		
6	Do the Use of Window Width and Window Level Provide a Good Image of the Chest CT? untuk Evaluasi Klinis TB Paru?	The use of lung window can show a clear image of the lungs.	That's enough because the mediastinal window can show fibrosis and the lung window can show a clearer picture of the lungs.	The use of Window Width and Window Level can provide a good CT Thorax image for clinical evaluation of pulmonary TB.

DISCUSSION

According to the WHO (2021), this examination aims to detect lesions that are not visible on X-rays and to evaluate the extent and severity of lung lesions. Meanwhile, at the RSI Siti Rahmah Padang radiology facility, it is used to detect nodules, tumors, or masses in the lungs, diagnose lung infections (such as pneumonia and tuberculosis), assess pulmonary fibrosis, emphysema, or bronchiectasis, and detect pulmonary embolism (blood clots in the lungs). The use of chest CT scans is not only intended to detect nodules, tumors, or masses in the lungs, but also to confirm the diagnosis of lung infections such as pneumonia and tuberculosis, assess the presence of fibrosis, emphysema, or bronchiectasis, and detect pulmonary embolism. With a slice thickness of 5 mm, smaller and clearer diagnostic images can be obtained, enabling the identification of small abnormalities in lung tissue and providing sharper and more informative details of lung structure.

The scan area used starts from the C5 cervical vertebra to approximately 2 inches (± 5 cm) below the xiphoid process. This area is selected to cover the entire lung, from the apex to the base, so that all lung structures can be clearly seen on the CT scan images. The scanning area used is adjusted to the patient's anatomical conditions and clinical needs in order to obtain an optimal image for establishing a diagnosis of pulmonary tuberculosis. This area is considered sufficient to show the entire lung parenchyma without any parts being cut off, although ideally the area could be slightly extended to reach the supra-renal area to ensure more complete coverage.

The window settings used for the mediastinum are window width 400, window level 40, and window lung (lung) is window width 1500 to 1800 and window level -200 to -300. These settings are chosen to clearly display differences in tissue density, both in the mediastinum and lung tissue, thereby facilitating

the detection of abnormalities and pathologies associated with pulmonary TB cases. The use of two types of windows, mediastinum and lung, has different diagnostic functions but complements each other. The combination of these two windows can reveal abnormalities and pathologies that appear in chest CT scans with clinical pulmonary TB. The mediastinum window is used to assess soft tissue structures around the lungs, such as large blood vessels, the heart, and mediastinal lymph nodes, which often enlarge in pulmonary TB cases. Meanwhile, the lung window is used to display lung tissue in detail, including areas of infiltration, cavities, and fibrosis, which are characteristic of tuberculosis infection. The application of mediastinum window settings (WW 400, WL 40) and lung window settings (WW 1500-1800, WL -200 to -300) at RSI Siti Rahmah Padang is appropriate for obtaining good diagnostic image quality. These settings allow for optimal visualization of both mediastinal structures and lung tissue, enabling the detection of abnormalities such as fibrosis, infiltrates, and cavities, which are characteristic indicators of pulmonary tuberculosis.

CONCLUSION

The use of 5 mm slice thickness in chest CT scans for clinical pulmonary TB at RSI Siti Rahmah Padang provides more detailed and accurate images. This thin slice thickness enables clear visualization of lung structures in axial, sagittal, and coronal sections, aiding in the detection of small lesions and comprehensive assessment of disease severity. The scan area from C5 to approximately 2 inches below the xiphoid process is considered optimal for displaying the entire lung without any sections being cut off. This setting allows complete visualization from the apex to the base of the lungs, without requiring special preparation for the patient, making the examination efficient and accurate for the diagnosis of pulmonary TB. The mediastinum window setting (WW 400, WL 40) and lung window setting (WW 1500-1800, WL -200 to -300) are able to clearly display abnormalities in the lung and mediastinum tissues. The combination of these two windows provides a complete picture of lung conditions, including fibrosis, infiltrates, and cavities, making it highly useful for comprehensive evaluation and diagnosis of pulmonary TB.

RECOMMENDATIONS

For chest CT scans in patients with clinical pulmonary TB, it is recommended to use a slice thickness of 1 mm for each axial, sagittal, and coronal section, with the scan area starting from C5 to 2 inches inferior to the xypoides process and window settings using lung and mediastinum windows to obtain a more detailed and clear clinical picture, such as the visible anatomy of the diaphragm and the right and left lobes. When using the scan area, it is advisable to extend it to the supra-renal region to achieve optimal results, such as the anatomy of the diaphragm, right and left lobes.

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