CASE REPORT

Lung Abscess Located in Lesion of Lung Tumor and Multiple Cavities due to Pulmonary Tuberculosis: A Case Report

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ABSTRACT

Introduction: People with tuberculosis (TB) have an increased risk of pulmonary cancer. They are also disproportionately affected by risk factors like immune suppression, smoking, and alcohol misuse. A lung tumor is reported to have occurred after an episode of TB, but we reported a patient with a lung tumor with co-infection TB and lung abscess at the same time.

Case: A 73-year-old man was hospitalized at Arifin Achmad General Hospital, Pekanbaru, with a 3-day history of bloody cough 2-3 times a day, 1-2 tablespoons estimated by the patient for blood from the cough. The patient had a cough with white phlegm in the last 4 months before the bloody cough. The patient also had a fever, night sweats, a limp body, decreased appetite for 6 months, and decreased body weight by 15 kg in the last year. Heterogenic consolidation on the superior lobe of the lung with prominence compression and irregular boundaries in the apex was found. We found an air bronchogram and multiple cavities with air-fluid levels inside the lesion. We also found a satellite nodule in the inferior lung and a mass connected with the chest wall. GeneXpert showed low detection for *Mycobacterium tuberculosis*. The patient was diagnosed with a left lung abscess, pulmonary TB, left lung tumor T4N2M1a, unspecified type of tumor stage IVA PS2, and osteoporosis.

Conclusion: Lung tumors could also be diagnosed with co-infection TB. Proper diagnosis to make sure cancer and TB are co-infected is necessary. Therefore, it will not be just a single disease that is treated.

INTRODUCTION

Lung cancer (LC) is a common cause of death after breast cancer by 15.9% in Indonesia.[1] Mortality will significantly be increased at later stages of diagnosis by 52.5% for a 5-year survival rate.[2] Pulmonary tuberculosis (PTB) is an infection by *Mycobacterium tuberculosis* (M. tb) transmitted by droplets.[3] PTB incidence in Indonesia fell in 2020 because of the COVID-19 pandemic and increased in 2021 to a total incidence of 969,000.[4,5] PTB cases are still problematic in Indonesia, which is the second highest burden country with PTB incidence globally.[5] Not just being the highest-burden country, PTB is another challenge when clinicians need to rule out cancer in patients.[2] Misdiagnosing in this scenario would worsen patient prognostic due to wrong treatment. A meta-analysis by Luczynski, *et al*. (2022) showed that people with TB have an increased risk for pulmonary cancer (SIR 3.20, 95%CI 2.21-4.63, I^2 = 90%).[6] A study showed that LC occurred after an episode of TB.[7] Ho, *et al*. (2021) showed secondary LC in 761 (10.97%) patients with TB, while Oh, *et al*. (2020) showed that the hazard ratio of LC among patients with PTB was 3.24.[8,9] Patients with a history of PTB could have a risk for LC. A previous study demonstrated that TB might increase primary LC risk by two-fold for more than 20 years after TB

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diagnosis.[10,11] Clinicians often underestimate the differentiation between LC and PTB because of the different etiology in that LC is unknown, and PTB is caused by M. tb. A sputum examination is needed to determine the cause of the patient's condition. However, there are similarities in clinical and imaging features between both diseases. It is also possible that LC would be co-infected with PTB. It is challenging to determine whether a patient has LC, PTB, or LC with PTB at the same time. We reported a case of co-infection TB with LC and lung abscess that was tricky to identify and treat.

CASE

A 73-year-old man was hospitalized at Arifin Achmad General Hospital, Pekanbaru, with a three-day history of bloody cough 2-3 times a day, 1-2 tablespoons estimated by the patient. The patient was coughing with white phlegm for four months before the bloody cough. The patient had a history of shortness of breath three months before hospitalization. Shortness of breath came with cough and was not provoked by dust, weather, or food. The patient also had a fever, night sweats, a limp body, decreased appetite for six months and decreased body weight by 15 kg in the last year. The patient also felt epigastric pain and back pain in the last year. In addition, the patient also appeared to be treated with delirium awareness without complaints of severe headaches or seizures. This condition has been experienced in the last month. There was no history of asthma, cardiorespiratory disease, or malignancy. The patient had no history of medication or a family history of the disease with the same complaint. The patient worked as a gardener. The patient had 20 years of environmental exposure to herbicides. The patient has been smoking for 50 years, with 32 cigarettes every day (severe Brinkman Index).

Physical examination showed oxygen saturation by 98% with nasal cannula 4 liters/minute, weight 60 kg (was 75 kg last year) and height 170cm (normal body mass index/BMI). Chest examination showed that the left chest lagged during exhalation, decreased focal fremitus in the left lung, and dull percussion on the left lung. Auscultation of the lung showed decreased vesicular sound on the left lung and rookie on both fields. The only oncological emergency found was a bloody cough. The patient did a chest X-ray examination (Figure 1) with the impression of an inhomogeneous consolidation accompanied by cavitation, fibrosis, and calcification, which was suspected of a mass with PTB infection. Then, the patient continued with a chest computed tomography (CT) scan with contrast. A chest CT scan was performed (Figure 2) and found heterogeneous consolidation on the superior lobe of the lung with prominence compression and irregular boundaries in the apex. We found an air bronchogram and multiple cavities with air-fluid levels inside the lesion. The presence of an air-fluid level picture indicates that a lung abscess has been found within the lesion of the mass. We also found a satellite nodule in the inferior lung and a mass connected with the chest wall. Paratracheal lymphadenopathy was found on the left side, fibrotic and paraseptal emphysema at the superior right lung, and compression fracture at VI-VII thoracal vertebrae with sclerotic endplate. The radiological conclusion was left lung mass suggestive of malignancy T4N2M1a, contralateral pulmonary metastasis, paratracheal lymphadenopathy on left side, fibrotic and paraseptal emphysema at superior lobe with calcification at right lung base, compression fractures of VI-VII thoracal vertebrae with sclerotic endplate suggestive for degenerative reason, and calcification was seen in the right lobe of the liver. After the results of a thoracic CT scan found a malignancy, the patient performed a head CT scan with contrast to determine whether the delirium was the result of metastasis or not. The results of the head CT scan did not show pathological hypodense and hyperdense lesions in the brain parenchyma, with the conclusion that no intracranial metastases were seen. The patient then underwent diagnostics with sputum cytology, transthoracic needle aspiration (TTNA), and CT-guided core biopsy for diagnostic confirmation of LC. After that, the patient was also scheduled for a bronchoscopy, but as the patient's performance status was not supportive, the bronchoscopy was postponed.

The results of anatomic pathology on sputum cytology examination had negative results for malignant tumor cells. Then, the results of the core biopsy and TTNA (Figure 4) found a histopathological appearance of a non-specific inflammatory process and did not show signs of malignancy. Advice from the Department of Anatomical Pathology was to re-examine with a more adequate specimen. A laboratory examination was also performed and showed anemia (Hb = 10.6), a decrease in hematocrit (35.9), and a low albumin level (2.1). We performed microbiological examinations with negative microscopic findings for acid-resistant bacilli (AFB), and GeneXpert showed low detection for M. tb. From the sputum culture results, a *pseudomonas aeruginosa* isolate was obtained. The patient was diagnosed with a left lung abscess, PTB, left lung tumor T4N2M1a, unspecified type of tumor stage IVA PS2, and osteoporosis. The patient started anti-TB drugs and was given antibiotics with a combination of ceftazidime IV and metronidazole IV for the management of PTB and lung abscess. The patient continued treatment until day 10 and decided to be outpatient.

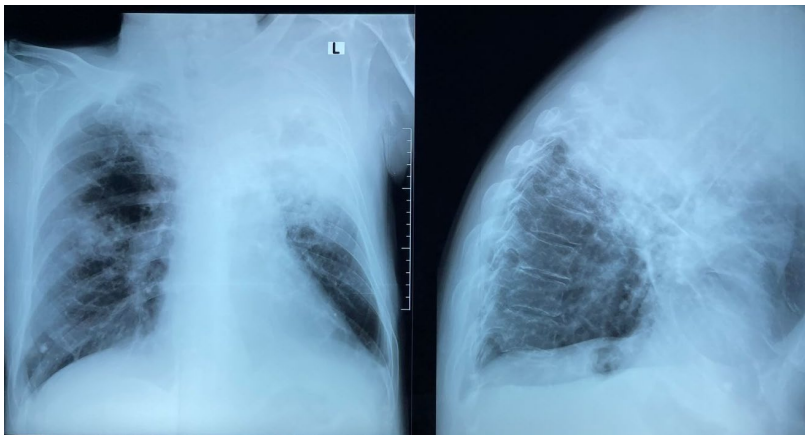

Figure 1. Chest X-ray
(Homogeneous consolidation with cavitation, fibrosis, and calcification in the superior lobe of the left lung)

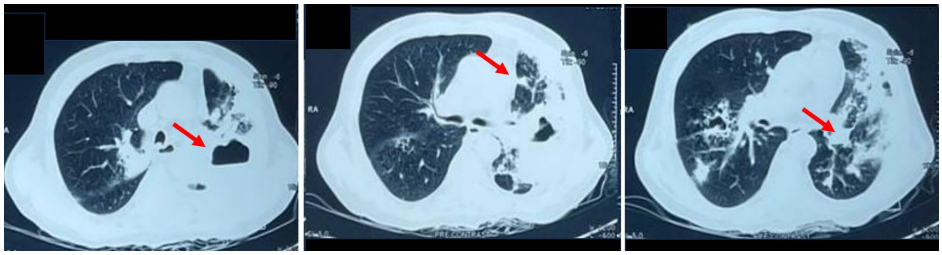

Figure 2. Chest CT scan without contrast
(There was a picture of air-fluid level, multiple cavities, and fibrocalcification in the right hemithorax, suggesting TB and lung abscess)

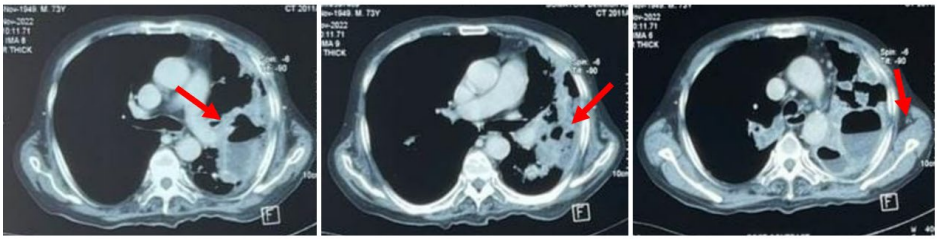

Figure 3. Chest CT scan with contrast
(A contrast-enhanced lesion in the fluid level with satellite nodules, ground-glass opacity (GGO), and invasive chest wall tumors with the impression of a mass that has invaded the cell wall)

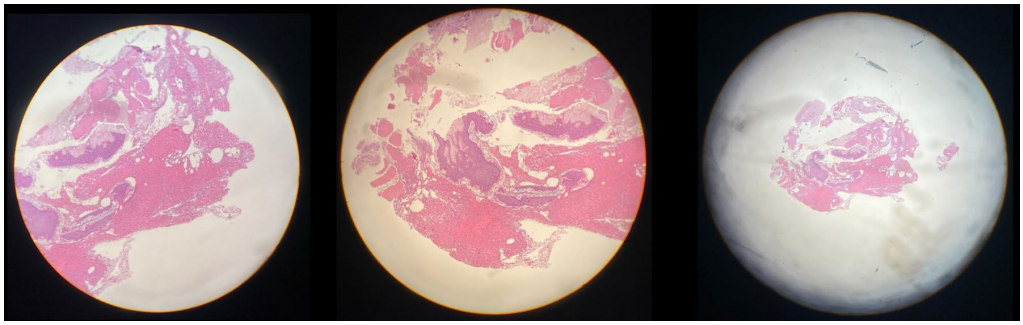

Figure 4. Anatomical pathology findings
(Non-specific inflammatory process and no sign of malignancy)

DISCUSSION

The mechanisms underlying the increased risk of cancer after TB infection have been reported through chronic pulmonary inflammation and fibrosis. TB infection can elicit a wide-ranging immune response in an individual because inflammatory cells in the lung produce a broad cascade of signaling cytokines, oxygen species, reactive nitrogen, prostaglandins, and tissue-damaging proteases. Cell wall components of M. tb can induce the production of nitric oxide and reactive oxygen species, which are involved in deoxyribonucleic acid (DNA) damage leading to carcinogenesis.

An infectious process can contribute to the process of carcinogenesis. Reactive oxygen or nitrogen species produced by active neutrophils bind to DNA, inducing genetic damage and neoplastic transformation. In most cases, LC goes undiagnosed for a long time because it has no symptoms in the early stages of the disease.[12,13] Chronic inflammation can promote tumor growth in several types of cancer, and chronic inflammation in the lung has been hypothesized as associated with carcinogenesis.[7,14] During infection, several immune systems are induced with the production of TNF, interleukin-4 (IL-4), and IL-13 related to prolonged fever, wasting and extensive pulmonary fibrosis.[14,15] Nitrative and oxidative DNA damage will be involved in carcinogenesis due to inflammation. M. tb can also increase the synthesis of BCL-2, which has the potential to cause an increase in anti-apoptotic activity. Chronic inflammation can also increase pulmonary fibrosis, potentially resulting in decreased clearance by lymph nodes and particulate matter from the infected site. Overall, the combination of DNA damage, anti-apoptosis, and continued chronic inflammation may enhance progenitor cell mutagenesis. This effect may lead to an increased risk of primary or secondary LC.[16,17]

LC occurs as a result of genetic damage to DNA and epigenetic changes in bronchial epithelial cells. This damage will affect the normal function of cells, cell proliferation, cell apoptosis, and DNA repair. Genetic interaction with environmental factors will trigger the development of LC. The more damage that occurs, the higher the risk of developing cancer.[18,19] A potential factor that could connect TB and LC is smoking. Smoking could induce lung disease and predispose to pulmonary infection. It is also a major risk for LC.[14] PTB and LC are diseases that need to be differentiated when diagnosing the patients. Hence, the patients will get proper treatment.[20]

The National Cancer Institute found that PTB is associated with an increased risk of LC (odds ratio/OR 2.1, 95% CI 1.4–3.1). PTB was associated with a 1.78-fold increased risk of LC in smokers and adenocarcinoma (relative risk: 1.6; 95% CI 1.2–2.1). The mechanism underlying the increased risk of cancer after PTB infection is inflammation and pulmonary fibrosis as inactive TB lesions.[21] A meta-analysis by Sun, *et al*. (2022) provided a comparison of clinical and imaging features for LC with PTB and only PTB.[20] The study showed no significant difference in most clinical symptoms of the patients in the two groups (persistent chest pain, chest distress, hemoptysis, fever, emaciation, and shortness of breath).[20] Nevertheless, it showed clinical characteristics to differentiate LC and PTB. Irritable cough was found to have a significantly higher frequency in PTB and LC in comparison with PTB only (OR 2.43).[20] Night sweating symptoms were dominated significantly by only PTB rather than PTB and LC. Compared to only PTB, PTB and LC were associated with high frequencies of dyspnea, hemoptysis, and hemorrhagic pleural effusion.[20] In radiological features, there are no significant differences in calcified shadow and mass shadow between PTB and LC. However, patients with PTB and LC show a high proportion of lobulation signs, mass, nodular shadow, satellite lesion, small vacuole signs, spicule signs, and pleural indentation.[20]

The spread of metastases in LC is most often lymphogenic in the cervical and supraclavicular lymph nodes, which are the first and most common sites. Symptoms of metastatic LC can range from bone pain to pathological fractures. These symptoms are also found in cases of certain stages of PTB. The increase in the incidence of PTB in the elderly occurs due to increased immune disorders (diabetes mellitus/DM and human immunodeficiency viruses/HIV). LC also begins to occur more frequently at a young age. Thus, age is no longer a benchmark for differential diagnoses of the two diseases. The formation of cavities in PTB can be a place for other secondary infections to occur, such as fungal infections and lung abscesses. The colonization of microorganisms also triggers the infection process in the cavity for the occurrence of a tumor lysis syndrome in LC.

Chest X-ray can be used as an initial modality for diagnosing cancer and PTB. Chest radiographs of PTB show parenchymal lesions, lymphadenopathy, miliary TB (2-3 mm diffuse nodules with a slight predominance in the lower lobe), pleural effusion, cavities, and parenchymal lesions with solid, homogeneous, or heterogeneous consolidation in each lobe (especially in the upper lobe), as well as fibrous changes. Malignant parenchymal lesions in LC have irregular edges. In addition, LC can also exhibit hilar protrusion, lung nodules, widening of the mediastinum, atelectasis of all or part of the lung lobes, consolidation, cavities (eccentric, irregular edges with nodularity), increased diaphragmatic depression (phrenic nerve palsy), and

pleural effusion. If a mass or lump is suspected to appear on the initial evaluation examination, further tests such as a CT scan, magnetic resonance imaging (MRI), or bronchoscopy can be considered to confirm the diagnosis.[13,18]

Multiple pulmonary nodular lesions of varying sizes in LC are usually misdiagnosed, especially when accompanied by nonspecific symptoms. The use of a CT scan cannot rule out LC, as approximately 20% of malignant nodules have regular edges. In addition, the picture of PTB can also be in the form of nodules. A CT scan can very well assess lymph node size but cannot differentiate between tumoral and reactive lymph nodes.[18] CT scan is recommended as an imaging modality for screening pulmonary malignancy, especially in high-risk populations.[2] It may identify malignant lesions earlier and reduce LC mortality by 20% compared with radiography.[2]

The CT scan features of PTB include irregular linear opacity, discrete miliary nodules, calcified nodules or consolidation, parenchymal bands, and paracicatricial emphysema.[22] A conventional CT scan is a radiology examination for distinguishing TB and lung tumor. Diagnosis and differentiation depend on the location, size and shape of the mass, as well as its lobes, borders, density, and enhancement characteristics.[23]

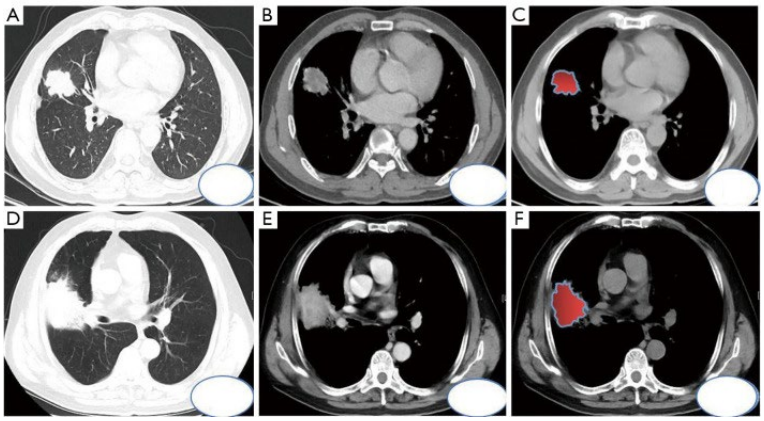

Figure 5. Images of PTB and lung tumor (A-C) showed representative images of PTB, and (D-F) showed representative images of LC[23]

CONCLUSION

LC could also be diagnosed with co-infection TB. Proper diagnosis to make sure the cancer and TB are co-infected is necessary. Hence, not just a single disease is treated. There are similarities in clinical symptoms between PTB and LC. Evaluation of anti-TB drugs and the clinical response of the patients needs further attention to minimize the potential for delays in the diagnosis of LC. Further research and clinical studies of PTB with suspicion of LC are needed, which can provide a better prognosis for the patients.

Consent

Written informed consent was obtained from the patient.

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Conflict of Interest

The authors declared there is no conflict of interest.

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Authors' Contributions

Designed the study: SII, ETMS, AW. Data collection: SII, ETMS, AM, WAF. Performed the analysis: SII, ETMS, AW, AM, WAF. Prepared the manuscript: ETMS. Reviewed the manuscript: SII, AW, AM, WAF. All authors contributed and approved the final version of the manuscript.

REFERENCES

1. Penyakit DJP dan P. *Pedoman Pengendalian Faktor Risiko Kanker Paru*. Jakarta, 2018.
2. Parker CS, Siracuse CG, Litle VR. Identifying Lung Cancer in Patients with Active Pulmonary Tuberculosis. *J Thorac Dis (Medical Surg Manag Pulm Infect*; 10, https://jtd.amegroups.com/article/view/22911 (2018).
3. Isbaniah F, Burhan E, Sinaga BYM, *et al*. *Tuberkulosis: Pedoman Diagnosis dan Penatalaksanaan di Indonesia*. 2nd ed. Jakarta: Perhimpunan Dokter Paru Indonesia (PDPI), https://bukupdpi.klikpdpi.com/wp-content/uploads/2022/08/BUKU-GUIDELINE-TB-2021.pdf (2021).
4. (WHO) WHO. *Global Tuberculosis Report 2021*. Geneva, https://www.who.int/publications-detail-redirect/9789240037021 (2021).
5. (WHO) WHO. *Global Tuberculosis Report 2022*. Geneva, https://www.who.int/teams/global-

tuberculosis-programme/tb-reports/global-tuberculosis-report-2022 (2022).
6. Luczynski P, Poulin P, Romanowski K, *et al*. Tuberculosis and Risk of Cancer: A Systematic Review and Meta-Analysis. *PLoS One* 2022; 17: e0278661. [PubMed]
7. Cabrera-Sanchez J, Cuba V, Vega V, *et al*. Lung Cancer Occurrence after an Episode of Tuberculosis: A Systematic Review and Meta-Analysis. *Eur Respir Rev* 2022; 31: 220025. [PubMed]
8. Ho L-J, Yang H-Y, Chung C-H, *et al*. Increased Risk of Secondary Lung Cancer in Patients with Tuberculosis: A Nationwide, Population-Based Cohort Study. *PLoS One* 2021; 16: e0250531. [PubMed]
9. Oh C-M, Roh Y-H, Lim D, *et al*. Pulmonary Tuberculosis is Associated with Elevated Risk of Lung Cancer in Korea: The Nationwide Cohort Study. *J Cancer* 2020; 11: 1899–1906. [PubMed]
10. Stella GM, Kolling S, Benvenuti S, *et al*. Lung-Seeking Metastases. *Cancers*; 11. Epub ahead of print 2019. [PubMed]
11. Chai M, Shi Q. The Effect of Anti-Cancer and Anti-Tuberculosis Treatments in Lung Cancer Patients with Active Tuberculosis: A Retrospective Analysis. *BMC Cancer* 2020; 20: 1121. [PubMed]
12. Tan KT, Kannan SK, Rajahram GS. A Case of Pulmonary Tuberculosis Masquerading as Lung Carcinoma. *Med J Malaysia* 2019; 74: 547–548. [PubMed]
13. Shu C-C, Chang S-C, Lai Y-C, *et al*. Factors for the Early Revision of Misdiagnosed Tuberculosis to Lung Cancer: A Multicenter Study in A Tuberculosis-Prevalent Area. *J Clin Med*; 8. Epub ahead of print May 2019. [PubMed]
14. Preda M, Tănase BC, Zob DL, *et al*. The Bidirectional Relationship between Pulmonary Tuberculosis and Lung Cancer. *International Journal of Environmental Research and Public Health*; 20. Epub ahead of print 2023. [PubMed]
15. Qin Y, Chen Y, Chen J, *et al*. The Relationship between Previous Pulmonary Tuberculosis and Risk of Lung Cancer in the Future. *Infect Agent Cancer* 2022; 17: 20. [PubMed]
16. Chen G-L, Guo L, Yang S, *et al*. Cancer Risk in Tuberculosis Patients in a High Endemic Area. *BMC Cancer* 2021; 21: 679. [PubMed]
17. Molina-Romero C, Arrieta O, Hernández-Pando R. Tuberculosis and Lung Cancer. *Salud Publica Mex* 2019; 61: 286–291. [PubMed]
18. Mashrabovna II, Faxriddinovna ND. Modern Method of Differential Diagnosis Tuberculosis and Lung Cancer. *Sci J Res Med* 2022; 1: 21–30. [Journal]
19. Nooreldeen R, Bach H. Current and Future Development in Lung Cancer Diagnosis. *International Journal of Molecular Sciences*; 22. Epub ahead of print 2021. [PubMed]
20. Sun W, Zhang L, Liang J, *et al*. Comparison of Clinical and Imaging Features between Pulmonary Tuberculosis Complicated with Lung Cancer and Simple Pulmonary Tuberculosis: A Systematic Review and Meta-Analysis. *Epidemiol Infect* 2022; 150: e43. [PubMed]
21. Petrilli JD, Araújo LE, da Silva LS, *et al*. Whole Blood mRNA Expression-Based Targets to Discriminate Active Tuberculosis from Latent Infection and Other Pulmonary Diseases. *Sci Rep* 2020; 10: 22072. [PubMed]
22. Xiang Y, Huang C, He Y, *et al*. Cancer or Tuberculosis: A Comprehensive Review of the Clinical and Imaging Features in Diagnosis of the Confusing Mass. *Front Oncol* 2021; 11: 644150. [PubMed]
23. Wei S, Shi B, Zhang J, *et al*. Differentiating Mass-Like Tuberculosis from Lung Cancer Based on Radiomics and CT Features. *Transl Cancer Res* 2021; 10: 4454–4463. [PubMed]