Original Article

Pulmonary Tuberculosis: Impact of Clinical and Radiological Presentations on Mortality

Zahir Salih Hussein

Department of Medicine, College of Medicine, Hawler Medical University, Erbil, Kurdistan Region, Iraq

Abstract

Background: Tuberculosis (TB) is an infectious disease, currently the top cause of infectious death from a single pathogen worldwide. **Objective:** The objective of this study was to determine the impact of clinical and radiological presentations of pulmonary TB on mortality. **Materials and Methods:** This retrospective case series study was performed on 215 patients (120 females and 95 males) using the recorded files of patients who were registered as pulmonary TB at the Chest and Respiratory Disease Center in Erbil, Iraq. Recorded files were studied from January 2018 to December 2019. **Results:** The mean age ± SD of the patients was 44.03 ± 21.57 years (ranged from 1 to 91 years), and female to male ratio was of 1.16:1. The right lung [97 (45.1%)] and upper zones [148 (68.8%)] were involved more frequently than other zones. Infiltration [120 (56%)] was the most common lung lesion. Clinical symptoms such as hemoptysis, weight loss, night sweat, shortness of breath, and chest pain were associated with a statistically significant increase in mortality. The right upper zones were affected more than other zones, and its involvement was statically significant. The involvement of both lungs had significant higher mortality [9 (25.7%)] than a single lung involvement [right lung: 2 (2.1%) versus left lung: 3 (3.9%)]; *P* value was <0.0001. The lower lung zone involvement has higher mortality [7 (19.4%)], and the type of lung lesion such as miliary distribution and cavitation has higher mortality, 2 (100%) and 3 (14.3%), respectively; *P* value was <0.016. **Conclusion:** Poor predictors of the outcome of pulmonary TB include clinical (hemoptysis, weight loss, night sweat, shortness of breath, and chest pain) and radiological (both lung involvement, upper zones especially the right upper zone, miliary distribution, and cavitation) presentations.

Keywords: Lesion, lobe, pulmonary, tuberculosis, zone

Introduction

Tuberculosis (TB) is an infectious disease, currently the top cause of infectious death of a single pathogen worldwide, ranking in the 10th position.[1] By the mid-1600s, according to the mortality report in London Bills in England, about 20% of deaths were due to TB.[2] There are many factors that increasing mortality in pulmonary TB, for example, malnutrition,[3] poverty,[4] low body weight and weight loss,[5] and smokers and diabetic patients.[6] The treatment outcome was more favorable in the younger TB patients compared with elderly patients.[7] Pulmonary TB case can be confirmed bacteriologically or diagnosed clinically and radiologically.[8] In spite of the important role of sputum examination for acid fast bacilli by smear or GeneXpert *MTB*/RIF assay,[9] chest radiology is an important tool for the management and monitoring complications of patients with pulmonary tuberculosis (PTB).[10] Modern imaging modalities offer a prompt detection of TB-associated lesions as well as an assessment of disease activity and patient follow-up.[11] Because of its high sensitivity (87%–98%), chest radiography is recognized as a powerful screening tool that has a higher accuracy than symptoms-based approaches, particularly in the detection of early TB.[12] Rapid and accurate diagnosis of TB is a key to avert death and to prevent further transmission of the disease. However, of the 10.4 million estimated new TB cases that occurred in 2016, 40% remained undiagnosed or underreported, including 450,000 cases (>75%) of rifampicin-resistance or multidrug-resistant TB.[1]

Access this article online

Quick Response Code:

Website: www.medjbabylon.org

DOI: 10.4103/MJBL.MJBL_48_22

Address for correspondence: Dr. Zahir Salih Hussein, Department of Medicine, College of Medicine, Hawler Medical University, Erbil, Kurdistan Region, Iraq.
E-mail: zahir.salih@hmu.edu.krd

Submission: 14-Mar-2022 **Accepted:** 14-Apr-2022 **Published:** 30-Jun-2022

How to cite this article: Hussein ZS. Pulmonary tuberculosis: Impact of clinical and radiological presentations on mortality. Med J Babylon 2022;19:288-93.

Some persons such as medical staff are at higher risk of pulmonary TB; according to the study that done in Baghdad, around one-third of healthcare workers had latent TB infection.[13]

Primary TB usually affects the lower and middle lung zones with ipsilateral hilar adenopathy, whereas postprimary mainly presents with cavitation and upper lobes of one or both lungs; on the other hand, the erosion of a parenchymal focus of TB into a blood or lymph vessel may result in a miliary pattern on the chest x-ray.[14]

Clinical and radiological characteristics of pulmonary TB have an effect on mortality and morbidity[15-18]; this study aimed to determine the impact of clinical and radiological presentations of pulmonary TB on mortality of patients registered and treated at the Chest and Respiratory Disease Center in Erbil, Iraq during 2018–2019.

Materials and Methods

This retrospective case series study was performed on 215 patients (120 females and 95 males) using the recorded files of patients who were registered as pulmonary TB at the Chest and Respiratory Disease Center in Erbil, Iraq.

Recorded files were reviewed, and variables such as age, gender, presenting symptoms, primary anatomical site, chest findings, stages, and chest x-rays findings on digitally saved chest x-rays films were studied from January 2018 to December 2019.

Demographic data, radiographic finding, and treatment outcome were retrieved from patients' records. Chest x-ray films of all patients were reviewed, and radiological findings were classified according to the side (right, left, both, and normal chest x-ray), zone (upper, middle, lower, and normal chest x-ray), and type of lung lesion (infiltration, opacity, cavitation, fibrosis, effusion, lymph adenopathy, and miliary). Deaths reported among registered TB cases are considered to be due to TB unless clear other causes of death were defined.

Inclusion criteria include patients diagnosed with active pulmonary TB at the Chest and Respiratory Disease Center in Erbil, whereas any patient with incomplete data or with no chest x-ray was excluded from the study.

Statistical analysis

The statistical calculations were performed using the Statistical Package for the Social Sciences version 23 (SPSS 25, IBM Company, Chicago, IL). In cross-tables, the chi-square test was used. When the chi-square test was inappropriate, then Fisher's exact test was used.

Ethical consideration

The study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. It was carried out with patients verbal and analytical approval before the sample was taken. The study protocol and the subject information and consent form were reviewed and approved by a local ethics committee according to the document number dated 30/11/ 2021 to get this approval.

Results

The mean age ± SD of the patients was 44.03 ± 21.57 years (ranged from 1 to 91 years), and the proportion of female patients were 55.8% with a female [120 (55.8%)] to male [95 (44.2%)] ratio of 1.16:1. The most common age group at diagnosis among female patients was between 15 and 34 years [40 (42.1%)], whereas among male patients, there were two peaks: the first was between 15 and 34 years [45 (37.5%)] and the second peak was above 65 years [37 (30.8%)] as shown in Figure 1.

The right lung [97 (45.1%)] was involved more frequently than the left lung [76 (35.3%)], and upper zones [148 (68.8%)] were involved more frequently than lower or middle zones as shown in Figures 2 and 3.

Figure 4 shows the frequency of types of lung lesions of patients with pulmonary TB; the results shows that infiltration [120 (56%)] was the most common lung lesion.

Table 1 shows the effect of clinical symptoms on the outcome of patients with pulmonary TB, according to the results of our study; hemoptysis, weight loss, night sweat, shortness of breath, and chest pain were associated with a statistically significant increase in mortality.

The anatomic distribution of pulmonary TB according to the lung and zone involvement was shown in Table 2, which indicates that upper zones, especially right upper zone, were affected more than other zones and its involvement was statically significant.

Table 3 revealed that chest x-ray findings have statistically significant effect on mortality; for example regarding the lung involvement, patients with both lung involvement have significant higher mortality [9 (25.7%)] than those with single lung involvement [right lung 2 (2.1%) versus left lung 3 (3.9%)]; *P* value was 0.0001. Lung zone involvement had a statistically significant effect on mortality in which the lower zone involvement has higher mortality [7 (19.4%)]; also a type of lung lesion has statistically significant effect on mortality in which miliary distribution and cavitation have higher mortality, 2 (100%) and 3 (14.3%), respectively; *P* value was <0.016.

Discussion

This retrospective study was done on 215 patients with PTB, the mean age ± SD of the patients was 44.03 ± 21.57 years (ranged from 1 to 91 years), and the female to male ratio is 1.16:1. The common age group at diagnosis among female patients was between 15 and 34 years, whereas

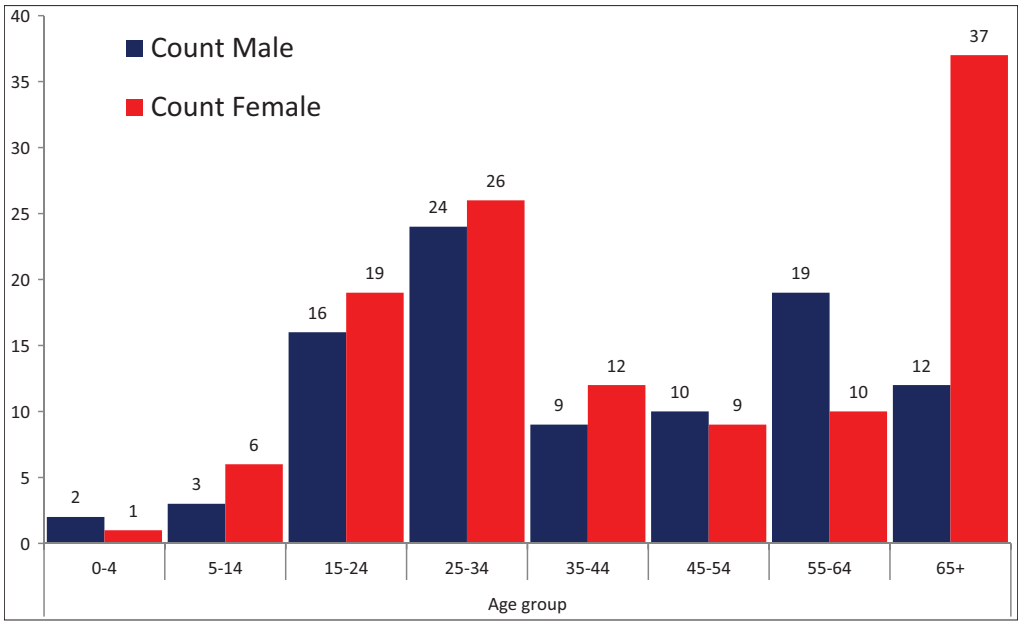

Figure 1: The age distribution of male and female patients with pulmonary TB

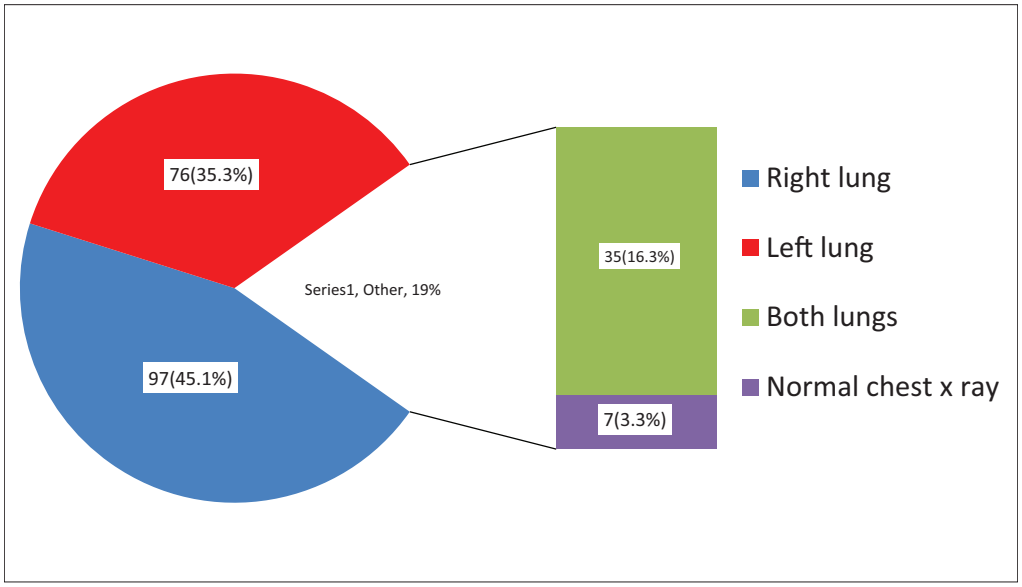

Figure 2: The frequency of the involved lung of patients with pulmonary TB

among male patients, there were two peaks: the first was between 15 and 34 years and the second peak was above 65 years old.

According to the results of our study, the right lung was affected in about 97 (45.1%) of patients, which is statistically significant; also the most common lung lesion was infiltration [120 (56%)], which is similar to the results of the other study done in Sulaymaniyah Province.[17]

In this study, hemoptysis, weight loss, night sweat, shortness of breath, and chest pain were associated with a statistically significant increase in mortality; the results were similar to other studies.[15,18]

The results of our study showed that chest x-ray findings have statistically significant effect on mortality; for example, regarding the lung involvement, patients with both lung involvement have a significantly higher mortality [9 (25.7%)] than those with a single lung involvement; similar results were observed in other studies.[16,17] Lung zone involvement had statistically significant effect on mortality in which lower zone involvement has higher mortality [7 (19.4%)] in contrast to the results of another study, which showed that the middle zone involvement had higher mortality[17]; also the type of lung lesion has statistically significant effect on mortality in which miliary distribution and cavitation have higher mortality, 2 (100%)

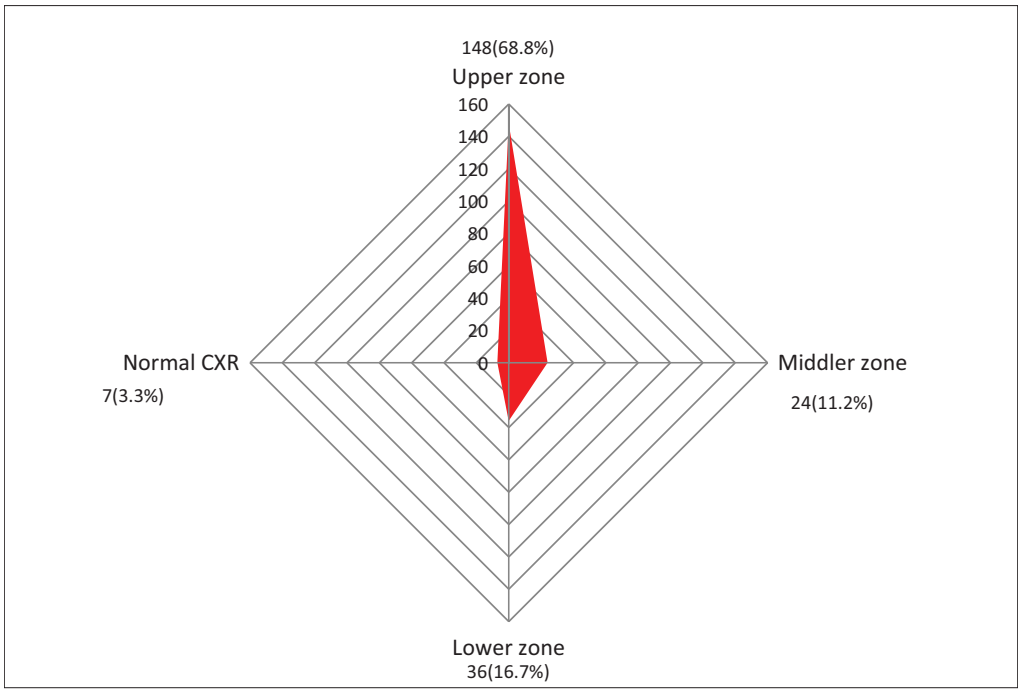

Figure 3: The frequency of the involved zone of lung of patients with pulmonary TB

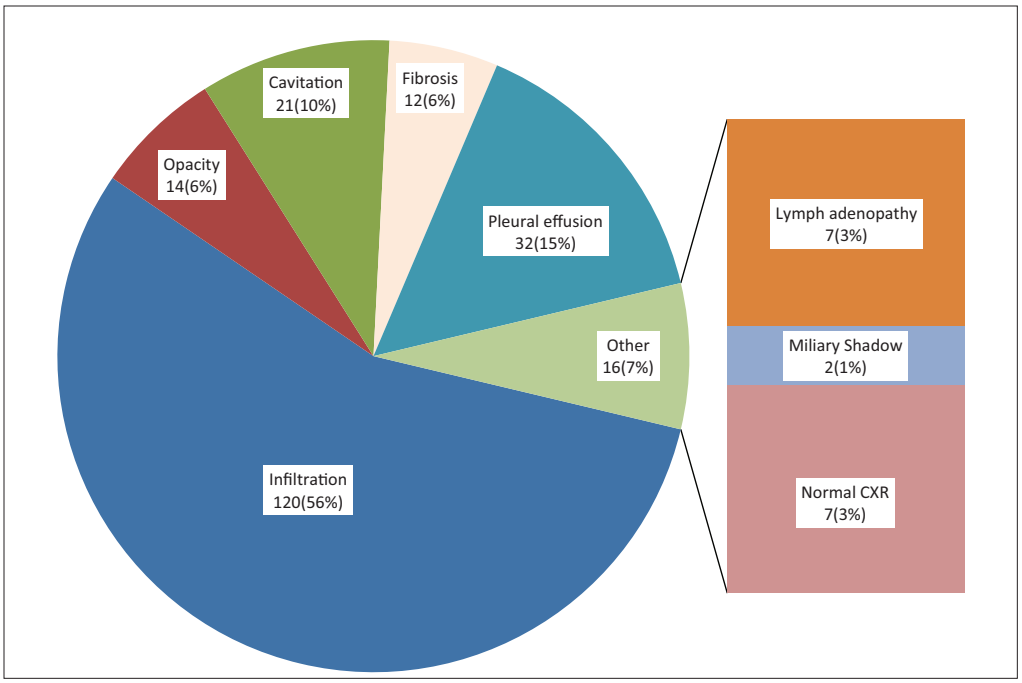

Figure 4: The frequency of types of lung lesions of patients with pulmonary TB

and 3 (14.3%), respectively; *P* value was <0.016.[16] On the other hand, cavitation is a risk factor for relapse.[19]

The weak point of our study was that we regarded all deaths were due to TB unless there was another clear cause of death, whereas according to previous studies, a majority of deaths among PTB were due to non-TB-related disease.[19]

Conclusion

Predictors of a poor outcome of pulmonary TB include clinical (hemoptysis, weight loss, night sweat, shortness of breath, and chest pain) and radiological (both lung involvement, upper zones especially the right upper zone, miliary distribution, and cavitation) presentations.

Table 1: Effect on the outcome of patients with pulmonary TB according to clinical symptoms of pulmonary TB

Clinical symptoms	Outcome		*P* value
	Survived	Died	
Cough	181 (90.0%)	14 (100%)	0.215
Sputum	179 (89.1%)	13 (92.9%)	0.65
Fever	165 (82.1%)	5 (4.2%)	0.083
Hemoptysis	71 (35.3%)	11 (78.8%)	0.001
Weight loss	84 (41.8%)	12 (85.7%)	0.001
Night sweat	90 (44.8%)	11 (78.6%)	0.014
SOB	55 (27.4%)	10 (71.4%)	0.001
Chest pain	61 (30.3%)	12 (85.7%)	0.001

SOB = shortness of breath

Table 2: Anatomic distribution of pulmonary TB according to lung and zone involvement

Lung involved	Radiological zone				*P* value
	Upper zone	Middle zone	Lower zone	Normal CXR	
Right lung	75 (34.9%)	9 (4.2%)	13 (6.0%)	0 (0.0%)	0.000
Left lung	54 (25.1%)	8 (3.7%)	14 (6.5%)	0 (0.0%)	
Both lungs	19 (8.8%)	7 (3.3%)	9 (4.2%)	0 (0.0%)	
Normal CXR	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (3.3%)	

CXR = chest x-ray

Table 3: Effect of chest x-ray findings of patients with pulmonary TB on outcome

Chest x-ray findings	Outcome		*P* value
	Survived	Died	
Lung involved			
Right lung	95 (97.9%)	2 (2.1%)	0.0001
Left lung	73 (96.1%)	3 (3.9%)	
Both lungs	26 (74.3%)	9 (25.7%)	
Normal CXR	7 (100%)	0 (0.0%)	
Lung zone			
Upper zone	143 (96.6%)	5 (3.4%)	0.009
Middle zone	22 (91.7)	2 (8.3%)	
Lower zone	29 (80.6%)	7 (19.4%)	
Normal CXR	7 (100%)	0 (0.0%)	
Lung lesion			
Infiltration	114 (95%)	6 (5.0%)	0.016
Opacity	14 (100%)	0 (0.0%)	
Cavitation	18 (85.7%)	3 (14.3%)	
Fibrosis	12 (100%)	0 (0.0%)	
Effusion	29 (90.6%)	3 (9.4%)	
LAP	7 (100%)	0 (0.0%)	
Miliary	0 (0.0%)	2 (100%)	

CXR = chest x-ray, LAP = lymphadenopathy

Recommendation

Further studies are necessary to confirm the effect of clinical and radiological features on mortality in pulmonary TB.

Acknowledgment

Special thanks to the Chest and Respiratory Disease Center in Erbil, Iraq.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. WHO. World Health Statistics 2018: Monitoring Health for the SDGs. Geneva: WHO; 2018. Available from: www.who.int/gho/publications/world_health_statistics/2018/en/. [Last accessed on 21 Jul 2021].
2. Lutwick LI. Introduction. In: Lutwick LI, editor. Tuberculosis. London: Chapman and Hall Medical; 1995. p. 1-4.
3. Rao VK, Iademarco EP, Fraser VJ, Kollef MH. The impact of comorbidity on mortality following in-hospital diagnosis of tuberculosis. Chest 1998;114:1244-52.
4. Rasanathan K, Sivasankara Kurup A, Jaramillo E, Lönnroth K. The social determinants of health: Key to global tuberculosis control. Int J Tuberc Lung Dis 2011;15 Suppl 2:30-6.
5. Miyata S, Tanaka M, Ihaku D. Usefulness of the malnutrition screening tool in patients with pulmonary tuberculosis. Nutrition 2012;28:271-4.
6. Reed GW, Choi H, Lee SY, Lee M, Kim Y, Park H, *et al*. Impact of diabetes and smoking on mortality in tuberculosis. PLoS One 2013;8:e58044.
7. Alavi SM, Bakhtyarinia P, Hematnia F, Albagi A. Clinical and radiographic manifestations and treatment outcome of pulmonary tuberculosis in the elderly in Khuzestan, Southwest Iran. Tanaffos 2014;13:14-9.
8. World Health Organization. Definitions and Reporting Framework for Tuberculosis—2013 Revision. Geneva: WHO; 2013. Available from: https://apps.who.int/iris/bitstream/handle/10665/79199/9789241505345_eng.pdf. [Last accessed on 18 Feb 2021].
9. Ahmed ST. GeneXpert *MTB*/RIF assay—A major milestone for diagnosing *Mycobacterium tuberculosis* and rifampicin-resistant cases in pulmonary and extrapulmonary specimens. Med J Babylon 2019;16:296-301.
10. Andreu J, Caceres J, Pallisa E, Martinez-Rodriguez M. Radiological manifestations of pulmonary tuberculosis. Eur J Radiol 2004;51:139-49.

11. Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM, *et al*.; WHO's Global TB Programme. Who's new end Tb strategy. Lancet 2015;385:1799-801.
12. World Health Organization. Chest Radiography in Tuberculosis Detection. Summary of Current WHO Recommendations and Guidance on Programmatic Approaches. Geneva: WHO; 2016. Avalable from: https://apps.who.int/iris/bitstream/handle/10665/252424/9789241511506-eng.pdf. [Last accessed on 17 Jan 2021].
13. Al-Ameri AH, Armean P, Al-Lami F. Prevalence of latent TB infection among health care workers in three main TB health facilities, Baghdad, Iraq, 2013. J Fac Med Bagdad 2014;56:339-42. Available from: https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBaghdad36/article/view/533. [Last accessed on 28 Feb 2022].
14. Alam A, Jagpal SK, Johannes J, Nagella N. ATS Review for the Pulmonary Boards; 2015. INFECTIONS chapter 11/page 491. Available from: https://store.thoracic.org/product/index.php?id=a1u40000000C1ulAAC. [Last accessed on 24 Oct 2019].
15. Sultan KM, Alobaidy MW, AL-Jubouri AM, Abbas Naser A, AL-Sabah HA. Assessment of body mass index and nutritional status in pulmonary tuberculosis patients. J Fac Med Bagdad 2012;54:204-8. Available from: https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBaghdad36/article/view/718. [Last accessed on 18 Nov 2021].
16. Tsao TC, Juang YC, Tsai YH, Lan RS, Lee CH. Whole lung tuberculosis. A disease with high mortality which is frequently misdiagnosed. Chest 1992;101:1309-11.
17. Karadakhy K. Radiological manifestations of pulmonary tuberculosis in patients registered at dots centers in Sulaimani, IRAQ 2010–2011. J Sulaimani Med Coll 2019;9:329-35.
18. Wejse C, Gustafson P, Nielsen J, Gomes VF, Aaby P, Andersen PL, *et al*. TBscore: Signs and symptoms from tuberculosis patients in a low-resource setting have predictive value and may be used to assess clinical course. Scand J Infect Dis 2008;40:111-20.
19. Jo KW, Yoo JW, Hong Y, Lee JS, Lee SD, Kim WS, *et al*. Risk factors for 1-year relapse of pulmonary tuberculosis treated with a 6-month daily regimen. Respir Med 2014;108:654-9.