

A PROSPECTIVE STUDY OF AETIOLOGICAL PROFILE OF CAVITARY LESION ON CHEST X-RAY OF PATIENTS ATTENDING TO DEPARTMENT OF PULMONOLOGY OF TERTIARY CARE HOSPITAL

Puligunta Chakradhar¹, Madduri Veerasekharaiah², Dasari Chakradhar³

¹Associate Professor, Department of Pulmonary Medicine, Santhiram General Hospital and Medical College, Nandyal, Andhra Pradesh.

²Senior Resident, Department of Pulmonary Medicine, Santhiram General Hospital and Medical College, Nandyal, Andhra Pradesh.

³Postgraduate, Department of Pulmonary Medicine, Santhiram General Hospital and Medical College, Nandyal, Andhra Pradesh.

ABSTRACT

BACKGROUND

A cavity has been defined as "a gas containing space with in the lung, surrounded by a wall whose thickness is greater than 1 mm."¹ According to Fleischner society, cavity is defined pathologically as: "a gas-filled space within a zone of pulmonary consolidation or within a mass or nodule, produced by the expulsion of a necrotic part of the lesion via the bronchial tree." Lillington defined cavity as "an abnormal air space that appears on the chest radiograph as a roughly spherical circumscribed area of radiolucency."

MATERIALS AND METHODS

This is a prospective study conducted on 80 patients with cavitory lesions in chest x-ray, attending the department of pulmonology, Santhiram General Hospital, Nandyal. This study was conducted for 18 months from January 2016 to July 2017. Baseline chest x-rays and CTs were taken for all the patients.

RESULTS

In our study, 80 patients were included out of whom, 52 (65%) patients were males and 28 (35%) patients were females. Male to female ratio is 1.85:1. Majority of patients 55/80 (68.75%) were in the age group of 31-50 years. The commonest presentation was cough in 64 patients (80%), followed by loss of appetite in 56 patients (70%), fatigue in 52 patients (65%), fever in 48 patients (60%), excessive night sweats in 40 patients (50%), chest pain in 28 patients (35%), dyspnoea in 28 patients (35%), and haemoptysis in 16 patients (20%).

CONCLUSION

Pulmonary tuberculosis is the leading cause for cavitory lung lesions followed by pneumonia, of which Klebsiella pneumoniae is the predominant organism isolated followed by Staphylococcus aureus and Streptococcus pneumoniae. Malignancy also has significant contribution in the aetiological profile of cavitory lung disease. In developing countries, pulmonary tuberculosis is still the leading cause of cavities in lung. One patient presented with cavitating necrotizing pneumonia and this pneumonia failed to resolve. This patient was subsequently evaluated with CT chest and collagen profile and diagnosed as SLE.

KEYWORDS

Aetiology, Cavity, Pulmonary Tuberculosis Pneumonia, Malignancy, Chest X-Ray.

HOW TO CITE THIS ARTICLE: Chakradhar P, Veerasekharaiah M, Chakradhar D. A prospective study of aetiological profile of cavitory lesion on chest x-ray of patients attending to department of pulmonology of tertiary care hospital. J. Evid. Based Med. Healthc. 2019; 6(5), 298-303. DOI: 10.18410/jebmh/2019/61

BACKGROUND

A cavity has been defined as "a gas containing space with in the lung, surrounded by a wall whose thickness is greater than 1 mm."¹ According to Fleischner society, cavity is

defined pathologically as: "a gas-filled space within a zone of pulmonary consolidation or within a mass or nodule, produced by the expulsion of a necrotic part of the lesion via the bronchial tree."² Lillington defined cavity as "an abnormal air space that appears on the chest radiograph as a roughly spherical circumscribed area of radiolucency." The lucency being surrounded and delineated by a ring of relative radio density known as "wall". Three fourths of the margins should be outlined and shadow of any anatomical structure should not form the wall of the cavity.³ A cavity is the result of a number of pathological processes, including suppurative necrosis (e.g., pyogenic lung abscess), caseous necrosis (e.g., Tuberculosis), ischemic necrosis (e.g.,

Financial or Other, Competing Interest: None.
Submission 17-01-2019, Peer Review 20-01-2019,
Acceptance 01-02-2019, Published 04-02-2019.

Corresponding Author:

Dr. P. Chakradhar,

H. No. 31, Nandi Green Homes,

Kranthinagar, Nandyal,

Kurnool Dist.- 518501, Andhra Pradesh.

E-mail: puliguntachakri@yahoo.co.in

DOI: 10.18410/jebmh/2019/61



pulmonary infarction), cystic dilatation of lung structures (e.g., ball-valve obstruction and Pneumocystis pneumonia), cysts in lung tissue (e.g., Echinococcus).³ Malignant processes may cavitate because of treatment-related necrosis, internal cyst formation, or internal desquamation of tumour cells with subsequent liquefaction (Miura et al.,⁴ 1998; Mortensen et al., 2015). The spectrum of infectious and non-infectious processes associated with pulmonary cavities is daunting. Hence, we conducted a study to evaluate the etiological profile of cavitary lung diseases as there are only a few studies done in this aspect.

Aim

Our aim is to find out the various etiological causes of cavitary lung lesions.

MATERIALS AND METHODS

This is a Prospective study conducted on 80 patients with cavitary lesions in Chest-X ray attending to the department of pulmonology, Santhiram general hospital, Nandyal, this study was conducted for 18 months from January 2016 to July 2017. Baseline chest x-rays and CTs were taken for all the patients.

Inclusion Criteria

All patients with cavitary lung lesions attending to the department of pulmonology were included in the study. Patients with pre-existing co-morbidities like hypertension, diabetes mellitus, chronic obstructive lung disease, asthma, chronic kidney disease and retroviral disease were included in the study.

Exclusion Criteria

Patients of paediatric age group were not included in our study (as most of paediatric patients were referred to paediatric department rather than pulmonology department) patients with Cystic bronchiectasis, bullous lesions and patients who refused to give consent were excluded from the study.

Detailed demographic data like age, sex were taken for all the patients. Clinical parameters like onset of symptoms (cough with expectoration, fever, shortness of breath, chest pain, haemoptysis) with duration, auscultatory findings suggestive of cavitation like bronchial breath sounds and systemic examination for any co-morbid illness were evaluated in all patients. Co-morbid illnesses like hypertension, cardiac failure, ischemic heart disease, chronic liver disease (cirrhosis of liver), chronic kidney disease and Diabetes mellitus were considered. Baseline chest x-ray was taken for all the patients and CT chest was taken in required cases.

Patients were Evaluated by:

Haematological Investigations-

Complete hemogram, Random Blood sugar, Serum creatinine, Blood urea, screening for Viral markers (HIV, HBsAg, HCV).

Sputum Examination (Microbiology)-

Sputum for AFB staining (auramine o), Gram staining, culture and sensitivity.

Sputum for KOH mount, Sputum for malignant cytology.

Radiological Investigations

Chest X-ray, USG chest & abdomen, CT chest (plain).

CECT chest in selected patients, 2D Echocardiogram.

ECG

FNAC / Biopsy, Connective Tissue Profile

Fiber Optic Bronchoscopy-

Bronchoalveolar Lavage (BAL) for AFB staining, BAL for culture and Sensitivity, BAL for KOH mount, BAL for malignant cytology.

Data Analysis

The following software were used for the data analysis:

- 1) Microsoft Excel-2013 for entering data
- 2) SPSS version 10 for cross tabulation and analysis.

RESULTS

In our study, 80 Patients were included out of which, 52 (65%) patients were males and 28 (35%) patients were females. Male to female ratio is 1.85: 1. Majority of patients 55/80 (68.75%) were in the age group of 31-50 years. The commonest presentation was cough in 64 patients (80%), followed by loss of appetite in 56 patients (70%), fatigue in 52 patients (65%), fever in 48 patients (60%), excessive night sweats in 40 patients (50%), chest pain in 28 patients (35%), dyspnoea in 28 patients (35%), and haemoptysis in 16 patients (20%). Out of 80 patients, 23 (28.75%) patients were addicted to smoking, whereas 16 (20%) patients were alcoholic. Diabetes Mellitus seen in 19 out of 80 patients (23.75%) (out of these 19 patients, 12 had Pulmonary Tuberculosis, 6 patients had non-tuberculous pneumonia and 1 patient had malignancy), Hypertension in 10 out of 80 patients (12.5%), chronic renal disease in 6 out of 80 patients (7.5%) and Coronary Artery Disease (CAD) in 3 out of 80 patients (3.75%).

In our study of 80 patients, infective aetiology (TUBERCULOSIS and PNEUMONIA) contributed to cavitary lesions in 74 (92.5%) patients, of which males contribute 48 (64.86%) cases, whereas females contribute about 26 (35.13%) cases. Male to female ratio in 74 patients of infective aetiology causing cavitary lesions is (M:F) 1.84: 1. Whereas other causes like malignancy and Systemic lupus erythematosus (SLE) contributed to 6 (7.5%) patients of which males were 4 (66.66%) and females were 2 (33.33%) male to female ratio (M:F) is 2:1. Most of the patients with infective aetiology were in the age group of 21 to 50 years, whereas the patients with non-infective aetiology (malignancy, SLE) were in the age group of more than 41 years.

50 out of 80 (62.5%) patients with cavitary lung lesions proved to be of tuberculous aetiology (out of which 33 (66%) patients had cavity in the upper zone, 10 (20%) patients had cavity in the lower zone and in 7 (14%) Patients,

multiple zones were involved). In our study out of 50 patients with tuberculous cavities, 7 patients (14%) had history of tuberculosis in the past and completed course of anti-tuberculosis treatment. In these 7 patients we did sputum smear for acid fast staining, sputum for Gene Xpert, sputum for Mycobacterial culture. We did Bronchoscopy and Bronchoalveolar lavage was subjected to Acid fast staining, Gene Xpert test and bronchoalveolar lavage for Mycobacterial culture. In these 7 patients with history of pulmonary tuberculosis in the past, all the tests were negative and came to conclusion that these 7 patients had cavity as Tuberculous sequalae. Out of the 80 patients, 15% patients had Klebsiella pneumonia, 6.25% had staphylococcal pneumonia, 3.75% had streptococcus pneumonia, 2.5% had Haemophilus pneumonia, 2.5% had mixed infections, 5(6.25%) had malignancy and 1 patient (1.25%) had systemic lupus erythematosus. Out of the five malignant patients, 4 patients (80%) were diagnosed by tissue biopsy as squamous cell carcinoma and 1 patient (20%) was diagnosed by lymph node biopsy as non-Hodgkin's lymphoma). All the 4 patients with squamous cell carcinoma were smokers.

39 patients had right upper zone predilection in cavitory lung disease followed by left upper zone in 23 pts and bilateral involvement was seen in 18 patients. In 50 patients of pulmonary tuberculosis with cavitory lung lesions, 38 (78.94%) were non-diabetic PTB patients. Out of these 38 patients 30 patients had upper zone predilection. Out of 12 Pulmonary tuberculosis patients with diabetes mellitus, 6 (50%) had lower zone predilection. In non-diabetic pulmonary tuberculosis patients, upper zones are predominantly involved whereas in diabetic pulmonary tuberculosis patients' lower zones are commonly involved. In our study of 80 patients, 22 patients had smoking history. 12 out of 50 (24%) PTB patients, 6 out of 24 (25%) pneumonia patients and 4 out of 5 (80%) malignancy patients had smoking history.

Out of 80 patients, 3 patients were diagnosed as retroviral positive and were infected by mycobacterial tuberculosis.

DISCUSSION

The aetiology of cavitory lung disease is influenced by several factors such as geographical area and the institution where the research is conducted. A knowledge regarding the spectrum of diseases which cause cavitory lesions will be valuable for the physician. A total of 80 patients who satisfied the inclusion criteria are included in the study. Out of 80 patients, 52 (65%) were males. There is male predominance in our study. Majority of patients 55 (68.75%) were in the age group of 31-50 years.

Co-morbidities were present in majority of the patients. In our study of 80 patients, 19 had Diabetes mellitus (23.75%), whereas 10 had Hypertension (12.5%), 6 had Chronic renal disease (7.5%) and 3 were HIV positive. 12 out of 50 (24%) Pulmonary tuberculosis patients, 6 out of 24 (25%) pneumonia patients and 4 out of 5 (80%) malignancy patients had smoking history. Out of 5 malignant

cavitory lesions in our study, 4 were males and all the males were smokers. Smoking is important predisposing factor in cavitory lung diseases, especially in malignancy. In a study done by Kolappan C, Gopi PG. (Epidemiology Unit, Tuberculosis Research Centre, Chennai, Indian Council of Medical Research, India. kola15@sify.com) there is a positive association between tobacco smoking and pulmonary (bacillary) tuberculosis (OR 2.5). The association also shows a strong dose-response relationship. A study done by Muhammad Furrukh (Sultan Qaboo sUniv Med J. 2013 Aug; 13(3): 345-358.) stated that smoking remains the most consistent causative agent for developing the Tuberculosis disease and carries a definitive prognostic and predictive value.

In our study of 80 cases most common aetiology for cavitory lung disease was pulmonary tuberculosis 62.5% (n=50), followed by pneumonia 30% (n=24), Malignancy 6.25% (n=50) and SLE 1.25% (n=1). In a study conducted by Kelvin Rivera Manzona⁵ out of 60 patients with cavitory lung disease, most common aetiology was pulmonary tuberculosis 38.33% (n=23), Study by J H Woodring et.al⁶ in post primary tuberculosis, cavitation in lung is observed in 45% of patients. In a study by Andreu J et al⁷ cavitation is the hallmark of post primary tuberculosis and appears in around 50% of patients.

In our study of 80 patients with cavitory lung disease, 50 patients were of pulmonary tuberculosis aetiology. Out of 50 tuberculosis patients, 32 patients were males (64%) and 18 patients were female (36%). Male to female ratio is 1.85: 1. In a study conducted in 446 patients of pulmonary tuberculosis with cavitory lesions by Suresh Rao,² the male to female ratio was 2: 1. In a study conducted by El-Khushman et al⁸ male to female ratio was 1.54:1. Out of 50 tuberculosis patients in our study, majority of patients were in age group 41-50Y. In a study conducted in 446 patients of cavitory pulmonary tuberculosis by Suresh Rao,² median age was 43 years. In our study of 50 PTB patients, majority (33 patients - 66%) showed cavities in upper zone. In a study conducted by Shumy F et al⁹ out of 100 tuberculosis patients, 45% patients had upper zone predilection. In a study conducted by El-Khushman et al,⁸ Out of 137 Tuberculosis patients 63% had upper lobe predilection.

In our study of 50 tuberculosis patients, 38 (76%) patients were non-diabetic, whereas 12 (24%) patients were diabetic. Out of 38 non-diabetic patients, 30 (78.94%) patients had upper zone involvement. Whereas in 12 patients with both Tuberculosis and diabetes, 6 (50%) patients had lower zone involvement In a study by Perz-Guzman et al¹⁰ comparing radiographs of in-patients admitted with pulmonary tuberculosis and diabetes (TBDM group, n = 192) with a control group of patients with pulmonary tuberculosis alone (TB group, n = 130), statistical differences were observed as follows: TB with diabetes patients had a decreased frequency of upper zone (17% vs. 56%), and an increased frequency of lower zone (19% vs. 7%) and multi zonal (64% vs. 36%) lung field lesions respectively. TB with diabetes patients developed cavitation often in the lower lung fields.

In our study, out of 24 cases of bacterial pneumonia, majority 12 (50%) of cavitory lesions were due to Klebsiella. In a study by Carpenter J et al¹¹ Klebsiella pneumonia can complicate to lung abscess in 16-50% of patients. A study from Taiwan¹² conducted on 90 patients with cavity with abscess, implicated K. pneumonias as the most common single cause of lung abscess, . In our study, 5 out of 24 bacterial cavitory lesions were due to Staphylococcus aureus. A Study by Macfarlane J. et al,¹³ showed that in 26 patients with staphylococcus, 7 (27%) had developed cavity. In our study of 80 cases, 3 (3.75%) cases were diagnosed as retroviral positive. In these 3 cases, Pulmonary Tuberculosis was the infective agent for cavitory lesions. In a study by Aviram G et al,¹⁴ on cavitory lung disease in patients with acquired immune deficiency syndrome (AIDS), 40% of cavitory lesions are due to Pulmonary tuberculosis.¹⁵ In our study, out of 80 cases with cavitory lung disease, 5 (6.25%) cases had malignant aetiology. Out of 5, 4 (80%) cases were diagnosed as squamous cell carcinoma whereas 1 (20%) was diagnosed as non-Hodgkin's lymphoma. In a study conducted by Kelvin Rivera Manzano⁵ out of 60 patients with cavitory lung disease, primary lung cancer was 18.33% (n=11). Study conducted by Kelvin Rivera Manzano⁵ in developed country, malignancy has high incidence, whereas in our study, which was conducted in developing

country, still Pulmonary tuberculosis is the major contributory factor in aetiology. In a study by Riyah Adil¹⁶ in 36 patients, they found that 7 cases (n=7) were due to Bronchogenic carcinoma, most of them were in the right lung 71.5%. Among the cell types of the cavitory pulmonary neoplasm, 85.7% were constituted by squamous cell carcinoma and 14.3% were constituted by adenocarcinoma. One of the rare etiological cause for cavitory lesion is SLE. 1 patient (1.25%) was diagnosed with SLE in our study. SLE case with cavitory lesion was reported previously in a study conducted by Maden et al.¹⁷

CONCLUSION

Pulmonary tuberculosis is the leading cause of cavitory lung lesions followed by pneumonia, of which Klebsiella pneumoniae is the predominant organism isolated followed by staphylococcus aureus and streptococcus pneumoniae. Malignancy also has significant contribution in the aetiological profile of cavitory lung disease. In developing countries, pulmonary tuberculosis is still the leading cause of cavities in lung. One patient presented with cavitating necrotizing pneumonia and this pneumonia failed to resolve. This patient was subsequently evaluated with CT chest and collagen profile and diagnosed as SLE.

Diagnosis	Gender	21- 30	31-40	41-50	>50 Years	Total
Pulmonary Tuberculosis	Male	6	10	12	4	32
	Female	4	7	6	1	18
Klebsiella	Male	2	3	2	1	8
	Female	1	2	1	0	4
Staphylococcus	Male	1	1	1	0	3
	Female	0	1	1	0	2
Streptococcus	Male	0	1	1	0	2
	Female	0	1	0	0	1
Haemophilus	Male	1	0	0	0	1
	Female	0	0	0	1	1
Mixed Infections	Male	0	1	1	0	2
	Female	0	0	0	0	0
Malignancy	Male	0	0	1	3	4
	Female	0	0	1	0	1
SLE	Male	0	0	0	0	0
	Female	0	0	1	0	1
Total		15	27	28	10	80

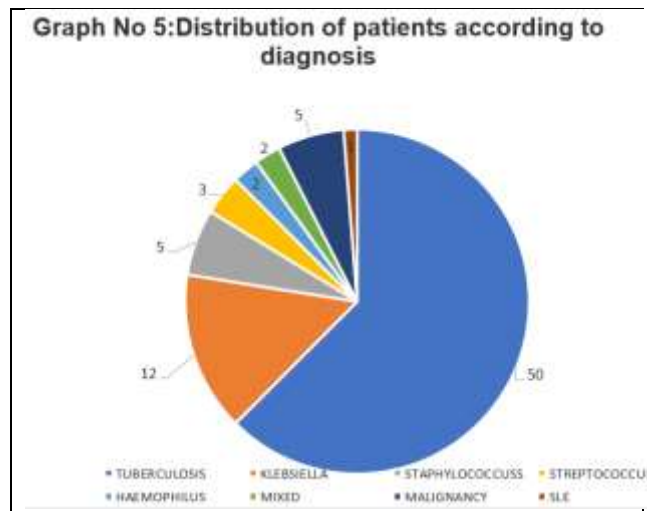
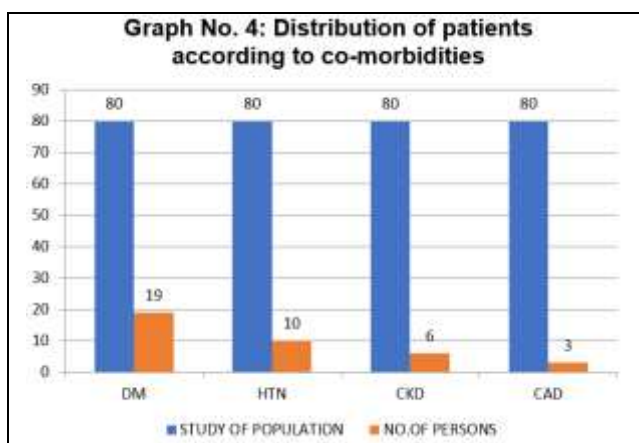
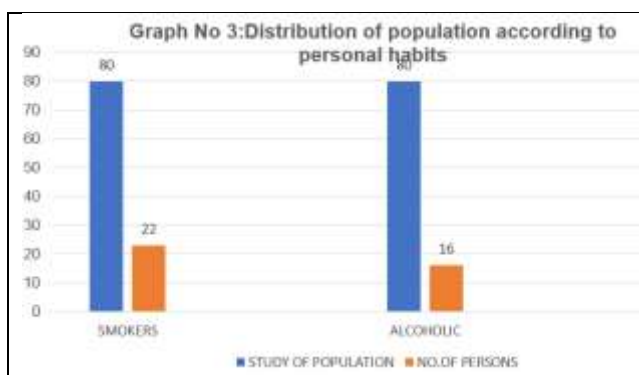
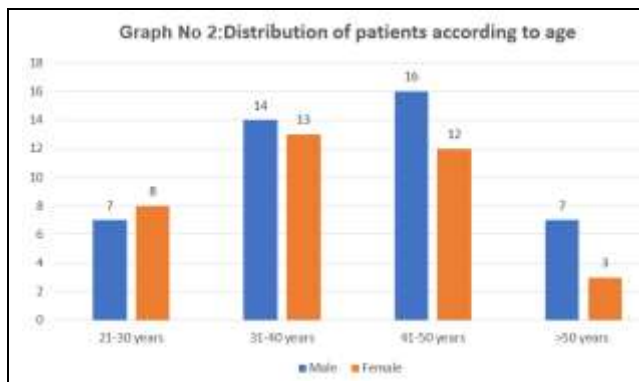
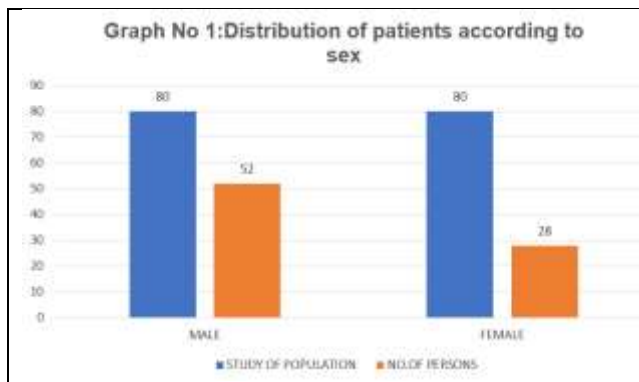
Table 1. Distribution of Patients According to Their Age, Sex and Final Diagnosis

Category	Diseases	Our Study	Perz-Guzman
Upper Zone	NON-DMTB	78.94%	56%
	TBDM	25%	17%
Lower Zone	NON- DMTB	10.52%	7%
	TBDM	50%	19%
Multi Zone	NON-DMTB	10.52%	36%
	TBDM	25%	64%

Table 2. Comparison of Patients According to Zone Predilection in Tuberculosis in Diabetics Versus Nondiabetics

Diseases	Our Study	Kelvin Rivera Manzano
TB	62.5%	38.33%
Pneumonia	30%	30%
Malignancy	6.25%	18.33%

Table 3. Comparison of Patients According to Aetiology



REFERENCES

- [1] Tuddenham WJ. Glossary of terms for thoracic radiology: recommendations of the nomenclature committee of the Fleischner society. *AM J Roentgenol* 1984;143(3):519-517.
- [2] Rao S. Tuberculosis and patient gender: an analysis and its implication in tuberculosis control. *Lung India* 2009;26(2):46-47.
- [3] Lillington GA. A diagnostic approach to chest diseases. Chap- 13, 2nd edn. Baltimore: Williams and Wilkins 1987:245-246.
- [4] Miura H, Taira O, Hiraguri S, et al. Cavitating adenocarcinoma of the lung. *Ann Thorac Cardiovasc Surg* 1998;4(3):154-158.
- [5] Manzano KR. Prevalence and risk factors of cavitary lung lesions in a metropolitan hospital at San Juan Puerto Rico. *Chest* 2015;148(4):143A.
- [6] Woodring JH, Fried AM, Chuang VP. Solitary cavities of the lung: diagnostic implications of cavity wall thickness. *Am J Roentgenol* 1980;135(6):1269-1271.
- [7] Andreu J, Cáceres J, Pallisa E, et al. Radiological manifestations of pulmonary tuberculosis. *Eur J Radiol* 2004;51(2):139-149.
- [8] El-Khushman H, Momani JA, Sharara AM, et al. The pattern of active pulmonary tuberculosis in adults at King Hussein Medical center, Jordan. *Saudi Med J* 2006;27(5):633-636.
- [9] Shumy F, Faiz MA, Anam AM. Predilection of zonal involvement and pattern of opacities in chest x-ray in post-primary tuberculosis. *Mymensingh Med J* 2013;22(4):721-726.
- [10] Perez-Guzman C, Torres-Cruz A, Villarreal-Velarde H, et al. Atypical radiological images of pulmonary tuberculosis in 192 diabetic patients: a comparative study. *Int J Tuberc Lung Dis* 2001;5(5):455-461.
- [11] Carpenter JL. Klebsiella pulmonary infections: occurrence at one medical center and review. *Rev Infect Dis* 1990;12(4):672-682.
- [12] Wang JL, Chen KY, Fang CT, et al. Changing bacteriology of adult community-acquired lung abscess in Taiwan: Klebsiella pneumoniae versus anaerobes. *Clin Infect Dis* 2005;40(7):915-922.

- [13] Macfarlane J, Rose D. Radiographic features of staphylococcal pneumonia in adults and children. *Thorax* 1996;51(5):539-540.
- [14] Aviram G, Fishman JE, Sagar M. Cavitory lung disease in AIDS: etiologies and correlation with immune status. *AIDS Patient Care STDs* 2001;15(7):353-361.
- [15] Gray KJ, French N, Lugada E, et al. *Rhodococcus equi* and HIV-1 infection in Uganda. *J Infect* 2000;41(3):227-231.
- [16] Riyah Adil JA. CT Charecterization of cavitory lung lesions. *Thi-Qar Medical Journal (TQMJ)* 2012;6(1):32-47.
- [17] Maden E, Teke T, Uzun K. Cavitory pulmonary lesion due to systemic lupus erythematosus: an unusual manifestation. *Pak J Med Sci* 2011;27(3):711-713.