

RADIOLOGICAL MANIFESTATIONS OF PULMONARY TUBERCULOSIS IN PATIENTS REGISTERED AT DOTS CENTERS IN SULAIMANI, IRAQ 2010-2011

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ABSTRACT

Background

The radiological findings of pulmonary tuberculosis show considerable variations but, in most cases, they are characteristic enough to suggest the diagnosis. Chest X-Ray remains an important tool of screening and diagnosis of the disease.

Objectives

The current study aims to describe the radiological findings in patients treated for tuberculosis in DOTS centers in Sulaimani city.

Methods

A CXR of a total of 179 patients diagnosed with tuberculosis during 2010-2011 were checked for findings in this analysis.

Results

The most common finding was infiltration in 127 (71%) cases followed by pleural effusion (18%), opacity (6%) and a cavity in 3% of the patients. Types of lesions were not statistically associated with age or sex. The right lung alone was the most affected side in 47% of cases, left lung in 33% and both lungs in 20% of cases. The lesions involved the upper zone in 69% of cases followed by the lower zone (16%) and the middle zone (15%). The overall mortality of these patients was 4.5%. Older age was a significant factor of death as mortality was 10.6 % in patients aged 65 and over while it was 5.8% in patients aged between 35-65 and zero in younger patients. The middle zone lesions were associated with a statistically higher mortality rate compared to the other zones.

Conclusion

The study showed that the infiltration was the most common radiological finding, the right lung was most affected, and mortality was higher in older age and middle zone lesions. Evaluation of CXR findings of tuberculosis patients remains important both for diagnosis and follow-up.

Keywords: *Tuberculosis, Chest X-Ray, Sulaimani, Iraq.*

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INTRODUCTION

In the current global situation where tuberculosis (TB) is reemerging as a major public health problem in many developing countries, rapid diagnosis and treatment have been emphasized by the WHO to provide appropriate therapy and reduce complications and fatal consequences ⁽¹⁾. Tuberculosis remains a major public health problem as there were 6.3 million incident cases and 1.3 million deaths in 2016 according to the report, and it is still the ninth leading cause of death worldwide ⁽¹⁾.

The purpose of screening chest X-ray (CXR) is to identify persons with active TB in high-risk populations as it may demonstrate findings consistent with prior as well as current infections ⁽²⁾. While the radiological findings are important for the diagnosis of TB, they may not be conclusive in the diagnosis of pulmonary tuberculosis that's why it has been emphasized and recommended as a screening examination of the population with bacteriological testing for all those with signs or symptoms suggestive of TB. CXR is also the mainstay in the evaluation of suspected or proven pulmonary TB ⁽³⁾.

Lymphadenopathy is the radiologic hallmark or dominant of primary TB and the prevalence of it decrease with increasing age. Effective control of TB requires early identification, isolation, and treatment of persons with active TB. The diagnosis of TB requires a high index of suspicion raised by medical history, physical examination, imaging studies and laboratory results for tuberculosis ⁽³⁾.

The radiological features show considerable variation, but if present, in most cases they are characteristic enough to suggest a diagnosis ⁽⁴⁾. In spite of this, as many as 15% of conventional chest radiographs may be normal in primary tuberculosis ⁽⁵⁾ making bacteriological diagnosis very important in the correlation with the CXR. In 2016 national TB prevalence survey in the Philippines showed 92% of diagnosed screened cases positive on chest X-ray ⁽¹⁾. CXR is a good screening tool for pulmonary TB because of its high sensitivity (87% to 98%, depending on how the CXR is interpreted ⁽⁴⁾, and up to 98% of those with culture-positive TB will have an abnormal CXR. From the perspective of the person being screened, CXR is a valuable tool because it provides rapid screening results for a range of medical conditions beyond TB ⁽⁶⁾. Every GP in India will need to consider TB as a differential diagnosis in persons with cough lasting two weeks or more and CXR is

very widely used in India ⁽²⁾. This study will evaluate the radiological findings and presentations of patients registered and treated in DOTS centers in Sulaimani, province, Iraq during 2010-2011. A full analysis of these and others without radiological findings is presented in a previous paper by the authors ⁽⁷⁾.

MATERIALS AND METHODS

Sulaimani is one of the three provinces of Kurdistan Region-Iraq with an estimated population of around 1,700,000 in 2010. There is a main TB center in the province and four centers in the major districts. Files of 307 patients were available for analysis out of which 179 patients had positive CXR findings and included in this study such as infiltration which is abnormal pathological appearance as a result of accumulation of substances cells and tissue at the site of exposed tissue to bacteria, virus or any other injuries. Infiltration, consolidations, and opacities could change the term position with each other. The initial and later CXRs of all patients were examined for positive findings. CXR images had been prescribed by Consultant Pulmonologist. Also, some essential sociodemographic characteristics of patients were extracted from the files for analysis. Patients' names and other identifiers were not recorded and thus privacy and confidentiality were respected. The study was approved by the relevant health authorities and the TB center. Data was analyzed in Stata.

RESULTS

A total of 179 patients diagnosed with TB during 2010-2011 were found to have chest X-ray findings and were included in this analysis. The characteristics of these patients are summarized in table 1. Almost 93% of these were new cases and 7% were relapse cases, 48% had positive sputum culture and 26% were older persons aged over 65 and over. The combination of the classical symptoms of cough, fever and weight loss was found in 47% of the patients and the mortality rate in these were 4.5%.

Table 2 shows distributions of major lesions found on plain chest radiographs of the patients before and after treatment. The most common finding was infiltration which was found in 127 (71.4%) of the patients. This was followed by pleural effusion (17.9%), opacity (6.1%) and a cavity in 3.4% of the patients. The resolution of these lesions after treatment was most prominent with infiltration which resolved in over 87% (i.e. lesion remained in 13% of patients). Pleural effusion resolved in 74.4% (remained in 25.6%) and opacities remained in 18.2% of cases. Types of lesions

were not statistically associated with age and sex.\

Table 3 shows the lesions with sides of the lung and zones affected. The right lung alone was the most affected side with 46.9% of cases followed by the left lung (33%) and both lungs 20.1%. In combination, the right lung was affected in 66.9% of cases and left lung in 53.1% of cases. The lesions involved the upper zone in 69.1% of cases followed by the lower zone (16.3% and the middle zone (14.6%).

The overall mortality of these patients was 4.5%. The mortality rate was analyzed by patient and lesion characteristics as shown in table 4. Although mortality was higher in females than males (6.7 vs. 2.3), this difference was not statistically significant. Older age,

however, was a significant factor of death as mortality was 10.6 in patients aged 65 and over, 5.8% in patients aged between 35-65 and zero in younger patents (p=0.02). Although mortality was higher when both lungs were affected (8.3%) and lowest when the right lung was affected, this difference was not statistically significant. With the zones affected, the middle zone lesions were associated with the highest mortality (11.5) and upper zone with the lowest mortality (2.4) and this association was statistically significant (p=0.04). Individual lesions (infiltration, cavity, effusion, etc) were not statically associated with significant differences in mortality.

Table 1. Characteristics of cases included in the analysis (n=179).

	Number	%
All	179	100.0
Male	89	49.7
Female	90	50.3
Year		
2010	100	55.9
2011	79	44.1
Diagnosis		
New	156	92.9
Relapse	12	7.1
Sputum culture		
Positive	85	47.5
Negative	63	35.2
Missing	31	17.3
Age group		
<35 years	80	44.7
35-64	52	29.1
65 and over	47	26.2
Classical symptoms (cough+ fever+ weight loss)		
Yes	84	46.9
No	95	53.1
Outcome		
Recovery/completion	171	95.5
Death	8	4.5

Table 2. Various X-ray findings.

	At diagnosis		After treatment	
	Number	% of the total	Number	% remaining
Infiltration	127	71.4	16	12.6
Pleural effusion	32	17.9	5	25.6
Opacity	11	6.1	2	18.2
Cavity	6	3.4	5	83.0
Fibrosis	1	0.6	1	100.0
Cyst	1	0.6	1	100.0
Upper mediastinal mass	1	0.6	0	0.0

Table 3. Patterns of lung affection.

	Number	%
Lungs affected		
Right lung	84	46.9
Left lung	59	33.0
Both lungs	36	20.1
Main zone affected		
Upper zone	123	69.1
Middle zone	26	14.6
Lower zone	29	16.3

Table 4. Mortality by patient and lesion characteristics.

Characteristic	Number (%) died	P-Value *
Gender		
Male	2 (2.3)	0.15
Female	6 (6.7)	
Age group		
0-34 years	0 (0.0)	0.02
35-64 years	3 (5.8)	
65 and over	5 (10.6)	
Lung affected		
Right lung	2 (2.4)	0.26
Left lung	3 (5.1)	
Both lungs	3 (8.3)	
Zone affected**		
Upper zone	3 (2.4)	0.04
Middle zone	3 (11.5)	
Lower zone	1 (3.4)	

DISCUSSION

The most common CXR findings in our study were infiltration which was 71.4% followed by pleural effusion (17.9%), opacity (6.1%) and a cavity in 3.4% of the patients.

Although previously published studies indicated that CXR is unreliable for the diagnosis of TB⁽³⁾, but still there is a big gap or variations between countries and regions^(1, 3, 8) and also between Immunocompromised and Immunocompetent Patients^(9, 10, 11), but using CXR as a screening tool is often considered as a cost-effective method. In addition to the diagnosis, CXR plays also a role in HIV/TB combined programs⁽¹¹⁾.

The radiological presentations of the TB remain individual and TB infects the lung parenchyma, pleura, lymph nodes and other parts of the respiratory system and extrapulmonary organs in 90% of patients, the infection remains latent. In approximately 5% it progresses to active disease within a short period, causing primary disease and in the remaining 5%, it may remain latent for many years before reactivating which we will see in our practice⁽¹²⁾.

There is an obvious difference between drug-sensitive (DS) and drug-resistant DR-TB especially multidrug-resistant MDR-TB which presents in various patterns, the radiological findings, such as cavity, fibrosis, bronchiectasis, calcification, node, atelectasis, bullae, emphysema, and other findings, were found more in MDR-TB group. The only exception was ground-glass opacity that was found more in the DS-TB group⁽¹³⁾, for DS TB group was infiltrate (66.7%) comparing our study almost the same, but for MDR-TB were cavitation (66.1%) and had a significant difference compared to DS-TB.

In a study from Iraq which was the only one I could find showed 41 cases (64.06%) were positive for acid-fast stain, while only 27 cases (42.19%) had CXR findings which was significantly lower than our results and they did not mention a detail about the patterns and the distributions of the CXR findings⁽¹⁴⁾.

All data indicate that there is a big variation between immunosuppressive and immunocompetent persons, but the radiological presentations are significantly different especially in the percentage of the consolidation and cavitation.^(1, 10, 11, 13, 14)

Riccardo P. et al used chest radiography for the diagnosis of TB and showed parenchymal opacities 83-96 % for primary diseases and (83-85%) for post-primary diseases⁽¹⁵⁾.

Our results fairly well correlated with a study radiological manifestation of pulmonary TB which showed around 73 % with consolidation in immunocompetent patients⁽¹⁶⁾. The evidence of parenchymal infection in other studies were variable between 70-90 % of adults^(3, 10) similar to the previous reports of 78 % to 85 %⁽¹⁷⁾.

Table 3 shows our results about the lesions with the sides of the lung and zones affected and we demonstrated that the right lung most affected side with (46.9%) of cases followed by the left lung (33%) and both lungs 20.1%. In combination, the right lung was affected in 69.1% of cases and left lung in 53.1% of cases.

The lesions involved upper zones then followed by lower zone and middle zone have been almost evidence base radiology of TB that the right lung is more affected than the left lung in all studies^(2, 3, 6, 14, 10), In the study of Anna R. Frank et al showed almost the same result, upper lung zones disease, for reactivation group (86%) and patients with primary tuberculosis (80%)⁽¹⁸⁾. The other findings like pleural effusion, cavitation, and miliary tuberculosis has been a big variations from study to the study and these radiographic presentations depend upon the study subjects, age, comorbidities, immunosuppressive medications and conditions like upper lobe cavitation in the immunocompetent adults whereas lower lung zone disease are the hallmarks of tuberculosis in an immunocompromised adult⁽¹¹⁾ and the most common abnormality in children is unilateral lymphadenopathy 90-95%⁽¹⁶⁾, and focal upper lobe opacities in HIV- seropositive TB was 15 %^(10, 19, 20, 21). The radiological features depend on age, underlying immune status, and prior exposure depicts the natural history and progression of the disease⁽²²⁾.

The resolution of these lesions after treatment was most prominent with infiltration which resolved in over 87% (i.e. lesions remained in 13% of cases). Pleural effusion resolved in 74.4% (remained in 25.6%) and opacities remained in 18.2% of cases. The most resistance findings to the medical treatment are cavitation which was remained in 5 of 6 cases (83% of cavities remain unchanged). Types of lesions were not statistically associated with age and sex.

A study from south Iran, prevalence and treatment outcome of pulmonary and extrapulmonary pediatric tuberculosis, 57 % of cases were pulmonary TB they did not use CXR in the diagnosis although most of the patients were above 10 years and then showed 91.7% were successfully treated and 8.3% had poor treatment outcome among children and only (2.2%) of the registered TB children were documented as dead. Unfortunately, the study could not help us in the patterns and the distribution of the CXR findings⁽²³⁾.

Seyed Mohammad et al. showed valuable data about the radiological manifestations, outcome, and mortality among children and elderly TB patients^(22, 23). Overall mortality in our study was 4.5%. The mortality rate was analyzed by patient and lesion characteristics as shown in table 3. Although mortality was higher when both lungs were affected and lowest when the right lung was affected, this difference was not statistically significant. Individual lesions (infiltration, cavity, effusion, etc.) were not statically associated with significant differences in mortality. Mortality rate and treatment response in our study were low comparing results from most of the studies mentioned previously with a variation of 15 to 20 % in the elderly⁽²⁴⁾.

In the end, we were faced with a few obstacles which is important to mention these limitations:

-Lack of information about the primary infections and most of the cases were treated as a post-primary or active TB infections.

-It was a retrospective study and we could not get the most informative data and of course family and social related avoidance. information about chronic diseases and the use of medications were not systematically collected.

-Underlying chronic diseases or comorbidities had not been registered.

-Limitation of CT Chest (HRCT) use at that time to reveal and evaluate patterns and distributions of the findings.

In conclusion, the study showed that the infiltration was the most common radiological finding, the right lung most affected and mortality was higher in older age and middle zone lesions. Evaluation of CXR findings of tuberculous patients remains important both for diagnosis and follow-up. The cavity presentation in our study was 3,4 % which was lower than expected and for further study we recommend High-Resolution

Computerised Tomography (HRCT) to reveal more findings detail.

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