

‘Tennis Racket cavity’ on Chest Radiograph: Strong Predictor of Active Pulmonary Tuberculosis! – A Case Report

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Received August 22, 2014; Revised August 29, 2014; Accepted September 02, 2014

Abstract Tuberculosis is the leading cause of cavitation on chest radiograph, more than 90% cases with cavitary lung diseases are because of tuberculosis especially in high burden countries like India. Overall 8-24% of pulmonary tuberculosis cases are having cavitation on chest radiograph. Although no radiological feature is the predictor of tuberculosis, some morphological characteristic features of lung cavitation on chest radiograph will help in predicting active form of pulmonary TB from cured form of disease. In this case report we described a 26 year male, with symptoms of weight loss, fever and cough of 2 months duration, found to have ‘Tennis Racket cavity’ on chest radiograph. We investigated further and found to have sputum smear positive pulmonary TB. We documented therapeutic response to the routine anti tuberculosis (ATT) drugs, and shown complete clinical and radiological recovery. Careful chest radiograph evaluation and interpretation is must in all the cases with respiratory symptoms, high index of suspicion with adequate chest radiology training is key in high burden setting especially in South East Asian region to cut the transmission of disease.

Keywords: tennis racket cavity, pulmonary tuberculosis, chest radiograph, sputum smear for AFB

Cite This Article: Patil Shital, and Laxman Kasture, “ ‘Tennis Racket cavity’ on Chest Radiograph: Strong Predictor of Active Pulmonary Tuberculosis! – A Case Report.” *American Journal of Medical Case Reports*, vol. 2, no. 9 (2014): 167-169. doi: 10.12691/ajmcr-2-9-1.

1. Introduction

Tuberculosis (TB) is one of the most ancient diseases of mankind and has co-evolved with humans for many thousands of years or perhaps for several million years. [1] WHO fact sheet on tuberculosis stated that overall one third of the world's population (over 2 billion) is currently infected with the TB bacillus [2].

Cavitation is known complication of primary as well reactivation tuberculosis. Cavitation can occur in up to 40 percent of cases of reactivation tuberculosis. These cavities typically have moderately thickened walls, but fewer than 10 percent of cases have air-fluid levels. Cavities are associated with endobronchial spread of the disease [3].

Chest X-ray as a diagnostic tool is more sensitive but less specific with higher inter and intra reader variation. However, it should be used judiciously. It should always be preceded by a repeat sputum smear examination. [4] similarly; the lesions of pulmonary tuberculosis can take almost any form on a radiographic picture [5].

2. Case Summary

26 year male attended outdoor of pulmonary medicine with complaints of weight loss, decreased appetite, low grade fever with night sweats, Cough which was nonproductive initially progressed to purulent sputum since 2 months. Initially patient visited general physician for similar complaints and undergone investigations like chest x-ray, complete blood count, HIV tridot test.

Chest x-ray Picture is as following (Figure 1)

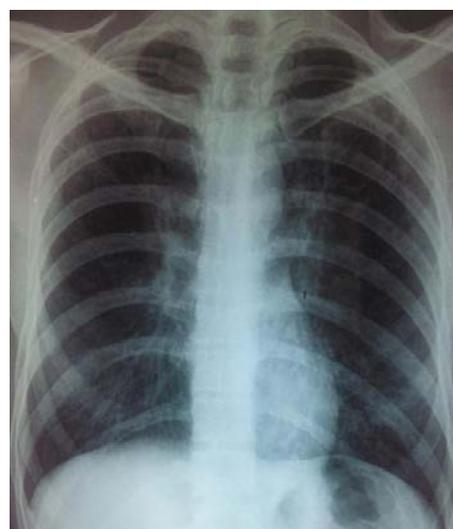


Figure 1.

Figure 1- chest x-ray PA Note thin walled cavity in left upper zone, with handle of it oriented along left hilum, a 'tennis racket' appearance of cavity. Classical spherical cavity with stem or handle is because of dilated and thickened bronchial wall because of destruction by underlying tuberculous process. (Careful interpretation is must!)

Complete blood count-Hemoglobin-9 gm% total WBC- 6900/cumm, Platelet count- 2.3 lacs

HIV tridot test- non reactive for HIV 1

Cavity on chest radiograph was missed by general physician, diagnosed as case of bronchitis and started him on beta-lactam group of antibiotics with bronchodilator mucolytic solutions for approximately 5-7 days. Patient show temporary recovery in symptoms, again visited general physician, never thought for careful chest x-ray evaluation or either referral to chest physician or at least sputum smear examination. General physician revised antibiotic, and patient received fluoroquinolones (Tablet Levofloxacin 750 mg once daily for 5 days). Patient reports marked clinical improvement. After transient clinical improvement on receiving Levofloxacin, his clinical condition starts worsening after 4 weeks, then GP referred case to outdoor of our department, pulmonary medicine. We documented complaints of weight loss, decreased appetite; productive sputum with yellowish purulent sputum was predominant symptoms. Respiratory system examination revealed bronchial breathing with crackles in right infraclavicular area and cavernous type of bronchial breathing in left infraclavicular area. We evaluated like chest radiograph, Hemogram, sputum smear for AFB, and blood sugar levels.

Chest radiograph as following (Figure 2) - Radiological worsening with bilateral upper and middle lung fields involvement as compared to previous chest x-ray taken 2 months back.

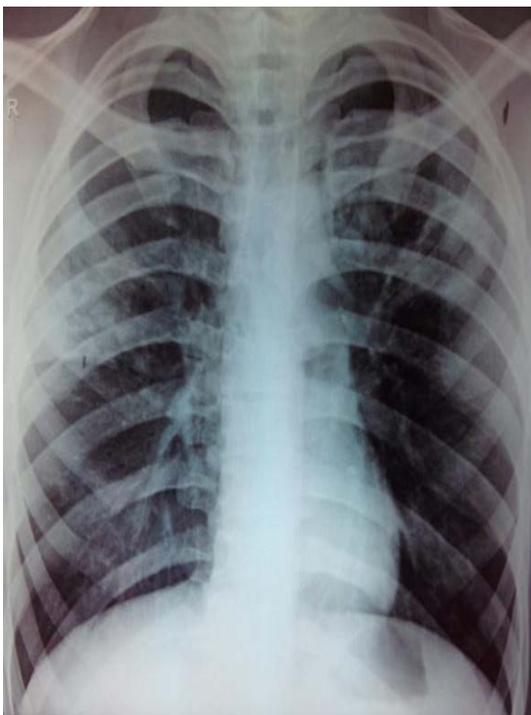


Figure 2.

Figure 2 – chest x-ray PA Moderate to thick walled cavity in left upper zone (note classical 'tennis racket'

appearance) with consolidation localized superiorly to horizontal fissure most probably in posterior segment of right upper lobe. Both the features significantly associated with pulmonary tuberculosis.

Complete blood count-Hemoglobin-7 gm% total WBC- 13600/cumm Platelet count- 2.3 lacs

Blood sugar level (random) - 118 mg% & ESR- 86 mm at the end of one hour

Sputum smear examination for AFB (Figure 3) - done ZN (zeihl nelson) staining after processing of good quality sputum and found to have positive for acid fast bacilli.

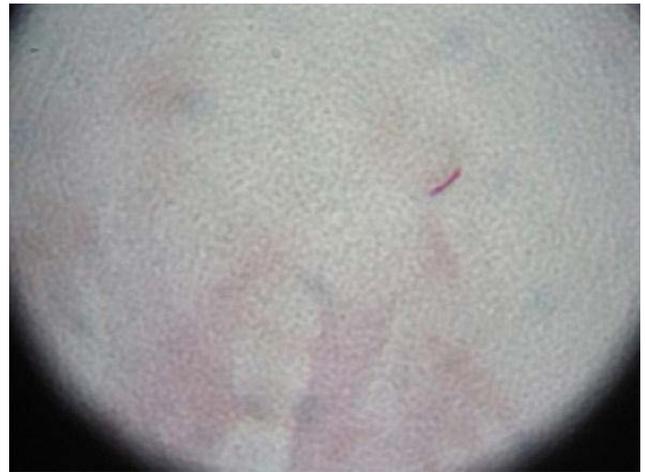


Figure 3. sputum smear AFB demonstration under oil immersion field

Patient received four drug antituberculosis chemotherapy containing Isoniazid, Rifampin, Pyrazinamide and Ethambutol for first two months of intensive phase and after that received Isoniazid, Rifampin for four months to complete six months regimen as per National guidelines for treatment of tuberculosis for new sputum positive case.

We documented clinical improvement in 6 weeks, bacteriological improvement in 6-8 weeks and radiological improvement at the end of chemotherapy in form of complete resolution of Tennis Racket Cavity.

We documented similar Radiological observation of Tennis Racket Cavity in four cases, with bacteriological confirmation in all the cases and complete therapeutic response to antituberculosis treatment in all four cases.

3. Discussion

3.1. Cavitory Lesions on Chest Radiograph [6]

The CXR showing cavity on either side of lung fields, either solitary or multiple suggestive of active pulmonary tuberculosis. In general, thin-walled cavities (<5 mm) tend to be infective and, when thick-walled (>10 mm), squamous cell carcinoma of the lung enters into the differential diagnosis. Other differential diagnoses of cavitory pulmonary lesions include infections from

Staphylococcus, *Klebsiella*, anaerobes, and non-infectious causes like squamous cell carcinoma of the lung, pulmonary infarcts, Wegener's granulomatosis, and rheumatoid nodules [6].

3.2. Cavitory Lesions and Tuberculosis [7]

Cavitation is a distinct feature of reactivation tuberculosis and is a finding of considerable diagnostic importance, since it usually indicates disease activity. One or more thin or thick walled cavities with a generally smooth inner lining, with high predilection for apical or posterior segment and superior segment of lower lobe are salient features. However, within the upper lobe, anterior segment involvement is rare. Fluid levels may be seen and may aid in the recognition of cavities, the walls of which may be indistinct or obscured by overlying densities. Frequently, however, fluid levels are not present [7].

3.3. Importance of ‘Tennis Racket cavity’ [8]

When tuberculous process is virtually confined to the bronchus, resulting in narrowing or occlusion with dilatation beyond, or in local wall destruction with weakening and dilatation, the ring shadow is in fact a dilated bronchus, and the wall of the ‘cavity’ has the histological feature of bronchial wall with or without tuberculosis foci in it. The rest of the bronchus, extending proximally towards the hilum, is often dilated as well, and its wall thickened by tuberculous involvement, so that a so called ‘tennis racket’ shadow. The draining bronchus of the most of the tuberculous cavities, whatever the type, is either concurrently or secondarily infected, leading to tennis racket appearance [8].

3.4. ‘Tennis Racket cavity’ as a Predictor of Active Tuberculosis [4]

Diagnosis of active tuberculosis needs confirmation by obtaining sputum and staining with fluorochrome or Zeihl Nielson and or culturing with Lowenstein Jansen media whenever initial smear examination is negative for AFB. The investigators found that the number of tubercle bacilli in the various types of lesions varied substantially. In an encapsulated, solid nodule, 2 cm in diameter, having no communication with the bronchi, the number of bacilli ranged from about one hundred (102) to not more than a few thousand (104). In contrast, a cavitory lesion of the same extent might contain about 10 million to a billion bacilli (107-109), i.e. 100 000 times as many as in noncavitory lesions. Such enormous quantities of tubercle bacilli discharged with the sputum can invariably be demonstrated by simple smear microscopy. Cavitory upper lobe disease has good correlation with a sputum positive smear and hence is extremely infectious [4].

We observed, smear examination is positive with higher grades i.e. 3+ on microscopic examination for AFB under oil immersion technique by ZN staining.

3.5. Response to Antituberculosis Treatment

Clinical response to antituberculosis treatment observed in case with ‘tennis racket’ cavity on chest radiograph; smear positive AFB in six weeks of starting chemotherapy. Bacteriological response was documented in as sputum smear conversion i.e. negative for AFB in seven weeks.

Radiological response was assessed by analyzing morphological characteristics of cavities like size, shape, thickness and number on chest radiograph by performing chest radiograph at interval of eight weeks of starting ATT.

We performed chest radiograph at 2, 4, 6 months of starting ATT. We documented radiological response as decrease in thickness of cavity in 2 months of chemotherapy, decrease in size of cavity in 4 months of chemotherapy and complete resolution was observed in four cases at completion i.e. 6 months of chemotherapy.

Response to ATT containing four drugs Isoniazid, Rifampicin, Pyrazinamide and Ethambutol as recommended by National Tuberculosis control programme and DOTS (directly observed treatment, short course) was excellent. Delayed radiological response as compared to clinical and bacteriological examinations was evaluated further with repeat smear examinations for AFB which were found to be negative, that means radiological response may lag behind in few cases; but frequent smear examination is must to assess response and predict early MDR (multidrug resistant tuberculosis) especially in high burden countries like India.

4. Conclusion

Although tuberculosis is the leading cause of ‘cavity’ on chest radiograph globally, no radiological pattern is specific for tuberculosis. Proportionate number of tuberculosis cases in India are having cavity on chest radiograph especially reactivation cases. ‘Tennis racket cavity’ is not very commonly described in literature as a predictor of active pulmonary tuberculosis. We confirmed higher grades of bacteriological yields in AFB smear examination in cases with ‘tennis racket cavity’.

Hence, carry home message is all the cases with ‘Tennis racket cavity’ on chest radiograph should be analyzed thoroughly for underlying active pulmonary tuberculosis, as it indicates underlying active disease process due to *Mycobacterium tuberculosis*.

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