CT IMAGINES OF PULMONARY TUBERCULOSIS AT OBRERO AND LUIS URIA HOSPITALS IN LA PAZ CITY

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ABSTRACT

Lung TB images depend on diverse aspects:
CT happens to be a highly sensitive technique, better than conventional x-ray films, for active and inactive TB cases detection.
The purpose of this communication is to show the most frequent CT findings seen in patients with pulmonary TB, who were diagnosed by bacteriological methods.
Bolivia has one of the highest TB rates in South America; reason enough to know the recognized facts about this disease, properly.

KEY WORDS
Pulmonary TB, active and inactive.

INTRODUCTION

Radiological images of pulmonary TB, depend on diverse facts, such as previous exposition to TB bacilli, age and patients immunitary status. (1). As it is well known, conventional x ray film, reaches a good sensitivity grade to diagnose active lungs disease (2,3). However, conventional CT showed to exceed conventional X-ray in order to detect changes that suggest active disease.

It is well known that CT shows more sensitivity to diagnose cavities and complications related to post- primary tuberculosis. (1,2,4).

Medical literature reports that CT findings related to active TB, are: micro and macronodules, cavities air-space consolidations and ground glass infiltrates, suggesting inactivity on the other hand, findings of retracted bronchiectasis, emphysema, broncovascular distortions, fibrotic changes and calcified mediastinal, adenopathies with high resolution CT (HRCT) we find lobe centred nodules, branched linear structures that mean endobronchial seeding, formerly known as “bud on tree”(6)

In this essay, we report the most frequent CT findings in patients who started to receive treatment because of diagnosed pulmonary TB; at CNS hospitals Obrero and Luis Uria de la Oliva.
Bolivia has one of the highest rates of tuberculosis in south America, reason enough to well know the facts related to that disease.

Recent WHO communications suggest that 1800 million people around the world are TB infected, also that there are 7.9 million of new cases per year, and that 1.8 million of deaths each year (7).

Are due to TB CT is considerably precise in primary TB investigation It can identify TB focus that conventional x rays cannot (5,6,8). As well CT can detect cavities hidden into a pleural effusion. CT can also identify bronchial stenosis, bronchial oclusions and polipoid endobronchial lesions, that can cause lung collapse.

Hilar and mediastinal lymphadenopathy, can easily be recognized, lymph nodes in TB lymphadenitis, especially when they reach more than 2cm diameter. (6, 8,9)

Show a low density center with enhancing border this kind of focal adenopathy, in children or in young people is highly suggestive of tuberculosis. Tuberculous meningitis or military TB can complicate primary TB (8). High resolution CT can detect military TB, when it is still not visible on conventional X ray films. (9).

Some of CT indications, and eventual findings, are: Cavities, suggesting that disease is active, especially when cavity contour is ill-defined, and “rosette” images in surrounding lung, that mean infiltrates, are seen. The cavity inner wall, is smooth and irregular, and cavities have just a few fluid amount. CT detection of a cavity hidden by a large pleural effusion. Can be an important evidence of pleural TB. (1,2,3,5,6,9).

CT detects infiltrates not shown on plain x-ray films, and can help to explain hilar or mediastinal adenopaties, specially in adult patients. Pulmonary nodules pattern quality, is quite variable. The nodules themselves can show particular features of central low density and enhancing contour. Afterwards calcification can be detected. (1,2,3,5,6,9).

CT is more accurate than plain x-ray films to detect military TB (9). Bronchiectasis related to TB, is easily detected by CT. (5.8.9).

Cavitation, especially when it is wide and irregular, thick walled or within a consolidation area, is very suspicious. However, surrounding lung areas must be carefully studied, because they may bring up, important ancillary findings, such as interlobular septa thickening, ground glass opacities, bronchial and vascular thickening and nodules, with branched opacities, bud-tree images, and lobular centered rosettes images. Lungs miliary infiltrates are an absolute finding of activity. As well pleural and pericardic effusions associated to TB parenchymal changes, are a strong indicator. (5,8)

At hila and mediastinum, activity is marked by lymph nodes that show a central low density, with enhancing contour. At the tracheobronchial tree, activity is marked by irregular wall thickening with stenosis or oclusions, thickened wall contrast enhancing, and peribronchial muffs that indicate peripheral extension. (5,8)

Of the disease about CT findings that suggest lung and mediastinum TB activity, we have: in lungs: centrelobular nodules or branched structures; “bud in tree images”, micronodules,
ground-glass areas, consolidations, cavities, septal interlobular thickening, miliary nodules, pleural thickening and effusions, and pericardial effusions. (5,8,9).

Lymph nodes show a central low attenuation zone. Peripheral enhancing and calcifications in 20% of cases.

In trachea and bronchi, there are irregular stricture, enhancing wall thickening, occlusions with peripheral peribronchial muffs. Signs that suggest inactivity in lung are: calcification, bronchiectasis, bronchial vascular distortion, pleural thickening or retractions, fibrosis, cavitation (5,8,9).

Lymph nodes have a uniform density and 80% of them show calcifications.

Trachea and bronchi, show stricture, often smooth, subtle or absent wall thickening and occlusion without peripheral peribronchial muffs (5,9)

**MATERIALS AND METHODS**

Our purpose was to find out CT findings related to active and inactive lung TB, so we reviewed retrospectively, CT studies performed to Obrero and Luis Uria Hospitals from January to September, 2008.

Selected for the study, were patients with Lung TB diagnosis, proven by bacteriological methods, undergoing treatment schemes, also inmates and external patients diagnosed at Obrero and Luis Uria Hospitals, who have had complications.

During that time, there were performed 37 chest CT studies to patients diagnosed of lung TB.

There were reviewed 32 CT studies of patients suffering of bacteriologically proven TB and who have started treatment schemes. There were not included patients in whom TB diagnosis was not bacteriologically proven. (5 patients).

All the studies were performed using a Philips 10-multislice Device. AT CT Unit, Image Dept. Obrero Hospital.

The conventional Chest CT studies protocol is as follows: Collimation: 1.5mm Kvp: 120 mA: 250 Indix: 10mm.Pith: 0.9. Rotation Time: 0.5.

Conventional CT was performed to 29 patients: 27 of them with IV contrast, and 2 of them, with no IV contrast, according to referring physician instructions.

Only in 3 patients, High Resolution CT was made.

CT and HRCT studies were reviewed at CT Dept. Work Station. Total of patients, were 32 two radiologists, read the studies.

Bidimensional and Tridimensional reconstructions were made, with multiplanar projections, and sometimes with maximal intensity projections. (MIP)

Based in those radiologists reports, an active and inactive TB findings was made. Those studies were classified according to findings of each report.
TABLE N-1
CT ACTIVITY CRITERIA
OBRERO- LUO HOSPITALS CNS

<table>
<thead>
<tr>
<th>ACTIVITY CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Micronodules</td>
</tr>
<tr>
<td>2 Macronodules</td>
</tr>
<tr>
<td>3 Ground Glass Opacities</td>
</tr>
<tr>
<td>4 Consolidation areas</td>
</tr>
<tr>
<td>5 Cavitation</td>
</tr>
<tr>
<td>6 Miliary nodules</td>
</tr>
<tr>
<td>7 Pleural effusions</td>
</tr>
<tr>
<td>8 Mediastinal Adenophaties</td>
</tr>
</tbody>
</table>

TABLE N-2
INACTIVITY CT CRITERIA
OBRERO- LUO HOSPITALS CNS

<table>
<thead>
<tr>
<th>INACTIVITY CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Calcified Granuloma</td>
</tr>
<tr>
<td>2 Brochiectasis</td>
</tr>
<tr>
<td>3 Fibrosis</td>
</tr>
<tr>
<td>4 Pulmonary Destructive Pattern</td>
</tr>
<tr>
<td>5 Emphysematous Pattern</td>
</tr>
<tr>
<td>6 Pleural Thickening or Retraction</td>
</tr>
<tr>
<td>7 Calcified nodules</td>
</tr>
</tbody>
</table>

RESULTS

Patients were distributed as follows: Male 21 (66%), female 11 (34%) ages ranging between 30-75 years. Media: 38 years. Standard Deviation (SD): 20.

The most frequent site of lesions, was upper lobes (1-2 Figures)

Figure N-1
Multiplanar coronal and MIP Reconstructions
RSL Consolidation
(Courtesy Obrero Hospital)
Figure N- 2
Multiplanar coronal Reconstruction
Interstitial Destructive Pattern, in LUL
(Courtesy Obrero Hospital)

![Image of lung CT scan showing multiplanar coronal reconstruction with interstitial destructive pattern in the left upper lobe.]

**TABLE N- 3**
Activity CT Criteria
CNS OBRERO - LUO HOSPITALS.
OWN ELABORATION

<table>
<thead>
<tr>
<th>ACTIVITY CRITERIA</th>
<th>STUDIES WITH THE CONDITION</th>
<th>FREQUENCY OF PRESENTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Micronodules</td>
<td>11</td>
<td>58%</td>
</tr>
<tr>
<td>2  Macronodules</td>
<td>2</td>
<td>10%</td>
</tr>
<tr>
<td>3  Ground-glass opacity</td>
<td>4</td>
<td>21%</td>
</tr>
<tr>
<td>4  Consolidated areas</td>
<td>12</td>
<td>63%</td>
</tr>
<tr>
<td>5  Cavitation</td>
<td>4</td>
<td>21%</td>
</tr>
<tr>
<td>6  Miliary nodules</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>7  Pleural Effusions</td>
<td>6</td>
<td>31%</td>
</tr>
<tr>
<td>8  Mediastinal adenophaties</td>
<td>9</td>
<td>47%</td>
</tr>
</tbody>
</table>

The most frequent active TB finding, was consolidation, seen in 12 Studies, (63%). (Figures 1,3 and 4)
Micronodular infiltrate was the second most frequent finding, and was seen in 11 studies (58%). (Figure 5, 6a and 6b)
According to present medical publications, maximal intensity projections, can identify small lung nodules (1 to 3mm) as we have shown in figures 6a and 6b.
Pleural effusion was seen in 6 studies (31%). (Figures 7, 8a and 8b). As third most frequent finding.
Cavitation was seen in 4 studies (21%), (Figure 9 and 10), as thin wall cavitated masses. One of the lesions seen showed a low attenuation area related to necrosis. (Figure 10).
Ground glass opacity, was seen in 4 studies (21%). (Figure n- 11)
Three studies (16%) were diagnosed miliary TB.
Macronodules were described only in two studies (10%).
Non calcified mediastinal adenopathies, were seen in 9 studies (47%)
Activity associate findings, were seen.

Thirteen patients had CT criteria of inactivity. We found frequencies as table 4 shows:

<p>| TABLE N- 4 |</p>
<table>
<thead>
<tr>
<th>Inactivity CT Criteria</th>
<th>CNS OBRERO - LUO HOSPITALS. OWN ELABORATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>INACTIVITY CRITERIA</td>
<td>STUDIES WITH THE CONDITION</td>
</tr>
<tr>
<td>1 Calcified granuloma</td>
<td>3</td>
</tr>
<tr>
<td>2 Bronchiectasis</td>
<td>10</td>
</tr>
<tr>
<td>3 Fibrosis</td>
<td>10</td>
</tr>
<tr>
<td>4 Lung destructive Pattern</td>
<td>5</td>
</tr>
<tr>
<td>5 Emphysematous Pattern</td>
<td>7</td>
</tr>
<tr>
<td>6 Pleural Thickening or retraction</td>
<td>9</td>
</tr>
<tr>
<td>7 Calcified Lymphnodes</td>
<td>10</td>
</tr>
</tbody>
</table>

Inactivity more frequent findings, were fibrosis and bronchiectasis which were found in 10 studies, respectively (77%).
(Figures 12a, 12b, and 13)
Figure N-12a
Coronal Reconstruction MIP
Pulmonary Fibrosis
(Courtesy Obrero Hospital)

Figure N-12b
Axial CT Wide window. Pulmonary Fibrosis
(Courtesy Obrero Hospital)
Pleural thickening and reaction were present in 9 studies (69%). (Figure N-14)

An emphysematous pattern was seen in 7 studies (54%). Calcified Granuloma was seen in 3 cases (16%) (Figure N-15).
Destructive Interstitial Pattern, was seen just in 5 cases (38%) (Figure N- 16)

Calcified mediastinum adenophaties were seen in ten studies (77%). (Figure N- 17). There was an association between conditions seen.
Between post primary TB complications, we found out, three studies with neumothorax (Figure N-18) And three with pleural emphyema (9%). (Figure N-19). Respectively.
DISCUSSION
Conventional CT seem to be a technique with very high sensitivity, and better than conventional X-ray, for detecting active and inactive TB cases, as well as to detect cavities, and post-primary TB complications. (2,5).
It is important to know about classical active tuberculosis findings, we found, as well as some authors did in their series (5,8,9), that most frequent active TB radiological sign, is consolidation. However, this pattern is often associated to others that suggest activity as well like ground glass, and micronodular pattern.
We emphasize association of different activity patterns, with pleural effusion.
We have found that not all of our active TB cases show mediastinal adenopathies and even that some of them could be calcified, as literature reports (5,7), it is possible that up to 20% of them, were calcified.

CT inactive TB findings, often are associated. We have seen frequently pleural thickening and retraction, Lung fibrosis and bronchiectasis. Adenopathies are calcified.

As well as Gonzales Costan et al (5). We have found out, that conventional CT (TCMD) and 2D, 3D and MIP reconstruction technique, as well as HRCT, show exquisitely CT patterns in active and inactive.
Our communication supports the value of conventional CT and its different techniques, for the investigation of active and inactive Lung TB.

It is important to let people know that the most frequent pattern seen in active TB is consolidation followed by bronchogenic dissemination, through fine micronodular pattern or bud in tree, pattern.
In case of an inactive TB, it is very frequent to see Lung Fibrosis associated to calcified adenopathies and bronchiectasis, which have been the most characteristic findings in this study.

**REFERENCE**