Mediastinal Lymphadenopathy in Pulmonary Sarcoidosis: Typical and Atypical Multi-Slice CT Findings


The Department of Radiology, Thoracic Imaging Unit, Faculty of Medicine, Cairo University

Abstract

Background: Sarcoidosis is a multisystem chronic inflammatory condition of unknown etiology. It is characterized by non-caseous epithelioid cell granulomas and changes in tissue architecture, which may affect almost any organ. Involvement of the mediastinal lymph nodes and the lung is most common, being seen in approximately 90% of patients. Multi-slice computed tomography (MSCT) plays a very important role in diagnosing typical and atypical nodal affection in sarcoidosis.

Aim of the Work: The purpose of this study is to depict the different patterns of mediastinal lymphadenopathy in sarcoidosis (especially atypical cases) and explore the role of MSCT for its diagnosis.

Patients and Methods: This study included 47 cases; 42 females and 5 males, age range 23 to 62 years old (average 42.66 years). Cases were referred to the Radiology Department Kasr Al-Aini for MSCT assessment of the chest. The patients were subjected to thorough clinical evaluation, laboratory assessment, CT chest (post intravenous IV contrast administration) done to all patients using MDCT (Toshiba- Aquillion, 64 detectors).

Results: In this study multi-slice computed tomography (MSCT) detected various CT chest signs in sarcoidosis patients with mediastinal lymphadenopathy.

Key Words: Multi-slice computed tomography – Lymphadenopathy – Typical and atypical sarcoidosis.

Introduction

SARCOIDOSIS is a multisystem disorder of unknown cause that is characterized by the presence of non-caseating granulomas and the proliferation of epithelioid cells [1].

Although sarcoidosis can affect patients of any age, sex, or race, it typically affects adults less than 40 years old, and the incidence peaks in the 3rd decade of life (ages 20-29 years) [2]. The diagnosis of sarcoidosis is commonly established based on clinical and radiological findings that are supported by histological findings [3].

In most studies, a higher rate of occurrence has been found among women than among men, across racial and ethnic groups [4].

The clinical signs and symptoms are nonspecific and include fatigue, general malaise, weight loss, and less commonly fever [3]. The characteristic radiological findings associated with sarcoidosis have been well described and the findings include bilateral hilar lymphadenopathy and parenchymal abnormalities [5]. In sarcoidosis, granulomas are widely distributed throughout numerous organs and tissues. They congregate in lymph nodes and in tissues with a rich lymphatic supply [6,7]. Thoracic Sarcoidosis has been called “the great pretender” as it manifests with various patterns at radiological imaging, with an initial broad pattern of differential diagnosis, including lymphoma, tuberculosis and other causes of chronic pulmonary infiltrates [7]. Pulmonary sarcoidosis may manifest with various CT patterns typically: (A) Bilateral hilar lymph node enlargement is the most common finding. (B) Parenchymal and pleural affections [3].

Concerning typical pattern of sarcoid mediastinal lymphadenopathy; the most common pattern is well-defined, bilateral, symmetric, hilar and right paratracheal lymph node enlargement “1, 2, 3” sign [7].

Bilateral hilar lymph node enlargement, alone or in combination with mediastinal lymph node enlargement, occurs in an estimated 95% of patients affected with sarcoidosis. Middle mediastinal nodes (at the left paratracheal level, subcarinal level, and level of the aortopulmonary window), prevascular nodes, or both are involved in approximately 50%
of patients [3]. Bilateral hilar lymph node enlargement may be a feature of infection (particularly fungal or mycobacterial infection) or malignancy (e.g. lymphoma) [5]. However, in the absence of specific symptoms or signs, sarcoidosis is the most common cause of bilateral hilar lymph node enlargement [3]. The risk of malignancy is low in patients with bilateral hilar lymph node enlargement and no history of malignancy, provided that findings at physical examination and routine blood tests are normal [5]. Histological confirmation is not required for a diagnosis of sarcoidosis in these patients. However, a biopsy should be performed if the chest radiographic findings worsen or specific signs and symptoms develop [8].

In atypical sarcoid lymphadenopathy; radiologic findings of lymph node enlargement may be asymmetric [9] or seen in unusual locations (e.g. internal mammary, paravertebral, abdominal and retrocrural regions) [7]. Such findings should lead to the inclusion of entities such as lymphoma or tuberculosis in the differential diagnosis. Isolated unilateral hilar lymph node enlargement (usually on the right side) is seen in less than 5% of cases [10].

Enlargement of mediastinal lymph nodes without hilar lymph node enlargement is even less common [3]. The enlarged nodes eventually may become calcified. The occurrence of lymph node calcification in sarcoidosis, as in other chronic granulomatous diseases, is closely related to the duration of disease; calcification occurs in 3% of patients after 5 years and in 20% after 10 years [11].

Calcifications may have an amorphous, punctate, popcorn-like, or eggshell-like appearance. Eggshell-like calcifications also may be seen in silicosis, and the other patterns of lymph node calcification in sarcoidosis may be indistinguishable from those seen in tuberculosis and histoplasmosis [11]. Atypical patterns of lymphadenopathy occur more frequently in patients older than 50 years [3].

**Aim of the work:**

The purpose of this study is to depict the different patterns of mediastinal lymphadenopathy in sarcoidosis (especially atypical cases) and explore the role of multi-slice CT, for its diagnosis.

**Patients and Methods**

This study included 47 cases; 42 females and 5 males, age range 23 to 62 years old (average 42.66 years) referred to the Radiology Department Kasr Al-Aini at the period from 2010 2011, till 2010 2012.

Twenty eight patients were already known to be cases of sarcoidosis: By transbronchial biopsy (twenty one cases), liver biopsy (five cases), and surgical biopsy from lower cervical lymph nodes (two cases).

Sixteen of them were under therapy by corticosteroids for periods ranging from one month to five years and were coming for follow-up.

Nine patients presented with persistent dry cough and dyspnea.

Two patients presented with erythema nodosum, one patient with arthralgia.

Out of the forty seven patients; thirty five complained of unexplained fatigue.

**Inclusion criteria:**

Biopsy proved sarcoidosis to all cases included in the study (transbronchial: thirty five cases, liver biopsy: ten cases, cervical lymph node biopsy: two cases).

**Methods:**

• Thorough clinical evaluation and laboratory assessment.

• **CT chest done:** To all patients using multi-detector computed tomography MDCT (Toshiba-Aquilion, 64 detectors). Post IV contrast CT was done in all patients. In ten patients non contrast multi-slice CT study was done also for detection of lymph node calcification (Table 1).

<table>
<thead>
<tr>
<th>Table (1): CT protocol For Toshiba-Aquilion multi-slice 64 channels CT scanner at Kasr Al-Aini Hospital.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation:</strong></td>
</tr>
<tr>
<td>Fasting for 6 hours prior to examination, adequate hydration for elderly patients and those who have renal impairment. Asking for any medications taken (especially oral hypoglycemic drugs), history of any allergic reaction to contrast media or drugs and anti-allergic measures for any allergic reaction.</td>
</tr>
<tr>
<td><strong>IV contrast:</strong> Non ionic contrast media (0.5-1mg/kg).</td>
</tr>
<tr>
<td><strong>CT scanning:</strong></td>
</tr>
<tr>
<td>The examination is done in supine position.</td>
</tr>
<tr>
<td>A scout is taken with 120kV and 120mA, then helical scanning is done in caudo-cranial direction to minimize respiration artifacts,</td>
</tr>
<tr>
<td>Slice thickness 10mm,</td>
</tr>
<tr>
<td>Pitch 1:5:1,</td>
</tr>
<tr>
<td>Speed (mm/rotation) 7.5mm,</td>
</tr>
<tr>
<td>Beam collimation 5mm,</td>
</tr>
<tr>
<td>Interval 1 cm,</td>
</tr>
<tr>
<td>Gantry tilt 0.0,</td>
</tr>
<tr>
<td>FOV depends on the patients’ body built, but is about 35cm,</td>
</tr>
<tr>
<td>kV 120-140,</td>
</tr>
<tr>
<td>mA 250-400,</td>
</tr>
<tr>
<td>Total exposure time 7 seconds (Toshiba).</td>
</tr>
</tbody>
</table>
• **Pulmonary function tests:** Done in 21 patients and showed restrictive changes in 18 patients and mixed changes in two patients and no appreciable changes in one case.

**Data assessment and interpretation:**

Based on literature [3,5,7,12]; The CT findings were divided into typical and atypical findings (Table 2).

<table>
<thead>
<tr>
<th>Table (2): Typical and Atypical Features of lymphadenopathy in Pulmonary Sarcoidosis at multi-slice CT [3].</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patterns of Lymphadenopathy in sarcoidosis:</strong></td>
</tr>
<tr>
<td><strong>Typical features:</strong></td>
</tr>
<tr>
<td>Bilateral.</td>
</tr>
<tr>
<td>Symmetric.</td>
</tr>
<tr>
<td>Well defined.</td>
</tr>
<tr>
<td>Hilar.</td>
</tr>
<tr>
<td>Mediastinal (right paratracheal).</td>
</tr>
<tr>
<td><strong>Atypical features:</strong></td>
</tr>
<tr>
<td>Unilateral.</td>
</tr>
<tr>
<td>Isolated.</td>
</tr>
<tr>
<td>Anterior and posterior mediastinal.</td>
</tr>
<tr>
<td>Calcified.</td>
</tr>
</tbody>
</table>

Table (3): Mediastinal lymphadenopathy of the studied cases (number and percentage of cases).

<table>
<thead>
<tr>
<th>No of cases</th>
<th>Bilateral hilar lymph nodes</th>
<th>Unilateral hilar lymph nodes</th>
<th>RPT</th>
<th>SC</th>
<th>PC</th>
<th>AM</th>
<th>PM</th>
<th>LPT</th>
<th>AP</th>
<th>Calcified nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of cases</td>
<td>93.6%</td>
<td>2.4%</td>
<td>85.1%</td>
<td>82.9%</td>
<td>59.5%</td>
<td>29.7%</td>
<td>42.5%</td>
<td>2.12%</td>
<td>10.6%</td>
<td>21.2%</td>
</tr>
</tbody>
</table>

**Results**

This study included 47 cases with sarcoidosis.

**Assessing their CT chest findings revealed:**

**Mediastinal lymphadenopathy:** Table (3) shows mediastinal lymph nodes distribution and percentage in studied cases (Table 3).

In nine patients (all females, age range 23-60) punctate calcification in the mediastinal lymph nodes were noted: in four out of them calcification was exuberant and in five it was micronodular. In one patient (male, age: 36 years) eggshell calcification was seen.

Fig. (1 A-C): Male patient 30 years with dyspnea and dry cough. Axial contrast material-enhanced CT scan (mediastinal window) shows (A) typical bilateral and symmetric hilar, (B) right paratracheal and (C) subcarinal lymphadenopathy (arrows).
Fig. (2 A-F): Female patient 54 years old presenting with left lower neck fullness due to lymphadenopathy, biopsy proved sarcoidosis. Axial post IV contrast enhanced CT (mediastinal window).

Fig. (3 A-C): Female patient 45 years old with scaroidosis presenting erythema nodosum. Axial contrast material-enhanced CT scan (mediastinal window) shows left unilateral hilar lymphadenopathy (arrows).

Fig. (4 A,B): Female patient 57 years old with sarcoid biopsy proved mediastinal lymph nodes. Axial CT scan with and without contrast material-enhancement (mediastinal window) shows typical bilateral and symmetric hilar and subcarinal lymphadenopathy, however, showing dense punctuate calcification (arrows).
Fig. (5 A,B): Male patient 36 years old known case of sarcoidosis coming for follow-up. Multi-slice CT in axial plane (mediastinal window) shows bilateral hilar lymphadenopathy with egg shell calcification (arrows).

Discussion

Sarcoidosis is a multisystem chronic inflammatory condition of unknown etiology. It is characterized by non caseous epithelioid cell granulomas and changes in tissue architecture [1]. Involvement of the mediastinal lymph nodes and the lung is most common, being seen in approximately 90% of patients [3], and accounts for most of the morbidity and mortality associated with the condition [13].

Plain films as a preliminary study is usually done with no evident changes detected in early stages or very subtle parenchymal changes, yet, it was helpful in staging of the disease process [14].

The limited role of the plain radiography in demonstration of the anatomic details of mediastinal lymph nodes that are involved in the disease, especially if they are mildly enlarged or if there is co-existent diseases that obscures their discrimination in two-dimensional plane, this necessitates their examination by another diagnostic modality with better resolution and for meticulous follow-up [15].

Computed tomography has a great value in establishing diagnosis either by demonstration of the thoracic and extra thoracic manifestations of the disease, better anatomical details regarding the mediastinal lymphadenopathy and parenchymal lesions or used as a guide for biopsy [18].

Computed tomography was of great value in establishing the diagnosis of thoracic sarcoidosis in terms of better demonstration of the anatomical details, clarifying the various groups of mediastinal lymph nodes, giving focused information about the morphology of the affected lymph glands. The adoption of multi-slice computed tomography (MSCT) technology testifies to its advantages over single slice computed tomography (SSCT). The principal basis of its advantages can be stated as follows: MSCT allows large anatomic ranges to be scanned while simultaneously producing both thin and thick slices and consequently results in lowered image noise with better contrast and spatial resolution and shorter scan time. The two major advantages of fast multi-detector row CT are a true isotropic through-plane resolution (spatial resolution) and a short acquisition time that enable high-quality examinations in severely dyspneic patients, this was also ensured by Gwnae-Cain, Taguchi & Anno, Flohr et al., and Miller et al., [11,17-19].

If biopsy from lymph nodes is necessary for the diagnosis, one of three techniques may be used: trans bronchial biopsy, CT guided biopsy, or surgical biopsy [20,21]. Such techniques were almost the same like those utilized in our study.

In our study the incidence of sarcoidosis is more common in females than in males in the studied sample, this goes with the results of Bourbannais and Samavati [4].

In this study, we used the same classification system of Criado et al., in which there are two main patterns of sarcoïd mediastinal lymphadenopathy; typical and atypical patterns [3] (Table 2).

The typical mediastinal lymphadenopathy in our study was bilateral hilar involvement, which was found in 93.6% of our patients (N=44 patients), and right paratracheal lymphadenopathy which was found in 85.1 % of our patients (N=40 patients), this was greatly matching Koyama et al., [6] stating that this typical lymphadenopathy pattern was found in 85% of patients. Actually this was not significantly different from Criado et al., [3] where combined bilateral hilar and right paratracheal lymphadenopathy were found in 95% Fig. (1).
In the current study we found mediastinal lymphadenopathy also in the subcarinal region in 82.9% of cases (N=39 patients), pre carinal region in 59.5% of cases (N=28 patients), left paratracheal, Fig. (2), region in 2.12% of cases (N=one patient), aorto pulmonary window in 10.6% of patients (N=5 patients) and in 29.7% of cases in the prevascular space (N=14 patients).

Atypical pattern of lymphadenopathy e.g. unilateral hilar, Fig. (3), was found in 4.25% of our patients (N=2 patients), this was almost similar to Park et al., and Whitten et al., [5,10] where such atypical pattern of lymphadenopathy was found in about 5% of patients or less.

Mediastinal lymphadenopathy without hilar lymphadenopathy is even less common. Moreover, isolated paratracheal lymphadenopathy has been rarely reported in sarcoidosis [8], and this goes with our results.

Calcified lymphadenopathy, Fig. (4), was found in 21.2% of our patients (N=10 patients) in one of these patients calcification was an egg shell pattern 2.12% of patients (N=one patient), Fig. (5), this agrees with Gwnae-Cain and Miller, who stated that mediastinal lymph nodes calcification in sarcoidosis patients occurs in up to 20% of cases [11,19].

According to Gwnae-Cain, atypical patterns of lymphadenopathy occur more frequently in patients older than 50 years [11]. This agrees with our study where the mean age of patients having atypical lymphadenopathy was 50.1 years [3].

Conclusion:

Multi-slice CT has an essential role in detection and recognition of both typical and atypical patterns of the sarcoid mediastinal lymphadenopathy and correlates it with pathologic data for early diagnosis and reduction of associated morbidity and mortality, moreover, it’s a good method for follow-up of already diagnosed cases.

References