Objectives

- Although *Ascaris suum* was once considered to be a subtype of *Ascaris lumbricoides*, these two entities are now thought to be separate species both morphologically (1) and immunoserologically (2). Humans are not often infected by *Ascaris suum*, due to the host specificity of this parasite for pigs.

- In Japan, parasitic infections decreased markedly following improvements in sanitation. However, they are once again drawing considerable attention. Although *Toxocara canis* and *Toxocara cati* are well known to cause visceral larva migrans lesions in the liver (3), an increase in the number of visceral larva migrans cases due to *Ascaris suum* is a foreseeable possibility (4), since the custom of eating raw porcine liver is still popular in Japan.

- Once a human becomes infected, the *Ascaris suum* larvae migrate among the various organs without growth, resulting in the clinical manifestation known as visceral larva migrans (1,5,6).

- The clinical manifestations of visceral larva migrans, which was first reported by Beaver in 1952 (7), are characterized by long-standing hypereosinophilia with hepatomegaly and/or pneumonia. Moreover, there are a wide variety of nonspecific symptoms, including general malaise, cough and liver function disorders (8).

- The purpose of this study was to retrospectively evaluate the pulmonary CT findings in patients with visceral larva migrans due to *Ascaris suum*.

References


Materials and Methods

Patients

- CT scans of the lungs of 35 patients (29 men, 6 women; age range: 18-84 years; mean age: 48 years) with visceral larva migrans due to *Ascaris suum* who had undergone chest CT scans between January 1994 and November 2007 at four institutions.

- Blood eosinophilia (range: 17-78%) was present in all patients. The diagnosis of pulmonary involvement was based on results from bronchoalveolar lavage (BAL) (n=21), surgical biopsy (n=1), transbronchial biopsy (n=3), and clinical findings (n=35).

CT Image Interpretation

- Three chest radiologists (F.O., Y.A., and S.M. with 23, 15 and 26 years of experience in chest CT image interpretation, respectively), who were aware of the underlying diagnosis, retrospectively and independently interpreted the CT scans.

- CT images were assessed with regard to each of the following radiological patterns: ground-glass attenuation, consolidation, nodules, thickening of bronchovascular bundles, interlobular septal thickening, crazy-paving appearance, bronchiectasis, honeycombing, enlarged hilar/mediastinal lymph node(s) (>1 cm in diameter of the short axis), pleural effusion (unilateral or bilateral) and pericardial effusion.

Comparison with Pathology

- Comparison of CT and pathologic findings was performed using actual specimens by a pathologist and 3 chest radiologists in 4 patients, using transbronchial biopsies in 3 and both transbronchial biopsies and surgical specimens in 1. Lung biopsies corresponding to the abnormal regions observed in the chest CT scans were performed within 14-44 days after the CT scans.
Results

CT Patterns

- The chest CT scans revealed abnormalities in 30 of 35 (85.7%) patients with Ascaris suum (Table 1).

- Among these 30 patients, nodules (n=20, 66.7%) (Figs. 1a, 2a and 2d) were the most frequently observed abnormality, followed by ground-glass attenuation (n=18, 60.0%) (Figs. 2a and 3). Nodules were present in both lungs and the majority showed a halo of ground-glass attenuation (n=17, 56.6%) (Figs. 1a and 2d). Interlobular septal thickening (n=15, 50%) (Fig. 3), thickening of bronchovascular bundles (n=4, 13.3%), consolidation (n=1, 3.3%), and centrilobular nodules (n=1, 3.3%) were also observed. CT findings of bronchiectasis, honeycombing or crazy-paving appearance were not found in any of the patients.

- Among the patients with abnormal findings (n=30), follow-up CT scans were performed in 7 patients at 14-65 days before the diagnosis of visceral larva migrans due to Ascaris suum and subsequent treatments. Of these 7 patients, nodules (n=6) and ground-glass attenuation (n=5) in 4 patients had disappeared from their original locations, and were present in other locations of the lungs as seen in follow-up CT scans (Fig. 2c and 2d).

Effusion and Lymph Nodes

- There were small effusions in 5 (16.7%) patients. Specifically, bilateral effusion was observed in 4 patients and unilateral effusion in 1 patient. Pleural effusion disappeared in all patients after treatment.

- Mediastinal and hilar lymph node enlargement (11-17 mm) were found in 1 patient (3.3%). Enlarged lymph nodes were generally found in the pretracheal, tracheobronchial or subcarinal regions. In the patient with enlarged lymph nodes, no follow-up CT scans were performed after treatment. No enlarged lymph nodes were found in axillary regions. None of the patients had pericardial effusions.

Comparisons of CT Images and Biopsy Specimens

- In all 4 patients who underwent a surgical or transbronchial lung biopsy, the extent of the ground-glass attenuation and the halo of ground-glass
attenuation around nodules corresponded with the extent of inflammatory cell infiltration, which was predominantly composed of eosinophils, into the alveolar septa. Nodules with a halo corresponded to necrosis surrounded by infiltrating inflammatory cells, including eosinophils, in the alveolar septa (Fig. 1b). In addition, thickening of bronchovascular bundles corresponded to infiltration of marked eosinophils along these bronchovascular bundles.
### Table 1

Thoracic CT Findings in 30 Patients

<table>
<thead>
<tr>
<th>Findings</th>
<th>No. (%) of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodules</td>
<td>20 (66.7)</td>
</tr>
<tr>
<td>with a halo</td>
<td>18 (60.0)</td>
</tr>
<tr>
<td>without a halo</td>
<td>2 (6.7)</td>
</tr>
<tr>
<td>Ground-glass attenuation</td>
<td>18 (60.0)</td>
</tr>
<tr>
<td>Interlobular septal thickening</td>
<td>15 (50.0)</td>
</tr>
<tr>
<td>Thickening of bronchovascular bundles</td>
<td>4 (13.3)</td>
</tr>
<tr>
<td>Consolidation</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>Centrilobular nodules</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>5 (16.7)</td>
</tr>
<tr>
<td>Lymph node enlargement</td>
<td>1 (3.3)</td>
</tr>
</tbody>
</table>

**Table 1:** Table 1 Thoracic CT Findings in 30 Patients

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**Fig. 1:** A 30-year-old man with Visceral Larva Migrans due to Ascaris suum. Transverse CT scan shows a small nodule with a halo of ground-glass attenuation in the right middle lobe (arrow).

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Fig. 2: Fig. 1b Photomicrograph of a surgical biopsy specimen from the right middle lobe shows necrosis surrounded by infiltrating inflammatory cells, including eosinophils, in the alveolar septa.

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**Fig. 3:** Fig. 2a A 69-year-old man with Visceral Larva Migrans due to Ascaris suum. Transverse CT scan obtained 1 cm below the level of the tracheal carina shows a nodule with GGA in the right upper lobe (arrow).

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**Fig. 4:** Fig. 2b Transverse CT scan obtained at the level of basal segmental bronchus shows no abnormality.

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**Fig. 5:** Fig. 2c Follow-up CT scans at 2 weeks after the initial CT scans (same level as Fig.2a) shows that the nodule with GGA in the right upper lobe have dissappeared.

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Fig. 6: Fig. 2d Follow-up CT scans at 2 weeks after the initial CT scans (same level as Fig.2b) show that a new nodule with halo has been present in the middle lobe.

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Fig. 7: Fig. 3 A 61-year-old man with Visceral Larva Migrans due to Ascaris suum. Transverse CT scan obtained at the level of the right upper lobe shows ground-glass attenuation and interlobular septal thickening (arrows).

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Conclusions

• CT manifestations of pulmonary involvement in patients with visceral larva migrans due to Ascaris suum consisted of some suggestive findings including small nodules with a halo of ground-glass attenuation, and focal areas of ground-glass attenuation in the lung periphery.

• In patients with hypereosinophilia, these features may represent the pathophysiologic background of visceral larva migrans due to Ascaris suum, and thus may assist in the diagnosis of this rare entity.