Primary pulmonary lymphoma is rare. Most cases are of B cell origin and commonly arise from bronchial mucosa associated lymphoid tissue (MALT). Non-B cell lymphomas—that is, T cell and natural killer (NK) cell lymphomas—involving the lung parenchyma are uncommonly reported. NK/T lymphoma is aggressive and delay in establishing the diagnosis can result in a fatal outcome.

CASE REPORT

A 72 year old female non-smoker presented with shortness of breath (SOB), productive cough, and intermittent fever for 3 months. She was treated with azithromycin for community acquired pneumonia without improvement. The chest radiograph showed multiple areas of consolidation in the right lung. Initial laboratory findings revealed normal complete blood count and an unremarkable chemistry panel. A computed tomographic (CT) scan of the chest showed bilateral areas of consolidation with cavitation in the right upper lobe and diffusely distributed small nodules. No mediastinal or hilar adenopathy was noted (fig 1). Antibiotic coverage was modified to intravenous doxycycline and cefotaxime. A bronchoscopy with transbronchial biopsy (TBB) was performed. The bronchoalveolar lavage (BAL) fluid revealed 240 white blood cells (WBC)/ml with 80% lymphocytes, and the TBB showed lymphocytic inflammation. Cultures from the BAL fluid subsequently grew group B Streptococcus and parainfluenza virus, which were believed to be responsible for the lymphocytic inflammation. She improved and was discharged home only to return to the hospital 2 weeks later with worsening SOB.

A repeat CT scan of the chest showed increasing consolidation in both lungs without adenopathy and a new right sided pleural effusion. Thoracentesis was performed which also revealed a lymphocytic exudate. Cultures and cytological examination of the pleural fluid were negative. The patient underwent a repeat bronchoscopy with TBB which again indicated lymphocytic infiltration. Gram stain and special stains for atypical organisms including mycobacteria, fungi, and Pneumocystis carinii were negative. The BAL fluid cultures were negative. Flow cytometry of the BAL fluid indicated that more than 80% of the lymphocytes were T cells (CD3+) with a CD4 to CD8 ratio of 0.3.

At this point a clinical suspicion for a T cell lymphoproliferative disorder was raised. A positron emission tomographic (PET) scan was obtained in an attempt to identify the extent of the disease and an alternative site for tissue sampling. The PET scan revealed an isolated intense hypermetabolic uptake in the right middle and lower lung regions without other identifiable adenopathy. An open lung biopsy was performed.
Immunocytochemistry showing that the malignant cells stained positive for (A) leucocyte common antigen (LCA) and (B) CD3. Magnification ×400.

DISCUSSION

Apart from HIV related lymphoproliferative disorders, primary lymphoma of the lung is rare. While extranodal manifestations of non-Hodgkin's lymphoma (NHL) are not uncommon, isolated involvement of the lung is found in only 3–4% of cases. Most cases reported are B cell lymphomas. The true incidence of pulmonary lymphomas other than B cell type is unknown. Tamura and co-workers reported 24 cases of primary pulmonary lymphoma, only one of which was T cell in origin. Since 1990 only 13 cases of non-B cell pulmonary lymphoma have been reported. Most of these reports are not in English. Eleven of the 13 cases are reviewed here. The clinical characteristics of these cases are summarised in table 1.

The patients were usually elderly, with a female to male ratio of approximately 2:1. Most of the cases presented with cough and dyspnoea. Only three patients were asymptomatic and were diagnosed after incidental discovery of an abnormal chest radiograph. The most common radiographic finding was bilateral diffuse nodular lesions. Mass-like consolidation, cryptogenic organising pneumonia (COP)-like lesions, hilar adenopathy, and pleural effusion were also reported. These radiographic features are also associated with bronchial MALT lymphoma and cannot be used to differentiate between non-B cell and B cell malignancy of the lung.

TBB was non-diagnostic in nine of the 11 cases. Transbronchial needle aspiration (TBNA) was obtained in one case, which was also non-diagnostic. Limited flow cytometry on BAL fluid (CD4/CD8 subpopulation analysis only) was done in two cases. An open lung biopsy (OLB) or lobectomy was eventually required in nine cases. The other two cases were diagnosed by an endobronchial biopsy of a well visualised mass, and by a cervical lymph node excisional biopsy. Immunocytochemistry of the surgical biopsy specimens showed T cell markers in all cases. None of the cases reported simultaneous NK cell markers on the tumour cells. Genotypic assessment—that is, TCR gene rearrangement—was not reported in any of the cases.

Treatment consisted of CHOP (cyclophosphamide, adriamycin, vincristine and prednisone) based chemotherapy in eight patients with varying success. Four patients subsequently died and four were still living by the time the reports were published. Boon et al and Hanawa et al reported dramatic clinical and radiographic response to systemic corticosteroid alone without chemotherapy. In one case corticosteroid was used as a temporary measure until the patient could tolerate OLB.

Surgical resection was performed on three patients. In two cases the tumours were focal and the lobectomy led to cure. The pathology and immunocytochemistry of the third patient showed mixed T cell lymphoma and squamous cell carcinoma of the lung. Adjuvant chemotherapy for lym-
Phenotypic and genotypic studies. A transbronchial needle aspiration (TBNA) or Wang needle aspiration may have a role in obtaining a clinical specimen for TCR gene rearrangement when thoracic lymphadenopathy is present. However, one third of all T cell lymphomas and virtually all NK cell tumours arise at extranodal sites. 14

As shown in table 1, most cases of pulmonary T cell lymphomas presented with isolated lung parenchymal lesions without thoracic lymphadenopathy. Only one of the 11 cases reported hilar adenopathy. 1 In our case, hilar and mediastinal adenopathy was not detected by CT scan or PET scan but was present at post mortem examination. This could be explained by the fact that the lymph nodes were adjacent to the mass-like parenchymal lesion which might have obscured the presence of distinct lymphadenopathy.

CD56 positive T cell lymphoma (or NK/T cell lymphoma) is a very aggressive neoplasm. According to the WHO and REAL classifications, this group of lymphomas is now referred to as “extranodal NK/T cell lymphoma, nasal and nasal-type”. 14 They are characterised by extranodal presentation, angiocentric and angiodestructive proliferation. 14 sinonasal disease is a usual finding, although skin and aerodigestive mucosae are not uncommonly involved. The lung is usually involved as a metastatised organ. Typically, the cells bear CD56 on the surface, with or without CD3. 14 CD20 is usually absent. Prognosis is variable, with long term survival ranging from 20% to 80%. Patients with early stage and non-bulky disease tend to have a better prognosis. 14 In our patient the lymphoma cells stained positive for CD3 and CD56 and showed an angiocentric preponderance. However, the post mortem examination did not reveal upper respiratory tract involvement of the lymphoma, which is a clinical hallmark of this entity. In conclusion, lymphoma of the lung is extremely rare and is typically of B cell lineage. Non-B cell lymphoma of the lung is an unusual diagnosis and warrants high clinical suspicion. Its presence portends a poor prognosis. To our knowledge, we report the first case of non-HIV related NK/T cell lymphoma with primary lung involvement.

In conclusion, lymphoma of the lung is extremely rare and is typically of B cell lineage. Non-B cell lymphoma of the lung is an unusual diagnosis and warrants high clinical suspicion. Its presence portends a poor prognosis. To our knowledge, we report the first case of non-HIV related NK/T cell lymphoma with primary lung involvement. Diagnosis is difficult and, because of its aggressive nature, a delay in diagnosis and treatment usually leads to a fatal outcome. It should be included in the differential diagnosis of progressive or unresolved pneumonia, especially when T cell lymphocytosis is persistent in the absence of a well defined infectious aetiology. A definitive diagnosis always requires adequate viable tissues for morphological, immunocytochemical, and

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**Table 1** Summary of reported cases of primary pulmonary T cell lymphoma since 1990

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age</th>
<th>Sex</th>
<th>Presentation</th>
<th>Radiographic findings</th>
<th>Diagnostic intervention</th>
<th>Treatment and outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asano 1</td>
<td>75</td>
<td>F</td>
<td>Dyspnoea</td>
<td>Multiple nodules, hilar adenopathy</td>
<td>Cervical lymph node biopsy</td>
<td>Chemotherapy with complete remission, alive*</td>
</tr>
<tr>
<td>Maehara 11</td>
<td>70</td>
<td>F</td>
<td>Productive cough, fever</td>
<td>L pleural effusion, LLL mass</td>
<td>Endobronchial biopsy</td>
<td>Chemotherapy, alive*</td>
</tr>
<tr>
<td>Boon 64</td>
<td>63</td>
<td>M</td>
<td>Fever</td>
<td>COP-like</td>
<td>LLL nodule</td>
<td>OLB</td>
</tr>
<tr>
<td>Fujitaa 69</td>
<td>42</td>
<td>M</td>
<td>Abnormal CXR</td>
<td>Multiple lung nodules</td>
<td>Lobectomy</td>
<td>OLB</td>
</tr>
<tr>
<td>Hanada 70</td>
<td>52</td>
<td>M</td>
<td>Abnormal CXR</td>
<td>Multiple lung nodules</td>
<td>OLB</td>
<td>OLB</td>
</tr>
<tr>
<td>M3ejima 44</td>
<td>62</td>
<td>M</td>
<td>Dyspnoea</td>
<td>Multiple lung nodules</td>
<td>OLB</td>
<td>OLB</td>
</tr>
<tr>
<td>Sasaki 11</td>
<td>65</td>
<td>F</td>
<td>Abnormal CXR</td>
<td>RML, RLL infiltrates</td>
<td>RML and RLL lobectomy</td>
<td>Lobectomy with residual disease, alive*</td>
</tr>
<tr>
<td>Hanawa 33</td>
<td>52</td>
<td>F</td>
<td>Recurrent infiltrates</td>
<td>COP-like</td>
<td>OLB</td>
<td>Systemic corticosteroid, alive*</td>
</tr>
<tr>
<td>Karakus 58</td>
<td>48</td>
<td>F</td>
<td>Cough, dyspnoea</td>
<td>Multiple lung nodules</td>
<td>OLB</td>
<td>Chemotherapy with partial remission, alive*</td>
</tr>
<tr>
<td>Kawashima 69</td>
<td>74</td>
<td>F</td>
<td>Cough, haemoptysis</td>
<td>RLL mass</td>
<td>Lobectomy</td>
<td>Lobectomy and chemotherapy, died</td>
</tr>
<tr>
<td>DeTorres 24</td>
<td>68</td>
<td>F</td>
<td>Fever, weight loss</td>
<td>Multiple lung nodules</td>
<td>OLB</td>
<td>OLB</td>
</tr>
</tbody>
</table>

*At the time the report was published.

F, female; M, male; LLL, left lower lobe; RML, right middle lobe; RLL, right lower lobe; COP, cryptogenic organising pneumonia; OL, open lung biopsy; CXR, chest x-ray; CNS, central nervous system

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molecular analyses. TBB, transthoracic needle biopsy, and TBNA are generally insufficient and early open lung biopsy or video assisted thoracoscopic lung biopsy should be considered. In view of its extreme rarity, there is no recommended treatment at present. CHOP based chemotherapy and surgical resection have been reported in the literature. The response to chemotherapy is variable. Surgical resection may offer a cure in a patient whose tumour is localised. Systemic corticosteroids may be tried as a temporary measure to stabilise the patient sufficiently to undergo surgical biopsy.

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