Primary Pulmonary Lymphomas*
A Clinical Study of 70 Cases in Nonimmunocompromised Patients

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We studied 70 patients with biopsy-proven pulmonary non-Hodgkin’s lymphomas without extrathoracic involvement or mediastinal adenopathy to determine the clinical, imaging, and endoscopic features of this condition in a homogeneous series. In low-grade (LG) lymphomas, symptoms were cough, dyspnea, chest pain, hemoptysis. Imaging features consisted of localized alveolar opacities, infiltrative diffuse opacities, atelectasis, and pleural effusions. Inflammatory changes of the mucosa were present in some patients, leading to bronchial stenosis in 7; biopsies showed lymphomatous infiltration in 12. Prognosis of LG lymphomas was excellent, with 93.6 percent survival at five years.

High-grade lymphomas differed from LG lymphomas principally by a more aggressive course and a worse survival. Inflammatory changes occurred in seven of nine cases leading to stenosis in two, and biopsies showed lymphomatous involvement in five. The profile of primary pulmonary lymphomas in this study could help clinicians consider this condition and prompt them to evaluate new diagnostic tools.

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HG = high grade; LG = low grade; MALT = mucosa-associated lymphoid tissue

Primary non-Hodgkin’s lymphomas of the lung are rare extranodal lymphomas which are usually low-grade (LG) B-cell types and are considered to originate from the mucosa-associated lymphoid tissue (MALT) of the bronchus. Furthermore, the pathologic entity that for a long time was called “pseudo-lymphoma” has been progressively assimilated into the group of lymphomas.1-3

Until now, the definitive diagnosis of primary pulmonary lymphoma generally has relied on histopathologic findings of lung specimens obtained by surgical excision of the lesions or open-lung biopsy. However, diagnosis occasionally has been achieved by less aggressive biopsies (bronchial, transbronchial, trans-thoracic) and/or immunocytochemical, immunochemical and gene rearrangement studies on material obtained by bronchoalveolar lavage (BAL).1,4-6

The prognosis of primary pulmonary lymphomas is more favorable than that of nodal lymphomas, but some high-grade (HG) forms have a rapidly severe course.1,3,7-12 The treatment of primary pulmonary lymphomas is not precisely codified, and the respective places of surgery, chemotherapy, radiotherapy as well as of therapeutic abstention are not clearly defined.

Since by definition primary pulmonary lymphomas initially are limited to the lung, the pulmonologist is confronted with the diagnosis of this condition and he has to decide on the most appropriate investigations. However, the experience of individual practitioners with the disease is obviously limited and thus the diagnosis is not always suspected until biopsy specimens have been obtained.

We therefore undertook this retrospective study to obtain a current clinical synthesis on primary pulmonary lymphomas and their course in order to provide a reliable basis for future diagnostic and therapeutic research in patients who have the disease.

METHODS

French respiratory physicians were asked to participate in the Clinicopathological Research Group under the auspices of the Société de Pneumologie de Langue Française by referring standardized detailed clinical information, x-ray films, tomograms and computed tomography (CT) scans on nonimmunocompromised patients whose condition they diagnosed between 1970 and 1990 as primary pulmonary non-Hodgkin’s lymphoma or “pseudo-lymphoma.” In addition, they were asked to refer cases in which pulmonary lymphoma developed in patients who had a previously or simultaneously diagnosed lymphoma limited to another extrathoracic and extranodal site.

We chose the following strict clinical inclusion criteria: (1) involvement of the lung or bronchus or both, either unilateral or bilateral, without evidence of mediastinal adenopathy or mass on chest x-ray film (we included cases in which infracostal mediastinal adenopathy was found by CT scan or at surgery, or by CT scan and at surgery, and in which pulmonary involvement was clearly predominant); (2) no extrathoracic lymphoma previously had
been diagnosed; and (3) no evidence of extrathoracic lymphoma or lymphatic leukemia at the time of diagnosis, as assessed by at least the following investigations: physical examination, complete blood cell counts, abdominal echography or CT scan or lymphography, bone marrow aspiration or biopsy or both; and (4) no extrathoracic involvement detectable by the above investigations for three months following diagnosis. The cases in which one or more of the previously noted investigations had not been done initially were included only if no extrathoracic lymphoma developed within 12 months following diagnosis.

Furthermore, for all cases, pathologic slides of pulmonary or bronchial specimens with lymphoma, or both, were referred for review by a panel of pathologists of the Clinicopathologic Research Group coordinated by one of us (R.L.) and assisted by an expert in hematologic pathology (J. Diebold, Hotel Dieu, Paris, France). The authenticated cases were classified according to the updated Kiel classification.13 Further pathologic analysis with immunophenotyping and subclassification of the cases of the current series will be published separately by the pathologists in the group. For the present clinical study, the cases were separated into two groups, low-grade (LG) or high-grade lymphomas.

The survival of patients was estimated from the time of pathologic diagnosis using the Kaplan-Meier method, as mentioned in the work of Machin and Gardiner.14 Comparison of survival curves was done by the log rank test. Since our study was retrospective, the treatment modalities varied considerably and thus could not be analyzed precisely.

RESULTS

Study Population

Seventy patients were included in the study. Thirty other referred cases were rejected on the basis of the following: histopathologic findings, 13 cases (pathologic diagnosis other than lymphoma in 7, size or quality or both of specimens insufficient for confident diagnosis of lymphoma in 6) and clinical findings, 17 cases (extrathoracic lymphoma present in 7, predominant mediastinal lymphomatous lesions in 5, incomplete clinical information in 5).

Furthermore, six other cases were referred (not included in the present study) in which an extrathoracic and extranodal lymphoma had been diagnosed prior to pulmonary lymphoma or simultaneously: of the stomach in three, of the ocular adnexa in two, of both the stomach and the ocular adnexa in one.

The 70 patients of the study consisted of 35 men and 35 women, and their mean age was 58.4 years (range, 35 to 79 years). Thirty-nine patients were nonsmokers and 27 were smokers or ex-smokers.

Histopathologic Diagnosis

There were 61 LG malignant lymphomas (87 percent) consisting of 51 B-type lymphomas of MALT type (14 centrocytic-like, 17 lymphoplasmacytic, 20 showing both centrocytic-like and lymphoplasmacytic features in the same tumor in a mixed pattern or in separate areas), 3 non-MALT LG malignant lymphomas (2 centrocytic, 1 lymphoplasmacytic), and 7 LG malignant lymphomas which could not be classified. There were nine HG lymphomas (13 percent) consisting of six centroblastic HG malignant lymphomas and three HG malignant lymphomas which could not be classified as to type.

Initial diagnosis was made on the basis of: surgical exeresis in 45 patients, consisting of pneumonectomy in 6 (5 LG, 1 HG); lobectomy or bilobectomy in 32 (30 LG, 2 HG); segmentectomy or tumorectomy in 7 (6 LG, 1 HG); open-lung biopsy in 17 patients (13 LG, 4 HG); bronchial biopsy in 4 patients (4 LG); transbronchial biopsy in 2 patients (2 LG); transthoracic needle biopsy in 1 patient (LG); necropsy in 1 patient (HG).

Low-Grade Lymphomas (61 Cases)

Clinical Presentation: In 27 patients (44 percent), the pulmonary lymphoma was discovered by routine chest x-ray film. In 15 cases, the interval between the finding of an abnormal chest x-ray film and the definite pathologic diagnosis was more than 1.5 years, with a mean of 5.3 years (range, 1.5 to 21 years).

Figure 1. Patient presenting in 1974 with patchy bilateral alveolar opacities, corresponding to a LG lymphoma (left). Slow progression of the lymphoma, despite several cycles of polychemotherapy, 1983 (center). Rapid and prolonged retrocession of the lymphoma with daily continuous chlorambucil treatment, 1989 (right).
Eight patients (13 percent) presented with fever and 16 (26 percent), with weight loss (mean, 5.4 kg; range, 2 to 14 kg). Twenty-five patients (41 percent) had no pulmonary symptoms at the time of diagnosis. Cough was present in 24 patients (39 percent), mild dyspnea in 13 (21 percent), hemoptysis in 6 (10 percent), chest pain in 10 (16 percent), cutaneous vasculitis of the lower limbs in 2 (3 percent) with cryoglobulin. In 11 patients (18 percent), crackles over the lesions, as evidenced radiologically, were present at auscultation. Auscultation was not remarkable in the other patients.

**Pleuropulmonary Imaging:** The imaging features identified by chest x-ray films, tomograms and CT scans consisted of localized opacities in 53 cases (87 percent), the size of which varied from 2 cm to more than half the hemithorax (Fig 1, 2). These consisted of alveolar mass or pneumonia-like consolidation of variable density, sometimes pleurally based. An air bronchogram was present in 27 (51 percent). The margins of the opacities were often ill-defined, but sometimes an entire lobe was consolidated (especially the middle lobe). The mass was rounded with sharper margins (tumor-like) in 13 cases. A cavitary mass was found in only one case. The number of localized opacities was 1 in 38 patients, 2 in 10, 3 or more in 5, and they were bilateral in 11 cases (21 percent).

A pattern of diffuse infiltrative opacities involving both lungs was present in five cases (8 percent) and combined both alveolar and interstitial opacities. The alveolar pattern generally predominated over the interstitial pattern. Atelectasis (lobar or segmental) was present in only three cases (5 percent). Pleural effusion was present in four cases (7 percent) (in one empyema led to the discovery of the underlying lymphoma, in one the effusion was lymphomatous on pleural fluid analysis and in two no pleural fluid analysis was available). In the 21 patients with a detailed CT scan analysis of the mediastinum, infracentimetric adenopathy was identified in 8 and no adenopathy was seen in 13.

**Fiberoptic Bronchoscopy and Bronchoalveolar Lavage:** Fiberoptic bronchoscopy was performed in 60 patients. It showed macroscopically normal features in 34 of 60 cases (57 percent) and abnormal features in 26 (43 percent). Abnormal endoscopic features consisted of inflammatory changes of the mucosa, leading to bronchial stenosis in seven cases. Biopsy of the bronchial lesions showed lymphomatous infiltration in 12 cases (including 6 of the 7 cases with bronchial stenosis). In three cases transbronchial pulmonary biopsies showed lymphomatous lesions.

A BAL was done in the area of the opacities evidenced on the chest x-ray film in 13 cases (22 percent). The percentage of lymphoid cells at differential cell count was more than 20 percent in 9 of 13 cases, with a mean of 64 percent (range, 40 to 90 percent). Immunocytochemical study (by immunofluorescence with monoclonal antibodies to IgM, IgG, IgA, kappa and lambda light chains) of the lymphoid cells done in two cases showed expression of monotypic immunoglobulin (IgA kappa in one, IgM kappa in the other).

Electrophoresis and immunoelectrophoresis of both BAL supernatant fluid and serum showed the presence of the same monoclonal immunoglobulin in three patients. Furthermore, the IgM/albumin ratio was respectively 6.8 and 8.2 times higher in BAL fluid than in the serum of 2 patients with a monoclonal IgM gammopathy, and 4.0 times higher for IgA in a patient with IgA gammopathy.

**Lung Function Tests:** Spirometry (done in 49 patients) showed an obstructive ventilatory defect (defined by a FEV₁/forced vital capacity [FVC] ratio less than 0.65) in 5 patients (mean FEV₁/FVC ratio: 0.58 ± 0.03) of which 3 were smokers and 2 were nonsmokers, a restrictive ventilatory defect (defined by FVC less than 80 percent of predicted values and FEV₁/FVC ratio more than 0.65) in 6 (mean percentage of predicted FVC: 69 ± 12) and was normal in 38 patients. The PaO₂ measured in 35 patients was above 70 mm Hg in 28 patients, and below this value in 7 (mean PaO₂: 61.9 ± 5.4 mm Hg).

**Blood Abnormalities:** As a result of the inclusion criteria, no patient had leukemia as disclosed by a complete blood cell count, and bone marrow aspiration or biopsy, or both (done in 52 cases), showed no lymphomatous infiltration. Serum protein electrophoresis or immunoelectrophoresis, or both, done in 57 patients showed no evidence of monoclonal gammopathy in 40 patients. In 17 patients (30 percent), a monoclonal gammopathy was present, consisting of IgM in 12 cases (kappa light chains in 10, lambda in 2), IgG in 4 (kappa light chains in all 4), IgA in 1 (kappa...
light chains) with Bence Jones proteinuria. The IgM monoclonal gammopathy with kappa light chains was associated with polyclonal IgG in two cases, resulting in cryoglobulinemia (in one case a kappa Bence Jones proteinuria also was present).

**Treatment and Survival:** Forty-two patients (69 percent) underwent surgical exeresis, without complementary treatment in 21, followed by cytostatic treatment in 16, by local irradiation in 3 and by a combination of both cytostatic treatment and irradiation in 2. Sixteen patients (26 percent) received cytostatic treatment, which was combined with irradiation in one. Three patients (5 percent) received no treatment.

The cytostatic treatment protocols varied considerably. Chlorambucil alone, used in 11 patients, was a most effective treatment. More aggressive chemotherapy protocols did not show evidence of better efficacy in the other patients, despite more severe side effects.

Extrathoracic involvement occurred in seven patients: in the stomach in three, in the bone marrow in three, in the spleen in three, in the liver in two; more than one organ was involved in three. Intervals between diagnosis and extrathoracic involvement ranged from ten months to seven years. Six patients received cytostatic treatment and one with gastric lymphoma underwent surgery.

Overall survival was 100 percent at two years and 93.6 percent at five years, with a 95 percent confidence interval of 79 to 98 percent. Survival median was not reached at ten years (Fig 3). By the closing date of the study, five patients had died (three of extrathoracic relapse of the lymphoma, one of nonrelated cause and one of unknown cause).

Prognosis did not differ significantly according to the treatment modalities. Patients receiving multiple cytostatic drugs had no better prognosis than those given only chlorambucil.

**High-Grade Lymphomas (9 Cases)**

**Clinical Features:** All patients were symptomatic, and in no case was the lymphoma discovered by routine chest x-ray film.

Fever was present in three of nine patients, and weight loss occurred in nine patients with a mean of 5 kg (range: 2 to 10 kg). Only one patient had no pulmonary symptoms at the time of diagnosis. Cough was present in five of nine patients, dyspnea in three of nine, and hemoptysis in one of nine. Crackles were present in three of nine patients on pulmonary auscultation.

**Imaging Features:** The imaging features consisted of localized opacities in six patients (five with one opacity, one with two opacities), with an air bronchogram in
two. A diffuse infiltrative pattern (Fig 4) was present in two. Pleural effusion was present in two, with lymphoma cells in one and without these cells in one. At CT scan of the mediastinum, infracentimetric adenopathy was identified in one, and no adenopathy was present in three.

**Fiberoptic Bronchoscopy:** Fiberoptic bronchoscopy was macroscopically normal in two of nine patients, and abnormal in seven of nine showing inflammatory changes of the mucosa, with bronchial stenosis in two. Bronchial biopsies showed lymphomatous involvement in five of seven cases (including the two cases with bronchial stenosis).

**Lung Function Tests:** Spirometry done in four patients was normal in one, and showed a restrictive pattern in three (mean percentage of predicted FVC:51±18). The PaO₂ value was above 70 mm Hg in two patients, and below this value in three (mean PaO₂:51.0±8.2 mm Hg).

**Other Procedures and Tests:** Bone marrow aspiration or bone marrow biopsy, or both, done in nine patients, showed no lymphomatous involvement. Serum protein electrophoresis or immunoelectrophoresis, or both, showed no evidence of monoclonal gammopathy in seven patients, and a discrete IgM kappa monoclonal gammopathy was present in two (one being a cryoglobulin).

**Treatment and Survival**

Four patients underwent surgical exeresis followed by cystostatic treatment. Four patients received cytostatic treatment, which was combined with irradiation in one. One patient died of peritonitis during initial evaluation before any treatment.

Survival of patients with HG lymphomas was significantly worse than that of patients with LG lymphomas (log rank = 40.4, p<0.001) (Fig 3). By the closing date of the study, five patients had died and four were alive. Besides the patient who died of peritonitis, three other deaths occurred in patients treated by chemotherapy and their immediate causes were respectively Guillain-Barré syndrome (at 3 months), invasive aspergillosis (at 7 months) and extensive pneumonia (at 35 months). One patient died of the relapse of the lymphoma at 46 months. Among the 4 patients alive at the closing of the study, 2 were in complete remission at 11 and 13 months, respectively, and 2 were relapsing: one with lymphomatous dissemination at 18 months (this patient died after the closing date of the study at 21 months) and the other with hepatic involvement at 35 months.

**Discussion**

The frequency of lymphomas arising in the lung is estimated to be less than 1 percent of all lymphomas. The strict inclusion criteria we chose for considering a lymphoma as primary in the lung probably exclude pulmonary localizations of lymphomas of another origin, and this confers a reliable homogeneity to this series.

Eighty-seven percent of our patients had a LG lymphoma and 13 percent had a HG lymphoma. This predominance of LG lymphomas is found in all previously reported series. However, the frequency of HG primary pulmonary lymphomas may be underestimated if some aggressive lymphomas arising in the lung extend rapidly to the mediastinum and extrapolicular sites, their pulmonary origin thus remaining unrecognized. Some mediastinal primary lymphomas with contiguity involvement to the lung could indeed be aggressive primary pulmonary lymphomas with secondary spread to the mediastinum.

The mean age (58.4 years) and male-female ratio (35:35) of our patients is similar to those of other series. A majority of patients were nonsmokers.

Our patients with LG lymphomas often were asymptomatic, the pulmonary lesions being discovered by routine chest x-ray film. Furthermore, in many cases, the definitive diagnosis was obtained only after several months or years of follow up, when the enlargement of the opacities on the chest x-ray film finally led the clinician to ask for an open-lung biopsy. The symptomatic patients had nonspecific constitutional or pulmonary symptoms, or both. Weight loss was rather common (26 percent). Cough, dyspnoea, hemoptysis and chest pain generally were mild. Two clinical details of interest were noted: the presence of fine crackles heard over the pulmonary lesions in 18 percent of the patients and a cutaneous vasculitis leading to the discovery of a monoclonal cryoglobulin in 2 cases. Thus, this series confirms that the clinical presentation of LG pulmonary lymphomas characteristically is indolent. On the contrary, all patients with HG lymphomas were symptomatic, with systematic weight loss, and no case was discovered by routine chest x-ray film.

The respective frequency of imaging features of primary pulmonary lymphomas is difficult to assess in the literature because of both varying radiologic terminologies and the heterogeneity of several series including all lymphomas of the lung, either primary or not, and the previously called pseudolymphomas as well as other lymphoid disorders.

An alveolar mass with rather ill-defined margins and an air bronchogram were the most frequent and characteristic imaging features in our patients. This pattern often has been mentioned and it is typical of this condition, the principal roentgenologic differential diagnosis being with bronchiloalveolar carcinoma or the chronic pneumonias such as bronchiolitis obliterans organizing pneumonia, especially when bilateral. A tumor-like rounded opacity was less fre-
quent in our series than in others. In such cases, diagnosis generally is achieved by lobectomy for a lesion presumed to be a carcinoma. Whatever their size, pulmonary lymphomas are extremely rarely cavitary.

The pattern of diffuse infiltrative opacities was rare in our patients, although the histopathologic lymphangitic distribution of pulmonary lymphomas is found even in localized lesions. The fact that such diffuse lesions were limited to the lung underlines the unusual nature of lymphomas arising in this organ.

Atelectasis, which was present in three cases of our series, was associated with bronchial stenosis. Pleural involvement was rare, and as a result of applying inclusion criteria, no large adenopathy was found in the mediastinum. Furthermore, pleural and mediastinal spread did not occur in LG lymphomas during the follow up of the patients even when untreated; however, there was a differentiation between LG and HG lymphomas since the latter have a more aggressive course. Nevertheless, initial imaging presentation did not clearly show a differentiation between LG and HG lymphomas.

Fiberoptic bronchoscopy was done in all but one case of our series. The procedure disclosed abnormalities with inflammatory changes of the mucosa in 33 of 69 (48 percent) cases and bronchial lymphomatous infiltration was present in 17 of 33 (52 percent) cases, especially when associated with bronchial stenosis. The endobronchial involvement in non-Hodgkin's lymphomas previously has been indicated, especially in disseminated disease. In our series, it was present in five of seven HG lymphomas, thus attesting to the aggressive invasion of bronchi, whereas in LG lymphomas bronchial involvement was present in only 12 of 60 cases. This is not surprising since the bronchi may be relatively spared by the progression of LG lymphomas as demonstrated by the presence of an air bronchogram inside the lymphomatous mass in many cases. However, it is likely that lymphomatous bronchial infiltration may sometimes be unrecognized when not massive because the mature lymphocytes of LG lymphoma may be confused with the lymphocytes of common inflammatory processes if the pathologist is unaware of the clinical context. Immunohistochemical techniques could prove useful for further characterization of the discrete lymphoid infiltrates, but the small size of the bronchial biopsies may not always allow such analysis. Transbrachial biopsies also provide small samples, but these may more readily involve a site with more massive lymphomatous infiltration.

Bronchoalveolar lavage was done in 13 cases of LG lymphomas of our series, and a lymphoid pattern was found in 9 of them, thus suggesting the diagnosis which was strengthened by immunocytochemical demonstration of the monotype of immunoglobulin expression by the lymphoid cells in 2 cases. Furthermore, the local production of a monoclonal immunoglobulin, as attested by an immunoglobulin-albumin ratio much higher in BAL fluid than in the serum, was detected in three cases; this was especially evident when an IgM monoclonal immunoglobulin was present in the BAL fluid which normally does not contain significant amounts of this large-molecular-weight immunoglobulin.

A monoclonal gammopathy was present at serum protein analysis in 19 of 66 patients. Where chest disease is accompanied by monoclonal gammopathy, plasma cell neoplasia or lymphoproliferative disease must be systematically investigated. This is especially true when the monoclonal gammopathy is of the IgM type, which was the case in 14 of 19 of our patients, since it rarely occurs outside of the context of a lymphoproliferative disorder. IgM monoclonal gammopathy was the most frequent gammopathy found in this and other studies of LG lymphomas. Furthermore, the monotypic immunoglobulin expression found by immunohistochemistry in most LG B-cell pulmonary lymphoma is IgM. Monoclonal gammopathies are less frequent in HG lymphomas and when present could suggest that the HG lymphoma developed from LG lymphoma.

No characteristic profile was evidenced in lung function test results of our patients, and spirometry was within normal limits in most of them. When a restrictive ventilatory defect was present, it paralleled the pulmonary lesions. Obstructive ventilatory defect could be related to smoking in some patients, and in the others no argument was present to relate it to bronchial lymphomatous involvement, although this cannot nevertheless be ruled out. A mild hypoxemia was an uncommon finding. Similar observations on lung function tests have been reported previously.

In our series, the diagnosis of lymphoma was made in 64 percent of patients on the basis of surgical exeresis, which generally had a simultaneous therapeutic purpose, usually for the suspicion of carcinoma. It is likely that if a diagnosis of lymphoma had been made preoperatively in all cases, some patients would not have undergone such large exeresis as pneumonectomy. Diagnosis was obtained in 24 percent of cases by open-lung biopsy, which was done when the lesions were infiltrative or multiple and thus could not be entirely removed by exeresis. Finally, less invasive procedures (bronchial, transbronchial, transthoracic needle biopsies) provided the diagnosis in 10 percent of cases, but we believe that if a lymphoma is suspected on a clinical and imaging basis, these procedures could be used more extensively in the future and give a reliable diagnosis in many more cases. Furthermore, precise BAL analysis (by cytoimmunochemistry, protein immunochemistry, molecular biology techniques)
will probably allow a confident diagnosis in some cases. However, although a diagnosis of LG lymphomas may rely on such techniques in many cases, the diagnosis of HG lymphomas which implies aggressive chemotherapy presently still requires large-size biopsy specimens for a valid characterization.

The present series confirms the favorable course of LG primary pulmonary lymphomas reported in previous studies, whereas whatever the treatment modalities. The progression of LG lymphomas in the lung is very slow, as indicated by the long interval between the finding of abnormalities on a chest x-ray film and the pathologic diagnosis in many cases. Most localized forms did not recur after surgical excision. Chlorambucil proved to be a remarkable and only mildly toxic chemotherapy, as or even more effective as polychemotherapy. Extrathoracic progression can occur more than five years after diagnosis, and we were impressed by the fact that in three patients it involved the stomach, another MALT-possessing organ. Furthermore, in six cases (not included in the current series), pulmonary lymphoma followed or was associated with a MALT lymphoma (stomach and/or ocular adnexa). This suggests that some MALT lymphomas could arise simultaneously or successively in different organs or that cells from MALT lymphomas might circulate and give rise to another lymphoma by "homing" in the MALT of another organ. The occurrence of successive MALT lymphomas in different organs already has been reported.

Although our number of HG lymphomas is small, it is clear these are aggressive malignancies probably requiring polychemotherapy as do nodal HG lymphomas. The transition of LG to HG lymphomas referred to in other studies was not seen in our series, although a discrete IgM monoclonal gammopathy was found in two HG lymphomas.

We think that the clinical and imaging features of primary pulmonary lymphomas are suggestive of its histogenesis and its relationship to pulmonary lymphomas and lymphoid interstitial pneumonia. Histopathology 1988; 13:1-17


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