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Rapid decrease in forced vital capacity in patients with idiopathic pulmonary upper lobe fibrosis

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ABSTRACT

Background: We are occasionally presented with patients with unclassifiable interstitial pneumonia of unknown etiology. Idiopathic pulmonary upper lobe fibrosis (IPUF) does not fit any of the currently defined subsets of idiopathic interstitial pneumonias (IIPs). This study was performed to examine clinical, functional, and pathological characteristics of IPUF.

Methods: We present 9 cases of histologically confirmed IPUF. The clinical and histological characteristics of the 9 patients were evaluated. The baseline respiratory function of all patients was measured. There were 7 patients whose forced vital capacity (FVC) had been monitored for at least a year who were selected to quantify the yearly decline in FVC.

Results: All patients were slender, with a body mass index of 16.0–19.8 kg/m^2. Seven patients had a history of pneumothorax. Six patients died 1.8 to 5.7 years after the onset of the first symptoms. Fundamental histological features were intraalveolar collagen deposition and densely packed elastic fibers in the subpleural areas. These findings are the same as those seen in pleuroparenchymal fibroelastosis. However, the visceral pleura was thickened with dense collagen in only 2 patients, and pleural thickening was localized, if present, in the remaining 7 patients. Ventilatory impairment was also a characteristic. The time course decline of FVC was rapid and almost linear. The median yearly decline in FVC was −20.3% (range, −7.7% to −26.5%), which was more rapid than that reported for chronic fibrosing interstitial pneumonias such as idiopathic pulmonary fibrosis.

Conclusions: IPUF is a unique pulmonary fibrosis that results in rapid deterioration of ventilatory function and poor prognosis.

Abbreviations: BMI, body mass index; DLco, diffusing capacity of carbon monoxide; FVC, forced vital capacity; FRC, functional reserve capacity; HRCT, high-resolution computed tomography; IIP, idiopathic interstitial pneumonia; IPUF, idiopathic pulmonary upper lobe fibrosis; IPPFE, idiopathic pleuroparenchymal fibroelastosis; IPF, diopathic pulmonary fibrosis; KL-6, Krebs von den Lungen-6; RV, residual volume; SP-A, surfactant protein A; SP-D, surfactant protein D; TLC, total lung capacity; UIP, usual interstitial pneumonia

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1. Introduction

We occasionally encounter patients with pulmonary fibrosis/interstitial pneumonia of unknown etiology that does not fit any of the currently defined subsets of idiopathic interstitial pneumonia (IIP) [1].

Although pulmonary upper lobe fibrosis of unknown etiology has been reported in the past, it is not recognized by current classification systems as a discrete class of IIP. The condition has been described by a variety of terms, including idiopathic progressive pulmonary fibrosis [2], pulmonary upper lobe fibrocystic changes [3], pulmonary apical fibrocystic disease [4], idiopathic progressive pleuropulmonary fibrosis [5], idiopathic pulmonary upper lobe fibrosis (IPUF) [6–11], marked pulmonary fibrosis in the upper lobe [12], marked pulmonary fibrosis in the upper lung field [13], (idiopathic) pleuroparenchymal fibroelastosis (IPPFE, PPFE) [14–17], and upper lobe-dominant pulmonary fibrosis [18]. The clinical and pathological characteristics of the cases reported by these authors include upper lobe-predominant pulmonary fibrosis with a chronic progressive course and no known cause for the fibrosis [2–18], a history of recurrent pneumothorax [6–10,12,13,15], and marked weight loss [2,5–13]. Although not all the patients described in previous reports had identical conditions, they had many pathological and clinical variables in common.

Of the reports mentioned above, those of Amitani et al. [6] and Frankel et al. [14] are key studies of the clinical and histological characteristics of pulmonary upper lobe fibrosis of unknown etiology. The patients in these 2 studies had similar clinical and histological characteristics, but there were some differences, which will be discussed in a subsequent section.

In this report, we adopt the term "idiopathic pulmonary upper lobe fibrosis" (IPUF), which was first used by Amitani et al. [6], and present 9 cases of IPUF with clinical and pathological characteristics and long-term follow-up data on respiratory function, which may be helpful for understanding the natural course of the disease.

2. Materials and methods

2.1. Patient selection

We reviewed the medical files of all patients admitted to the departments of respiratory medicine at Fukuoka University Hospital, Fukuoka University Chikushi Hospital, National Hospital Organization Omuta National Hospital, and National Hospital Organization Fukuoka Higashi Medical Center from 2000 to 2010, and selected records of patients who had undergone a surgical lung biopsy or an autopsy. After reviewing the pathological and clinical information on these patients, we identified 9 patients with IPUF.

2.2. Clinical data

Clinical data including age, sex, smoking status, history of pneumothorax, steroid treatment, and body mass index (BMI) were reviewed. The follow-up interval from the onset of symptoms or the first recognition of abnormal findings on a chest radiograph to the date of the last follow-up consultation was determined, and information on the prognosis of the patients was recorded. The results of analyses for levels of Krebs von den Lungen-6 (KL-6), surfactant protein A (SP-A), and surfactant protein D (SP-D) were also recorded.

2.3. Imaging and histological findings

Chest radiographs and conventional and high-resolution computed tomography (HRCT) images of the 9 patients were reviewed and compared with those of patients whose cases were previously reported in the literature. Pathological specimens were obtained from surgical lung biopsies (patients 1–4 and 6–9) and autopsies (patients 5 and 9). Slides stained with hematoxylin and eosin or with elastica van Gieson (EVG) were reviewed.

2.4. Respiratory function parameters

Forced vital capacity (FVC) was measured using spirometry with the patient in a seated position. Results are expressed as absolute values (mL) and as percentages of predicted values (% pred), which were calculated using the formulas of the Japanese Respiratory Society and adjusted according to sex, height, and age [19]. Total lung capacity (TLC), functional reserve capacity (FRC), and residual volume (RV) were measured using the helium gas dilution method, and the diffusing capacity of carbon monoxide (DLco) was measured using the single-breath-holding method [20]. Predicted values for each lung volume parameter were estimated using Grimby's formula [21], and predicted values for DLco were estimated using Burrows' formula [22].

2.5. Baseline and follow-up data on respiratory function

Baseline respiratory function was estimated from the first measurements conducted at our hospitals on patients 2–9. Baseline data for patient 1 were obtained from another hospital.

To estimate the annual change in respiratory function, we used data from patients whose respiratory function parameters had been monitored for at least a year. Annual changes in respiratory function were estimated using linear regression, assuming time dependency and linearity. The annual percentage decrease or increase in respiratory function relative to baseline (Δ) was estimated from the linear equation [23].

The institutional review board at Fukuoka University Hospital approved this retrospective study (#10–127).

3. Results

3.1. Patient characteristics

Enrolled patients consisted of 5 females and 4 males. Their age at the first visit to our hospital ranged from 43 to 81 years. Seven of the patients (patients 2–6, 8, and 9) had never smoked, and patients 1 and 7 had stopped smoking 3 and 7 years previously. Seven of the 9 patients had a history of pneumothorax, and 3 of the 7 patients with pneumothorax had a recurrent pneumothorax that had been treated by tube