Aims and objectives

Idiopathic pulmonary fibrosis (IPF) is a disease characterized by progressive lung fibrosis as a result of an unknown etiology. Single lung transplantation (SLT) for patients with IPF provides a unique opportunity to study fibrosis in the native lung over time in the setting of pronounced immunosuppression.

The use of quantitative scoring methods for CT scans have been proven to be acceptable modality for the evaluation of lung fibrosis progression, but few reports have been published on the analysis of long term lung fibrosis on the CT scans of the native lung after SLT in patients with IPF.

The purpose of our study is to evaluate the progression of native lung fibrosis on thin-section CT scans in patients with IPF after SLT surviving more than 3 years.

Methods and materials

In total, there are 76 patients had undergone SLT who underwent single lung transplantation for IPF at at University of Washington Medical Center between September 1994 and March 2008. Among them, sequential CT scans had been performed in 12 patients between Jan 2000 and Feb 2012, and these were included in the study. Serial CT scan images of 12 patients who underwent single lung transplantation for IPF were reviewed by three radiologists as a team. The initial scan was performed within 12 months after SLT, and follow-up CT scans were performed more than 36 months post-SLT. Total lung volume CT measurements were performed on native lungs. CT scores were then evaluated for the native lung findings for each thin-section CT, including the degree of fibrosis, ground-glass opacities (GGO) and traction bronchiectasis.

Results

Twelve patients (3 female, 9 male; 49-66 years old, mean 58.6 years old) fulfilled our selection criteria between Jan 2000 and Feb 2012 and were entered into the study. Of these patients, eight died during the study period and four were still alive by the end of the follow-up period, and they survived 43~110 months (mean 74.7±19.5 months) post-SLT. In total, 31 CT scans were evaluated. In six patients, SLT was performed on the right side, with six on the left side. Our patient population was affected by severe restrictive lung function. All twelve patients underwent SLT operation with standard postoperative
management and were treated with a lifelong regimen of steroids, an anti-proliferative agent and a calcineurin inhibitor.

The initial CT examinations were obtained at mean time of 3.7±1.9 months after SLT (range, 7 months before SLT to 11 months after SLT). After SLT, the follow-up period ranged from 43 to 110 months (mean, 74.7±19.5 months). In each patient, between two and five CT examinations were performed.

Eleven patients showed an increase in the extent of fibrotic changes in the native lung after SLT (Fig.1) and one patient remained stable at 36 months post-SLT. The average score regarding fibrotic changes increased (r=0.515, p<0.001). The rate of the progression of fibrosis scores on CT scans was at an average of 0.300 per year (Fig.2).

Twelve patients showed progression in the degree of traction bronchiectasis on later CT scans compared to the first scan, with a progression in scores each year of approximately 0.147 per year (r=0.696, p<0.001) (Fig.3).

The degree of GGO improved in seven patients, was stable in one patient and worse in four patients. When the initial CT scan GGO score was compared with the follow-up CT images, the GGO score tended to decrease over time (r=0.721, p<0.001) with an average reduction of 0.18 per year (Fig.4).

The CT lung volume measurement decreased in nine patients and increased in three patients in later CT scans compared to the volume measured on the initial CT images. The volume of the native lung in lung CT reconstruction measurements tended to show a trend of decrease over time (5.4%/year, r = 0.653, p = 0.001), in nine cases without further complications that may have affected the native lung volume, such as pleural effusion. The mean volumes from all 12 patients at 1-, 3-, 4-, 5-, 6- and 9-years post-SLT were 1243.70 ml, 1168.69 ml, 1227.84 ml, 1084.52 ml and 1275.12 ml, respectively. Of the three patients that had an increase in lung volume, two had medial pleural effusions on their initial CT scans, and another one had atelectasis in the grafted lung on their follow-up CT scan. There was a decrease in the CT lung volume in nine patients, and, the trend is shown in Fig.5.

Images for this section:
**Fig. 1:** The progression of fibrosis on CT scans of the native lung of a 57-year-old male patient with IPF at a) 11 months, b) 36 months and c) 75 months post-SLT.
Fig. 2: Changes in the fibrosis score over time.
Fig. 3: Changes in the traction bronchiectasis score over time.
Fig. 4: The GGO score of the native lung post-SLT with IPF decreases over time from transplantation.
Fig. 5: A negative linear correlation between the volume of the native lung and years from transplantation. SLV, single lung's volume (native lung's volume).
Conclusion

Fibrotic disease within the native lung progresses in patients that receive SLT with IPF despite prolonged high dose immunosuppression.

Personal information

X. Wu, MD, Department of Radiology, Beijing Friendship Hospital affiliated to Capital Medical University, Beijing 100050, China; Visiting scholar, Department of Radiology, University of Washington, Seattle, WA.

mail to: luckyemilyxh@aliyun.com.

W. Burivong; Department of Radiology, Srinakharinwirot University, Nakorn Nayok, Thailand. Visiting scholar, Department of Radiology, University of Washington, Seattle, WA.

D.Ma, Department of Radiology, Beijing Friendship Hospital affiliated to Capital Medical University, Beijing 100050, China

J. Edelman, Department of Medicine, University of Washington, VA Puget Sound Health Care System, Seattle, WA 98108, USA

H. Chen, School of Biomedical Engineering, Capital Medical University, Beijing 100060, China.

E. Stern, Department of Radiology, University of Washington Medical Center, Seattle, WA 98105, USA

References


