ically presents in the third and fourth decades of life,[21] earlier than patients with BHD syndrome described in this report. However, both of these disorders can be associated with recurrent spontaneous pneumothoraces, although a known family history of BHD syndrome would obviously be helpful in the differential diagnosis. Additional evaluation including biopsy of lung, skin lesions or renal tumor may help distinguish these two disorders. In some patients, BHD syndrome may be mistaken for tuberous sclerosis because the latter disorder is also associated with lung cysts (almost exclusively in women) and facial skin lesions.[21,22]

BHD syndrome is associated with renal tumors of various histologic types, including clear cell, chromophobe, and papillary types of renal cell cancers, as well as oncocytomas.[6,23] Thus, patients with BHD syndrome should be screened for renal tumors and carefully followed up at periodic intervals. Similarly, family members of patients with BHD syndrome should be screened for renal tumors and offered genetic counseling.

In conclusion, we find cystic lung disease in BHD syndrome to vary in severity in patients affected with this rare disorder. Although our data are limited by small number of patients, smoking appears to be associated with more severe lung disease compared to nonsmokers, a relationship not previously explored in BHD syndrome. Limited follow-up of our patients suggests a relatively slow rate of progression for this lung disease.

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Nonfatal Systemic Air Embolism Complicating Percutaneous CT-Guided Transthoracic Needle Biopsy*

Four Cases From a Single Institution

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Background: **Systemic air embolism is recognized as a potentially fatal but extremely rare complication following percutaneous transthoracic needle biopsy. However, its incidence might be underestimated by missing systemic air in patients without cardiac or cerebral symptoms.**

Methods: **This study was based on four cases (one man and three women; age range, 54 to 75 years) of systemic air embolism complicating CT scan-guided transthoracic needle biopsy, which were encountered among 1,010 procedures performed at our institution**

from April 1999 to December 2006. The target lesion was a lung tumor in three patients, and a mediastinal tumor in one patient. The procedure was performed percutaneously under CT scan-fluoroscopic guidance by using a coaxial biopsy needle system.

Results: **In all four patients, a specimen was successfully obtained from the lesions. During or immediately after the procedure, all patients experienced paroxysms of coughing. In three patients without cardiac or cerebral symptoms, the presence of systemic air was confirmed on postprocedural CT scan images; it was resolved without causing morbidity after the immediate therapy. The presence of systemic air was missed in one initially asymptomatic patient, resulting in a subsequent neurologic deficit.**

Conclusions: **Systemic air embolism following CT scan-guided transthoracic needle biopsy was encountered more frequently than would be expected. The considerable attention we gave to this complication enabled us to recognize it in patients without cardiac or cerebral symptoms. No sequelae were observed in the three patients in whom systemic air embolism was detected, and the therapy was initiated immediately, whereas missing systemic air led to cerebral embolism in one patient in our four cases.**

(CHEST 2007; 132:684–690)

Key words: air embolism; CT scan-guided biopsy; needle lung biopsy

Percutaneous CT scan-guided transthoracic needle biopsy has been widely accepted as a diagnostic procedure for pulmonary lesions. Although complications such as pneumothorax, intraparenchymal hemorrhage, and hemoptysis are not rare, the majority of these can be treated conservatively or with minimal intervention. Conversely, systemic air embolism is recognized as a potentially fatal but extremely rare complication; its incidence has been reported to be 0.02 to 0.07%.[1–3] However, considering that the diagnosis of systemic air embolism largely depends on the clinical manifestations of a rapid deterioration of neurologic and/or cardiac status, its incidence might be underestimated because systemic air may be missed in patients without cardiac or cerebral symptoms. Herein, we present four cases of nonfatal systemic air embolism complicating percutaneous CT scan-guided transthoracic needle biopsy, including three patients without cardiac or cerebral symptoms.

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Materials and Methods

Our institutional review board did not require approval to report this study.

Patients and Lesions

From April 1999 to December 2006, we performed 1,010 percutaneous CT scan-guided transthoracic cutting needle biopsy procedures at our institution after obtaining written informed consent. Among these patients, we encountered four cases (0.4%) of systemic air embolism, which form the basis of this study. The patients comprised one man and three women, with a mean age of 66.5 years. The target lesion was a lung tumor in three patients and a mediastinal tumor in one patient. The characteristics of the patients and lesions are summarized in Table 1.

Biopsy Procedures

In all four patients, the procedure was performed percutaneously under CT scan-fluoroscopic guidance by an experienced radiologist; the instrument used was a coaxial biopsy system consisting of a 19-gauge introducer needle (Co-Axial Introducer Needle; Medical Device Technologies; Gainesville, FL) and a 20-gauge core biopsy needle (Super-Core II Biopsy Instrument; Medical Device Technologies). Cardiac and respiratory parameters, such as BP, heart rate, ECG, and blood oxygen saturation, were monitored throughout the procedure. All four patients were placed in the prone position. Prior to the procedure, CT scan images were obtained for targeting the lesion. The needle path was determined while avoiding interlobular fissures, visible bronchi, and relatively large vessels. Our routine biopsy techniques were as follows: (1) after the administration of local anesthesia, the introducer needle was

Table 1—*Characteristics of Patients and Lesions

Case No.	Patients				Lesions		
	Age, yr/Sex	History	Pulmonary Emphysema	Coagulopathy	Location	Size, cm	CT Characteristics
1	71/M	None	Yes	No	Left lower lobe	1.3	Ground-glass opacity with solid component
2	54/F	None	No	No	Posterior mediastinum	7.2	Solid tumor
3	75/F	Microscopic polyarteritis	No	No	Left lower lobe	1.3	Solid tumor
4	66/F	Breast cancer	No	No	Left lower Lobe	2.5	Pure ground-glass opacity

*M = male; F = female.