Endovascular Catheter-guided Forceps Biopsy for the Diagnosis of Suspected Pulmonary Artery Sarcoma: A Preliminary Study of Eight Cases

Wan-Mu Xie1,2, Zhen-Guo Zhai1,2, Le-Feng Wang1, Jun Wan1,2, Yuan-Hua Yang2,4, Chen Wang1,2
1Department of Respiratory and Critical Care Medicine, China-Japan Friendship Hospital, Beijing 100029, China
2Beijing Key Laboratory of Respiratory and Pulmonary Circulation Disorders, Beijing 100020, China
3Department of Cardiology, Beijing Chao-Yang Hospital, Capital Medical University, Beijing 100020, China
4Department of Respiratory and Critical Care Medicine, Beijing Chao-Yang Hospital, Capital Medical University, Beijing 100020, China

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INTRODUCTION
Pulmonary artery sarcoma (PAS) is a rare malignant tumor that originates from the pulmonary artery (PA) with a poor prognosis.[1] Early diagnosis and radical surgical resection offer the only chance for survival.[2,3] As most PA sarcomas involve the PA trunk, making a preoperative histopathological diagnosis is quite difficult. So far, most PAS cases were reported with diagnosis made either at autopsy or intraoperatively with frozen sections.[4,5] Therefore, it will be very helpful if PAS can be diagnosed before surgery. For this purpose, some authors have attempted transcatheter suction biopsy to diagnose PAS preoperatively.[6,7] However, transcatheter suction biopsy often misses out the tumor as it does not provide sufficient core tissue. In our clinical practice and other reports, few of them succeeded.[8] In this preliminary study, a new technique of endovascular catheter-guided forceps biopsy (CGFB) was used to diagnose PAS. We describe the procedure and report results on a series of eight cases.

METHODS
The Ethics Committee of Beijing Chao-Yang Hospital approved this study. Written informed consent was obtained from each patient before each invasive procedure. Between January 2012 and May 2015, 16 consecutive patients suspected with PAS were admitted in Beijing Chao-Yang Hospital for further diagnosis. Eight of the patients agreed to perform CGFB after right-heart catheterization. Details of the CGFB were described as followings: (1) A 6-F guiding catheter JR4.0 (Medtronic, Inc. Minneapolis, USA) was advanced to the PA with the help of wire. (2) The wire was removed, and the catheter was put in close touch with angiographic “thrombus-like” substance. (3) Endomyocardial biopsy forceps (Argon Medical Devices, Inc. Plano, USA) were inserted directly in touch with the mass, once resistance was sensed, clamp the tissue quickly and then pulled out the forceps. The operation was repeated until enough tissues were obtained [Figure 1]. Hematoxylin-eosin staining and immunohistochemical staining of the specimen were carried out for evaluation.

RESULTS
Of the eight patients agreed for CGFB, three were men and five were women. The mean age of the patients was 52.4 years (range, 32–75 years), [Table 1]. Of eight patients, six were initially diagnosed as pulmonary embolism and treated with anticoagulants (6/6) or thrombolysis (2/6) without any improvement. PAS was suspected at first visit in two patients. The thrombus-like mass occluded the central pulmonary arteries in all of the eight patients. Three patients occluded the right PA (RPA), two in the left PA, and two...
located both in the PA trunk and RPA, and in one case, the mass involved the outflow tract of right ventricle, PA valve, PA trunk, and both sides of the pulmonary arteries. Lung involvement was also identified in three patients [Figure 2].

All the eight patients were performed CGFB successfully and tissue samples were gained for histological examination. PAS was confirmed in five patients, and chronic thromboembolic pulmonary hypertension (CTEPH) was considered the correct diagnosis with the histological findings from CGFB and confirmed after pulmonary thromboendarterectomy later [Figure 3]. While in two patients, there were only necrotic tissue and thrombus detected from the harvested sample, one of the patients was then confirmed PAS with computed tomography (CT)-guided percutaneous lung biopsy 4 months later.

Of the five patients diagnosed with PAS after CGFB, two died between 3 and 4 months without any specific treatment. One was still alive at the time of the last follow-up (14 months) with chemotherapy. The other two was not received any treatment yet. Among the other three patients not confirmed as PAS after CGFB, one was diagnosed as CTEPH and improved dramatically after surgery as followed up for 4 months. One of the patients was then confirmed to have PAS with CT-guided percutaneous lung biopsy 4 months later. Moreover, the other one suffered from sudden cardiac death after 15 months without any specific treatment.

All the eight patients tolerated the procedure well. There were no complications such as bleeding and perforation during and after CGFB in eight patients.

Table 1 shows demographic and clinical characteristics of eight cases with suspected PAS.

**DISCUSSION**

PAS is a rare and lethal neoplasm. It generally occludes the central pulmonary arteries and is frequently misdiagnosed.
Table 1: Demographic and clinical characteristics of eight cases with suspected PAS

| Case number | Gender/age (years) | Main complaints | Initial diagnosis | Site of tumor | Pathological diagnosis with CGFB sample | Final diagnosis | Treatment | Outcome and follow-up |
|-------------|-------------------|-----------------|------------------|---------------|----------------------------------------|----------------|----------|-----------------------|
| 1           | Male/75           | Dyspnea         | PE               | RPA           | Necrotic tissue                        | –              | NS       | Died, 15 months       |
| 2           | Female/49         | Hemothysis, chest pain, dyspnea | PE            | LPA + lung involvement | Intimal sarcoma | PAS   | Chemotherapy     | Alive with disease, 14 months |
| 3           | Female/32         | Dyspnea         | PAS              | RPA           | Intimal sarcoma                        | PAS            | NS       | Died, 3 months        |
| 4           | Male/59           | Chest pain, dyspnea | PE        | PA trunk + RPA | Intimal sarcoma                        | PAS            | NS       | Died, 4 months        |
| 5           | Female/46         | Chest pain, dyspnea | PE    | RPA + lung involvement | Thrombus | PAS (diagnosed by CT-guided percutaneous lung biopsy) | NS | Alive with disease, 4 months |
| 6           | Male/47           | Chest pain, dyspnea, hemothysis | PE    | LPA          | Fibrous and degenerative tissue, consistent with CTEPH | CTEPH | PET | Alive with improvement, 6 months |
| 7           | Female/69         | Chest pain and dyspnea | PE | Outflow tract of right ventricle + PA valve + PA trunk + RPA + LPA | Sarcoma | PAS | NS | Alive with disease 1 months |
| 8           | Female            | Cough and dyspnea | PAS | PA trunk + RPA + lung involvement | Sarcoma | PAS | Chemotherapy | Alive with disease 2 weeks |

CTEPH: Chronic thromboembolic pulmonary hypertension; PE: Pulmonary embolism; LPA: Left pulmonary artery; PA: Pulmonary artery; RPA: Right pulmonary artery; NS: Not specific; PET: Pulmonary thromboendarterectomy; PAS: Pulmonary artery sarcoma; CT: Computed tomography; CGFB: Catheter-guided forceps biopsy.

as acute or chronic pulmonary thromboembolism.[9-11] This misdiagnosis contributes to its poor prognosis as it delays making the correct diagnosis and administering the appropriate treatment. The definite diagnosis of PAS is based on pathological examination, and so far, the majority of specimens is taken by surgery or autopsy. It was reported that an early diagnosis of PAS may improve its prognosis.[12] Therefore, it will be very helpful if it can be diagnosed preoperatively. However, the diagnosing of PAS is still considered very hard before surgery or autopsy although many attempts have been made. Endovascular aspiration biopsy has been attempted to diagnose PAS, but with limited success.[6-8] Insufficient core tissue is the main concern. Endobronchial ultrasound-guided transbronchial needle aspiration has also been reported with a successful diagnosis of PAS. However, the increasing complications of bleeding have been questioned.[13-15]

In our cases, endovascular biopsy was performed through catheter-guided forceps clamp. Results showed that six of the eight patients get histopathological diagnosis with the samples obtained through CGFB, including one diagnosed as CTEPH and five as PAS. In PAS, the tumor tissue is often covered with in situ thrombus and necrotic tissues. In comparison with endovascular aspiration biopsy, CGFB may obtain more core tissues. In our study, of the eight cases, only necrotic tissue or thrombus was obtained through CGFB in two patients. As one of the two patients was later confirmed as PAS, the definite diagnosis was not available for the other one. There were probabilities that CGFB may miss out the tumor. In our experience, forceps should be inserted in touch with the mass and clamp the tissue when resistance was sensed as quickly as possible. The procedure may be repeated until the core tissues were obtained, which have more chance to get the real lesion site.

In one case, there was no distinct morphologic and immunohistologic differentiation detected; thus, the origin of the tumor was not clear through CGFB. Not enough tissue for histopathological analysis and poor differentiation of the tumor were possible reasons.

There might be another concern about the safety of CGFB; however, CGFB was safe in our cases. No complications occurred in all of the eight patients. CGFB is comparatively less invasive and easier to be carried out, and the materials used in CGFB are easily available in a catheter laboratory. However, it has to be admitted that the technique takes risk of bleeding, perforation, etc.

In conclusion, our cases suggest that CGFB is a safe and feasible approach to the tissue diagnosis of suspected PAS preoperatively. CGFB can be used as a diagnostic option for PAS according to the tumor location although additional experience is required.

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Conflicts of interest
There are no conflicts of interest.

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