



Case report

Pulmonary artery sarcoma: Case report and review of the literature

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ABSTRACT

Pulmonary artery sarcoma is a rare malignancy with poor prognosis which can be misdiagnosed as pulmonary thromboembolism. We present a case of a middle age woman who initially diagnosed with presumptive pulmonary embolism that was later found to have pulmonary artery sarcoma. Symptoms, pathology, imaging characteristics and available treatments are discussed.

1. Introduction

Pulmonary artery sarcoma (PAS) is a rare malignancy carrying a poor prognosis. It has been demonstrated that early diagnosis leads to improved outcomes. However, it can be easily misdiagnosed as pulmonary embolism (PE) in nearly half of the cases [1–3]. To help differentiate between PE and PAS, there must be careful attention to subtle differences between these diagnoses on computed tomography (CT) [4], magnetic resonance imaging (MRI), transthoracic echocardiogram (TTE) and fluorodeoxyglucose-positron emission tomography (FDG-PET) [5].

We present a case of PAS that was misdiagnosed initially as PE and discuss key imaging features and treatment modalities.

2. Case report

A 44 year old Hispanic woman presented to the outpatient pulmonary clinic for evaluation of cough, pleuritic chest pain and dyspnea. She had history of papillary follicular thyroid cancer status post thyroidectomy and radiation.

Six months prior to presentation she had been diagnosed with suspected acute pulmonary embolism involving the entire right pulmonary artery (Fig. 1). This diagnosis was only based on the filling defect of the pulmonary artery. Venous dopplers of the lower extremities were negative for deep vein thrombosis. She had been treated with enoxaparin. Due to her persistent symptoms she was re-evaluated with Ventilation-Perfusion (V/Q) scan and chest x ray.

Her chest radiograph showed an enlarged hilum.

V/Q scan showed absence of perfusion in the right lung.

Six month after her initial diagnosis of presumptive pulmonary embolism, a CT chest showed significant enlargement of a large endovascular mass completely obstructing the right pulmonary artery. The mass had progressed into the distal main pulmonary artery and its branches (Fig. 2). The primary mass measured 56 mm × 30 mm. There were peripheral right lung consolidations that likely represented tumor thrombus.

Echocardiogram showed normal left and right ventricular systolic function. Right ventricular systolic pressure could not be estimated.

Fine needle aspirations of the mass were obtained through endobronchial ultrasound (EBUS). Cytology showed tumor cells with spindle cell proliferation (Figs. 3 and 4). Immunohistochemical studies were positive for MDM2 and negative for erythroblast transformation-specific transcription factor (ERG) (Fig. 5). These findings were suggestive of an intimal sarcoma.

Because the diagnosis had been confirmed by EBUS, further imaging testing with MRI or FDG-PET scan were not performed.

The patient was evaluated by a multidisciplinary team, consisting of radiologists, pathologists, cardiothoracic surgeons and pulmonologists. Even though surgery was a consideration, she was not deemed to be a surgical candidate due to extent of the tumor invasion based on imaging studies. She received doxorubicin and ifosfamide. Due to continued progression of disease she was treated with paclitaxel and then imatinib. Eventually she was also enrolled into a phase I study for drug NLG802, a new checkpoint inhibitor.

Despite the above treatment, eleven months after presentation her follow up CT chest showed significant progression of the endovascular

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Abbreviation list

CPTe	chronic pulmonary thromboembolism
CT	computed tomography
FDG-PET	fluorodeoxyglucose-positron emission tomography
EBUS	endobronchial ultrasound
ERG	erythroblast transformation-specific transcription factor
PAS	pulmonary artery sarcoma
PE	pulmonary embolism
TTE	transthoracic echocardiogram

tumor, resulting in occlusion of the right pulmonary artery. There was subtotal resorptive atelectasis of the right hemithorax with reactive loculated moderate pleural effusion. (Fig. 6). Twelve months after presentation she developed SVC syndrome and passed away.

3. Discussion

3.1. Epidemiology

PAS is a rare malignancy with poor prognosis. The median overall survival is 17 months [6]. This poor prognosis seems to be related to the fact that early diagnosis of PAS is quiet difficult. This was shown by



Fig. 1. Axial image of the chest from CTA pulmonary exam shows a large filling defect in the right pulmonary artery (arrow) as compared to the normal opacification in the main pulmonary artery (asterix). The main pulmonary artery is normal in size.



Fig. 2. Axial image of the chest from CTA pulmonary exam showing the large filling defect in the right pulmonary artery branches into the anterior segment of the right upper lobe and interlobar pulmonary arteries (straight arrows). The margins of the filling defect are lobulated (curved arrow). There is also subcarinal lymphadenopathy (asterix).

Bandyopadhyay et al. who reported that about 47% of PAS are misdiagnosed as PE [1], as in our case. The prognosis seems to be slightly better when complete resection is achieved: Blackmon et al. showed that the median survival was 36 ± 20 months if curative resection was achieved vs. 11 ± 3 months for those undergoing incomplete resection [5].

PAS has a very low incidence and only a total of 400 cases have been reported in the literature [7].

The usual age of presentation is 45–55 years (range 13–86) with a female to male ratio of 2:1 [8].

3.2. Clinical presentation and diagnosis

Patients with PAS can be asymptomatic initially when there is no hemodynamic compromise from pulmonary artery occlusion. With advance disease, insidious symptoms such as dyspnea, chest pain/tightness, edema, constitutional symptoms, cough and hemoptysis may develop [6]. Unfortunately, these symptoms are non-specific and can also be present in other pulmonary and non-pulmonary diseases, such as PE. This makes clinic diagnosis very difficult. Definitive diagnosis of PAS can be done intra-operatively at the time of resection or by modalities such as EBUS [3] or CT guided biopsy [9].

3.3. Pathology

Histologically, PAS develop from the wall of the pulmonary artery. It can either arise from the intimal wall (angiosarcoma, osteosarcoma and rhabdomyosarcoma) or be intramural (leiomyosarcoma) [8]. Immunohistochemical staining of the tumor is routinely performed for desmin, cytokeratin, vimentin, ERG and actin. These tumors also over-express MDM2. There is no correlation between the histologic type and patient survival [5].

3.4. Imaging

Because differentiation of PAS from PE is very difficult, several imaging modalities have been described (Table 1).

Regarding PAS CT presentation, Hui-Li Gan et al. described 12 patients with PAS in comparison with patients with chronic thromboembolic pulmonary hypertension and acute PE. [8] CT chest finding suggestive of PAS was a filling defect occupying the entire lumen of the

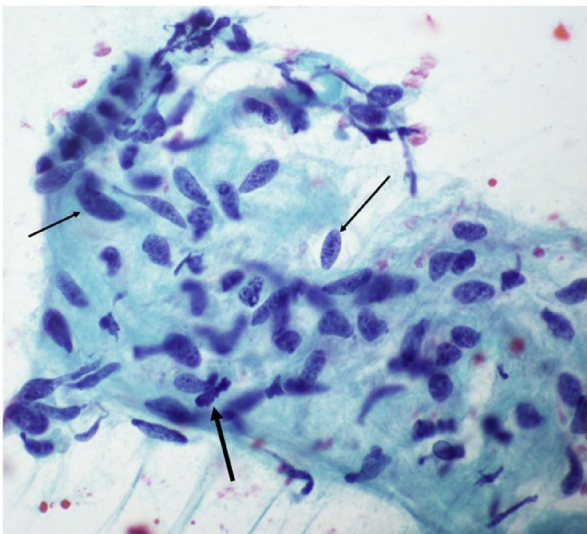


Fig. 3. 60× Giemsa stain. Fine needle aspiration of right paratracheal mass shows atypical spindle cells with variable degrees of nuclear pleomorphism (thin arrow) and occasional mitotic figures (thick arrow) on this smear prep slide.

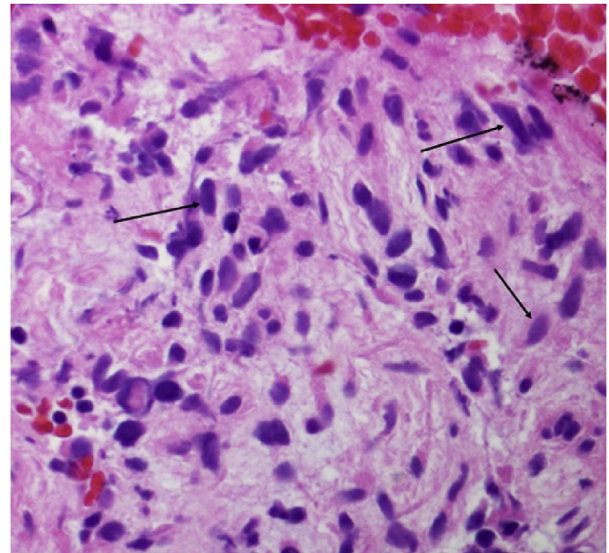


Fig. 4. 40× H&E stain. Cell block shows atypical spindle cells with variable nuclear pleomorphism (arrows).

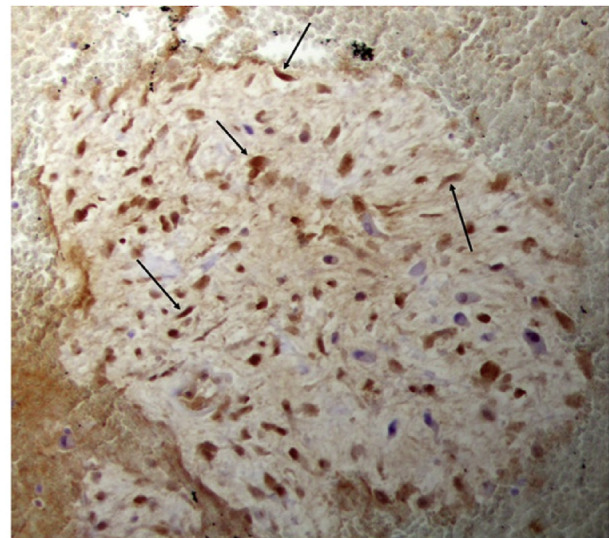


Fig. 5. 20×. Immunohistochemical evaluation of the cell block shows scattered nuclear reactivity to MDM2.

pulmonary trunk with an increase in diameter of the involved vessel and delayed patchy contrast enhancement, which is more evident in venous phase. They described a specific PAS finding called the ‘wall eclipsing sign’ which is defined by the presence of the following three findings: almost complete filling of the pulmonary artery and its branches by a low-density mass; protrusion of the proximal end of this mass towards the right ventricular outflow tract; and eclipsing of one or both walls of the pulmonary trunk or its branches by this lesion. The “wall eclipsing sign” was not seen in any of the CTEPH or acute PE patients [8].

Ming-Xi Liu et al. also compared PAS versus chronic pulmonary thromboembolism (CPTE). They found that the morphology of PAS tumors was often a full form and expansive growth, with subsequent widening of the corresponding pulmonary artery, as opposed to CPTE which tended to be attached to the intima. The proximal end of the PAS lesions was usually bulging and lobulated. This differs from CPTE which is eccentrically displaced and has a higher Hounsfield unit value [10].

The Ming-Xi Liu et al. group also described PAS and CPTE findings on MRI, which shows that the pulmonary artery intima adjacent to the



Fig. 6. Axial image of the chest from CTA pulmonary exam shows a pleural effusion (dashed line) surrounding collapsed lung. The pulmonary artery sarcoma is seen as a lobulated expansive filling defect in the main and right pulmonary arteries (curved arrows).

Table 1
Radiologic and clinical differences between PAS and PE.

	<i>Pulmonary Artery Sarcoma</i>	<i>Pulmonary Embolism</i>
CT (pulmonary artery) [10]	Usually involves the main pulmonary trunk Expansive growth with proximal bulging Presence of “wall eclipsing sign” [8]	Involves right or left pulmonary artery, saddle Flat proximally or cup shaped clot Absence of “wall eclipsing sign” [8]
CT (non-pulmonary artery) [14]	Pulmonary nodules, parenchymal changes, hilar adenopathy, pleural effusions	Wedge shaped infarct, pleural effusion
FDG PET [15]	Higher SUV uptake (10.2 ± 10.8)	Lower SUV uptake (1.7 ± 0.3)
MRI [10]	Thickened pulmonary artery intima Higher T2 signal intensity	Calcifications
Thrombolytics	No response	Partial/complete resolution
Symptoms	Cough, shortness of breath, pleurisy	Cough, shortness of breath, pleurisy

tumor was thickened, and delayed enhancement was observed. Also, the T2 signal intensity for PAS was always higher than for CPTA [10].

Yeung et al. described PAS findings on echocardiogram. PAS characteristics, as opposed to PE, include mobility, absence of echo lucent areas, bulging rather than linear morphology, and attachment to the pulmonary valve or pulmonary artery wall [11].

FDG-PET characteristics were described by Tueller et al. They presented 3 patients with PAS who had a FDG-PET. They used this imaging modality to confirm the presence of malignancy. The FDG uptake was more intensive in all 3 cases as opposed to PE which uptake was less intense [12,13].

3.5. Treatment

Different treatment modalities such as pulmonary endarterectomy, chemotherapy (adjuvant and neoadjuvant) and radiation have been described in the literature [6,16].

Complete excision when possible is recommended because surgical management has shown a survival benefit [5]. Chemotherapy regimens used include Adriamycin plus isosfamide, gemcitabine plus taxane or dacerbazine regimens [5].

Radiation therapy has been described in operable and inoperable patients [5].

4. Conclusions

PAS is an uncommon endovascular malignancy of poor prognosis that is often misdiagnosed as pulmonary embolism. High clinical suspicion is required to make the diagnosis.

Symptoms are usually equivocal. However, findings on CT chest such as involvement of the main pulmonary artery trunk and expansive growth with proximal bulging, should raise the concern for PAS. Increase SUV uptake on FDG PET and increase T2 signal on MRI may also be seen in PAS.

Tissue biopsy can be obtained intra-operatively, by CT guided biopsy or by EBUS. The present case is actually the second case in the literature in which the diagnosis was made by EBUS [3].

It is recommended that the diagnosis and treatment of PAS be aggressively managed with a multi-modality approach, with resection when possible, chemotherapy and radiation.

Summary of conflict of interest

- Natalia I. Moguillansky, MD: No conflict of interest.
- Nupur, Verma, MD: No conflict of interest.
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Appendix A. Supplementary data

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