Pulmonary metastases: a rare cause for pulmonary artery invasion and in situ pulmonary artery thrombosis—demonstration with multidetector computed tomography

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INTRODUCTION

Pulmonary artery (PA) thromboembolism is a well-known complication of peripheral venous thrombosis. Cancer patients are known to have an increased tendency to pulmonary thromboembolism. Pulmonary artery tumour emboli may be found at autopsy in up to 30% of patients of certain malignancies.¹ Pulmonary arteries may also be involved by contiguous extension of tumour thrombus from a known malignancy at a distant site.² Direct neoplastic invasion of PAs by bronchial tumours has been described in literature.³ We describe a case of pulmonary metastases invading the PA causing in situ (PA) thrombosis demonstrated at multidetector computed tomography (MDCT) in a known patient of metastatic malignant peripheral nerve sheath tumour (MPNST). To the best of our knowledge, this is the first case in the English literature documenting imaging demonstration of pulmonary metastases invading PA with tumour thrombosis.

CASE REPORT

A 54-year-old lady presented to our surgical outpatient department with complaints of a slowly increasing swelling on the inner aspect of the left arm of two months duration. She gave past history of carcinoma rectum (T₁N₀M₀) successfully treated surgically (abdomino-perineal resection done) 12 years back. She has been a known hypertensive for the last 3 years and was on regular medication. On general examination, her vital

parameters were within normal limits. Systemic examination did not reveal any significant abnormality. On local examination, she was found to have a firm, mildly tender subcutaneous swelling measuring approximately 4 cm × 2 cm on the medial

Figure 1 Computed tomography guided fine needle aspiration cytology from metastatic pulmonary nodule, axial section (soft tissue window) in prone position. The needle tip lies within the metastatic nodule (arrow).

Figure 2 Photomicrograph (Leishman Geimsa stain: 400×) of the fine needle aspiration cytology from pulmonary metastatic nodule. Neoplastic cells are seen in clusters surrounded by metachromatic stroma. Some of these neoplastic cells show spindle shaped nuclei suggestive of metastases from soft tissue sarcoma.

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Figure 3 Contrast-enhanced computed tomography thorax, axial sections: (A) lung window shows presence of metastatic deposit (arrow) in the apical segment of right lower lobe, (B) soft tissue window at a higher level showing thrombus involving right pulmonary artery and RDPA, and (C) soft tissue window at the same level as that of figure 'A' showing contiguity of the metastatic deposit (block arrow) with the RDPA. RDPA: right descending pulmonary artery.

Figure 4 Curved coronal reconstruction depicting clearly thrombosis in the RPA and RDPA contiguous with the metastatic nodule. LA: left atrium, MN: metastatic nodule, MPA: main pulmonary artery, RDPA: right descending pulmonary artery, RPA: right pulmonary artery.

aspect of the left arm. The overlying skin was free from the swelling. There was no such similar nodule or any stigmata of neurofibromatosis elsewhere in the body. Fine needle aspiration cytology (FNAC) from the swelling was done, which suggested possibility of a spindle cell neoplasm. She underwent wide local excision of the tumour. Histopathology of the specimen revealed MPNST, intermediate grade with cut margins of the resected specimen free from tumour. A chest radiograph revealed multiple rounded soft tissue density nodules scattered in both lung fields suggestive of pulmonary metastases. A computed tomography (CT) scan study of the chest showed presence of multiple well-defined variable sized soft tissue density nodules distributed in both lung fields consistent with pulmonary metastases. The largest nodule ($4.2 \times 3 \text{ cm}^2$) was found in the apical segment of right lower lobe (RLL). A CT-guided FNAC was done from the largest parenchymal nodule (Figure 1). The cytology was consistent with metastases from MPNST

(Figure 2). She was on three cycles of chemotherapy (Inj Doxorubicin 75 mg, Inj Dacarbazine 1,200 mg, Inj Ifosfamide 7.5 g, Inj Mesna 7.5 g in each cycle) at three weekly intervals. After the completion of three cycles of chemotherapy, she was re-assessed for response to chemotherapy and for possible metastasectomy. At this point, her main complaints were intermittent dry cough and breathlessness on exertion. A contrast-enhanced CT (CECT) scan study of the chest was carried out in a 16 slice multidetector CT machine (Somatom Sensation 16, Siemens, Germany). The CECT study revealed increase in the size and number of pulmonary nodules. The nodule in the apical segment of RLL now measured $5 \times 4.3 \text{ cm}^2$. This metastatic nodule was seen to be contiguous with the descending branch of right descending pulmonary artery (RDPA). There was loss of definition of the intervening wall of the RDPA suggestive of contiguous invasion (Figures 3A–C). The RDPA was found to be filled with enhancing intraluminal thrombus (pre-contrast average Hounsfield (HU)=34, post-contrast average HU=50) best appreciated on curved coronal reconstruction (Figure 4). Thrombus was seen to extend into the middle lobar artery as well. Rest of the pulmonary circulation was normal with no evidence of thrombosis elsewhere up to fifth order (sub-segmental level) branches. Main pulmonary artery (MPA), ascending aorta (at the same level as MPA), right and left pulmonary arteries measured 25, 32, 18, and 17 mm, respectively. The right ventricle (RV) and left ventricle (LV) ratio was normal (26:31) with interventricular septal bowing towards the RV suggesting absence of RV strain or pulmonary arterial hypertension. Electrocardiogram as well as echocardiography did not reveal any abnormality. She had undergone biochemical and sonographic evaluation which ruled out possibility of peripheral venous thrombosis. Her complete coagulation profile was also within normal limit. Based on the CT scan findings, a diagnosis of pulmonary metastases from MPNST invading RDPA with tumour thrombus within was made. The patient is on regular follow-up at our medical oncology centre.

DISCUSSION

Because of the unique anatomy with rich capillary network and central location in the circulatory system, lungs are the most frequent sites for haematogenous metastases from a variety of malignant tumours. Also, pulmonary arteries offer less resistance to neoplastic invasion as compared to systemic vessels possibly because of a lower pressure gradient across the vessel wall. As compared to general population, cancer patients are at an increased risk for development of thromboembolism due to multifactorial disturbance of haemostatic balance. Malignancies such as carcinoma of the breast, hepatocellular carcinoma, renal cell carcinoma, choriocarcinoma, carcinoma of stomach, and malignant melanoma are known to have PA tumour emboli in almost up to one-third of cases.¹ Majority of patients with PA tumour emboli have features of chronic pulmonary thromboembolism (PTE). However, at times, PA tumour emboli can be rapidly fatal.^{4,5} Moreover, PA may also be involved by contiguous extension of tumour thrombus from a variety of tumours located at distant sites like liver, kidney, etc.² and sometimes from unusual locations.⁶ Direct neoplastic invasion of PA by primary lung cancers have also been described.³ Engelke et al have described a case of pulmonary hemangiosarcoma, an unusual cause for main PA thrombosis imitating subacute pulmonary embolism with infarction.⁷

The MPNST is a rare tumour of ectomesodermal origin with an incidence of 1 per 100,000 population and MPNST accounts for 3–10% of all soft tissue sarcomas.⁸ They usually occur in deep soft tissues in close proximity to a nerve trunk. Earlier, this group of tumours was known by a variety of terms like malignant schwannoma, neurogenic sarcoma, neurofibrosarcoma, etc. until World Health Organization coined the term MPNST to avoid confusion arising out of nomenclature for these tumours having similar biologic behaviour.^{9,10} Malignant peripheral nerve sheath tumours may arise spontaneously or in association with neurofibromatosis type I which accounts for 40–60% of cases.¹⁰ Malignant peripheral nerve sheath tumours have an aggressive biologic behaviour with increased tendency for local recurrence and distant metastases despite adequate surgical resection of the primary tumour. Haematogenous spread occurs most commonly to the lungs.

Although direct neoplastic invasion of PA by primary lung neoplasms have been described, there is no report in the literature about contiguous invasion of PA by a pulmonary metastatic deposit, as has been demonstrated in our present case. In view of the rarity of the finding, it is felt that close proximity of a metastatic deposit to a major PA can result in direct invasion of the vessel wall where the primary tumour is well-known to be aggressive in its biologic behaviour, and should be searched for specifically. Previous CT studies may not have demonstrated such a finding due to their slow acquisition speed and lower spatial resolution as compared to the MDCT, which now offers unique advantages of high speed volume acquisition and

thinner collimation with multiplanar reconstructions (MPR) having isotropic resolution in all directions. The MDCT also facilitates curved MPR providing clear depiction of structures which are not in a straight line, and thus depict crucial information when combined with conventional axial and MPR sections. Our case also highlights the utility of curved MPR in clearly demonstrating the contiguous involvement of RDPA by the metastatic deposit in the apical segment of RLL.

To conclude, we describe an unusual cause for PA thrombosis in a case of metastatic MPNST, wherein the metastatic pulmonary deposit invaded pulmonary artery with tumour thrombosis, which was detected at MDCT imaging during metastatic workup in a patient not presenting with clinical features of pulmonary thromboembolism.

CONFLICTS OF INTEREST

None.

REFERENCES

- Engelke C, Schaefer-Prokop C, Schirg E, Freihorst J, Grubnic S, Prokop M. High resolution CT and CT angiography of peripheral pulmonary vascular disorders. *Radiographics* 2002;22:739–764.
- Wieder JA, Laks H, Freitas D, Marmureanu A, Belldegrin A. Renal cell carcinoma with tumor thrombus extension into the proximal pulmonary artery. *J Urol* 2003;169:2296–2297.
- Takahashi M, Murakami Y, Nitta N, et al. Pulmonary infarction associated with bronchogenic carcinoma. *Radiat Med* 2008;26:76–80.
- Keenan NG, Nicholson AG, Oldershaw PJ. Fatal acute pulmonary hypertension caused by pulmonary tumour thrombotic microangiopathy. *Int J Cardiol* 2008;124:e11–e13.
- Hoshino A, Matsuo A, Suzuki K, et al. Sudden death due to pulmonary tumor embolism from testicular tumor: a case report. *J Cardiol* 2006;48:227–232.
- Hines N, Lantos G, Hochzstein J, Gitig A, DeAnda A. Osteosarcoma of the lumbosacral spine invading the central venous pathways, right-sided cardiac chambers, and pulmonary artery. *Skeletal Radiol* 2007;36:1091–1096.
- Engelke C, Riedel M, Rummeny EJ, Marten K. Pulmonary haemangiosarcoma with main pulmonary artery thrombosis imitating subacute pulmonary embolism with infarction. *Br J Radiol* 2004;77:623–625.
- Kar M, Deo SVS, Shukla NK, et al. Malignant peripheral nerve sheath tumors (MPNST) – Clinicopathological study and treatment outcome of twenty-four cases. *World J Surg Oncol* 2006;4:55.
- Wanebo JE, Malik JM, VandenBerg SR, Wanebo JH, Driesen N, Persing JA. Malignant peripheral nerve sheath tumors. A clinicopathologic study of 28 cases. *Cancer* 1993;71:1247–1253.
- Hrehorovich PA, Franke HR, Maximin S, Caracta P. Malignant peripheral nerve sheath tumor. *Radiographics* 2003;23:790–794.