

# Case Report

## Mitral valve obstruction by tumor embolus as a cause of irreversible cardiac arrest during right pneumonectomy\*

Obstrução de valva mitral por embolização tumoral per-operatória  
(pneumectomia direita) com parada cardíaca irreversível

Rui Haddad<sup>1</sup>, Carlos Henrique Ribeiro Boasquevisque<sup>2</sup>, Tadeu Diniz Ferreira<sup>3</sup>,  
Mario Celso Martins Reis<sup>3</sup>, Fernando D'Imperio Teixeira<sup>4</sup>

### Abstract

A 26-year-old patient with a voluminous primary pulmonary hemangiopericytoma in the right lung, diagnosed through previous surgical biopsy, presented irreversible cardiac arrest during the hilar dissection portion of a right pneumonectomy. The patient did not respond to resuscitation efforts. Autopsy showed total obstruction of the mitral valve by a tumor embolism. In cases of large lung masses with hilar involvement, as in the case presented, we recommend preoperative evaluation using transesophageal echocardiography, magnetic resonance imaging or angiotomography. If injury to the pulmonary vessels or atrial cavities is detected, surgery with extracorporeal circulation should be arranged in order to allow resection of the intravascular or cardiac mass, together with pulmonary resection. We recommend that care be taken in order to recognize and treat this problem in patients not receiving a preoperative diagnosis.

**Keywords:** Embolism; Heart arrest; Pneumonectomy.

### Resumo

Um paciente de 26 anos, portador de volumoso hemangiopericitoma primário de pulmão direito, diagnosticado por biópsia cirúrgica prévia, apresentou parada cardíaca irreversível durante dissecação hilar de pneumectomia direita. O paciente não respondeu às manobras de ressuscitação. A necropsia mostrou obstrução total de valva mitral por êmbolo tumoral. Os autores recomendam, em casos de grandes massas pulmonares com envolvimento hilar, como no caso aqui apresentado, a avaliação pré-operatória com ecocardiografia transesofágica, ressonância magnética nuclear ou angiotomografia. Se for detectada lesão em vasos pulmonares ou cavidades atriais, deve-se programar a cirurgia com circulação extracorpórea, para permitir ressecção da massa intra-vascular ou cardíaca, combinada com a ressecção pulmonar. Os autores recomendam cuidados para reconhecer e tratar este problema, se o diagnóstico pré-operatório não for feito.

**Descritores:** Embolia; Parada cardíaca; Pneumonectomia.

### Introduction

Systemic tumor embolization is a rare complication that most often occurs in left atrial myxomas. Tumor embolization in the perioperative period following pulmonary resection is extremely rare. A broad review of the literature, published in August of 1992, showed that, among the 30 cases of perioperative tumor embolization found in

publications in English, only 2 presented embolization to the cardiac chambers. Of those, only one presented embolization to the mitral valve.

In this report, we describe a case of death from acute cardiac arrest caused by obstruction of the mitral valve due to perioperative embolization of a fragment of a primary

\* Study conducted in the Thoracic Surgery Division of the *Instituto de Doenças do Tórax* of the *Universidade Federal do Rio de Janeiro* – IDT-UFRJ, Thoracic Diseases Institute of the Federal University of Rio de Janeiro – in the Graduate Course of the Surgery Department of the UFRJ School of Medicine and in the Thoracic Surgery Department of the UFRJ Clementino Fraga Filho University Hospital, Rio de Janeiro, Brazil.

1. Tenured Professor of the Graduate Course in Surgical Sciences. *Universidade Federal do Rio de Janeiro* – UFRJ, Federal University of Rio de Janeiro – School of Medicine, Rio de Janeiro, Brazil.

2. Head of the Department of Thoracic Surgery at the *Instituto de Doenças do Tórax* (IDT, Thoracic Diseases Institute), *Universidade Federal do Rio de Janeiro* – UFRJ, Federal University of Rio de Janeiro – Rio de Janeiro, Brazil.

3. Surgeon of the Thoracic Surgery Division of the *Instituto de Doenças do Tórax*. *Universidade Federal do Rio de Janeiro* – IDT-UFRJ, Thoracic Diseases Institute of the Federal University of Rio de Janeiro – Rio de Janeiro, Brazil.

4. Thoracic Surgeon at Bonsucesso General Hospital, Bonsucesso, Brazil.

Correspondence to: Prof. Dr. Rui Haddad. Rua Barão de Lucena, 48, CEP 22260-020, Botafogo, Rio de Janeiro, RJ, Brazil.

Tel. 55-21-25373499. E-mail: haddad@ufrj.br

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pulmonary hemangiopericytoma. This complication occurred during right pneumonectomy with irreversible cardiac arrest, and the diagnosis was confirmed through autopsy.

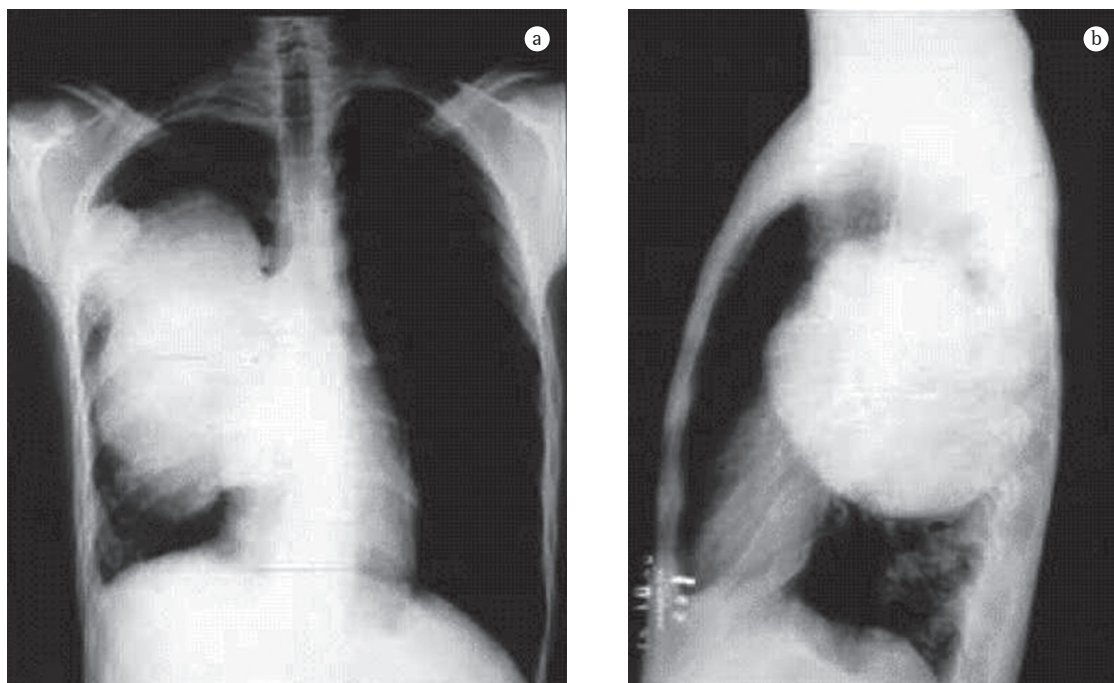
The relevance of this study lies in the necessity of knowledge and recognition of this complication, preferably in the preoperative period, allowing a chance to save the life of the patient, with the correct treatment procedures.

### Case report

A male patient, aged 26 years, a native and resident of Sergipe, Brazil, was evaluated in the Thoracic Surgery Department of the Clementino Fraga Filho University Hospital of the Federal University of Rio de Janeiro due to a large pulmonary mass, detected through chest X-ray (Figure 1). The computed tomography scan of the chest provided little additional data. The patient presented cough with hemoptysis and dyspnea for two months prior to hospitalization. In his hometown, the case was investigated through fine-needle puncture of the lesion. The findings were consistent with a diagnosis of lymphoma. The patient was submitted to polychemotherapy and, since he did not improve,

he decided to suspend treatment and come to Rio de Janeiro. Following negative extrathoracic staging for metastases, the patient was submitted to a mass biopsy, through minimal right thoracotomy. The histological findings confirmed the diagnosis of hemangiopericytoma. The preoperative pulmonary evaluation showed that the patient presented functional pneumonectomy, with a vital capacity of 54%, a forced vital capacity of 46% and a forced expiratory volume in one second of 41%. We therefore decided to perform a thoracotomy in order to resect the mass, due to the fact that the patient was young and in good general health, there were no signs or symptoms of distant metastases and there was no other efficient treatment for the patient.

The surgery was performed through right posterior lateral thoracotomy, with orotracheal intubation using a Robert-Shaw tube (double-lumen tube). The detachment of the large mass presented pronounced bleeding, as expected due to the vascular origin of the tumor. However, the patient responded well to fluid replacement. After the lung was released, we proceeded to dissect the pulmonary hilum, which was retracted due to the presence of the lesion. After approximately 1 h of surgery, following the



**Figure 1** – Anteroposterior (a) and lateral right (b) chest X-ray showing the large right pulmonary mass, with clear hilar involvement.

dissection of the pulmonary hilum, we decided that it was possible to perform the pneumonectomy, and concomitant to the ligation of the right pulmonary artery, there was a pronounced drop in systolic arterial pressure followed by asystole. The usual open-chest resuscitation was immediately performed, unsuccessfully, and death was recorded 90 min later.

During the cardiac massage, we felt that there was an uncharacteristic lesion inside the heart. However, we did not consider the possibility of a tumor embolus.

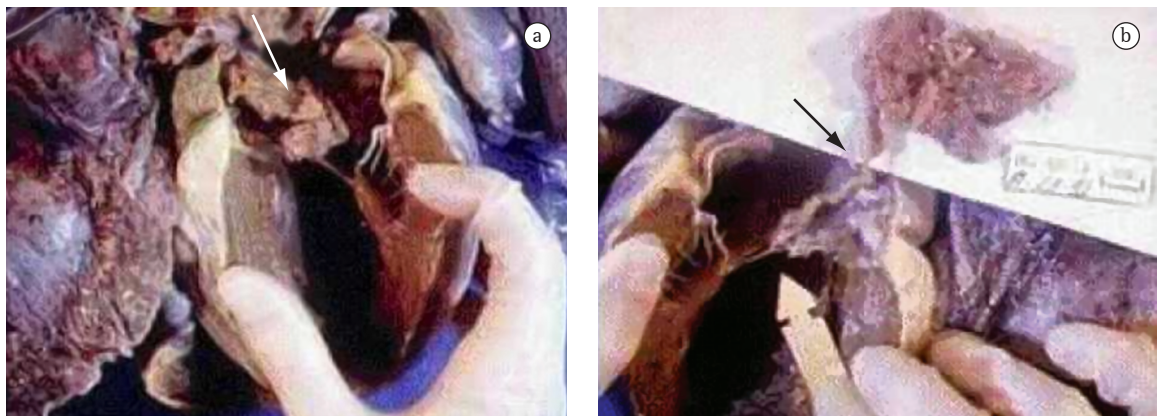
The patient was submitted to autopsy, and the cause of death was found to be total obstruction of the mitral valve within the left atrium, as shown in Figure 2. In the left lung, there were four small (3- to 6-mm) metastases that had not been detected in the preoperative period. The finding of a "cord" of tumor tissue wrapped in the mitral valve chordae and connected to the intra-atrial mass suggests that the metastasis found within the atrium was still attached to the primary tumor. With manipulation, this "cord" broke, and the metastasis migrated to the valve. Other autopsy findings were microscopic tumor emboli in the liver, kidneys and brain, probably due to embolism during surgery.

## Discussion

Tumor embolism during pulmonary resection is an uncommon occurrence. One group of authors conducted an extensive review of the literature, adding two personal cases to it.<sup>(1)</sup> In this review,

30 cases published in the English literature were analyzed. The majority were cases of primary pulmonary tumors. The most common type was bronchogenic carcinoma (21 cases), followed by metastatic sarcoma (6 cases), metastatic thyroid cancer (1 case) and tumors which were not histologically typed (2 cases). Sixteen patients died as a consequence of the embolic complication, which shows its high mortality rate. Most surviving patients presented systemic arterial embolism of easy surgical access (10 cases of embolization to the distal aorta, subclavian artery and femoral arteries). Nine cases were diagnosed through autopsy as arterial embolism and one third of the cases presented multiple systemic embolisms. Concomitant intracardiac embolism occurred in only 2 cases, which shows the difficulty of diagnosing the situation, due to its rarity. Of those 2 intracardiac embolisms, one accompanied bronchogenic carcinoma, and the other accompanied pulmonary metastatic leiomyosarcoma (primary in the uterus). Both of those tumors were found in the lower lobes, one on the right and the other on the left. One of the patients was submitted to extracorporeal circulation, the intracardiac (mitral valve) tumor was resected, and the patient survived.<sup>(2)</sup> The other patient died.<sup>(3)</sup> In 17 cases, the pulmonary vein involvement was recognized during surgery. There were 2 patients who presented no vascular involvement. In the 11 remaining patients, it is unknown whether there was concomitant vascular involvement.

Another study presented 2 cases of massive tumor embolism in pulmonary metastatic osteosar-



**Figure 2** – Autopsy sample, showing, in a, tumor thrombus occluding the mitral valve from inside the left atrium (white arrow) and in b the tumor thrombus separated from the heart, revealing the tumor "cord" which probably connected the lesion to the primary tumor (black arrow).

coma, leading to obstruction of the pulmonary artery and death of the patients.<sup>(4)</sup> This is another form of vascular complications of pulmonary tumors, and the outcome was the same as that occurring in our case.

Although most cases of perioperative pulmonary embolism reported in the literature have been related to lung cancer, the case presented here occurred in a 26-year-old man, with a rare tumor (hemangiopericytoma), in an even rarer primary location (pulmonary). It is known that the hemangiopericytomas are vascular tumors originating from cells in the blood vessel walls, known as pericytes, whose function, albeit ill-defined, apparently involves contractility of the vessel. These tumors, which are generally singular and circumscribed, can also be multicentric. They were first described by Stout and Murray in 1942<sup>(5)</sup> and are most often observed during the fourth and fifth decade of life.<sup>(6)</sup> They typically occur in the retroperitoneum and lower limbs. A hemangiopericytoma in the trunk or upper limbs is an unusual finding. Most cases of pulmonary hemangiopericytoma are metastatic, and a primary tumor in this location is considered extremely rare.<sup>(7)</sup>

As to the phenomenon of perioperative tumor embolization, it is suggested that early ligation of the pulmonary veins can prevent this complication in cases of systemic embolism. In practice, this seems inefficient<sup>(1)</sup> and would have been useless in our case, since the event occurred during the manipulation of the pulmonary hilum, and since there was no systemic embolism but rather intracardiac embolism.

When there is suspicion of tumor embolization in patients with primary and secondary pulmonary tumors with extensive hilar involvement, the most important procedure is the preoperative diagnosis. Tumor embolization can be confirmed by minimally invasive methods, such as transesophageal echocardiography, nuclear magnetic resonance or computed angiography of the chest, which would lead to the preoperative diagnosis of vascular or atrial involvement. Once the diagnosis has been confirmed, pulmonary resection, accompanied by resection of the vascular or cardiac extension, using extracorporeal circulation, can be performed, thereby avoiding tumor embolization.

Perioperative and postoperative radiotherapy are indicated as complementary to the tumor

resection,<sup>(7)</sup> although, apparently, chemotherapy, being systemic, can best help control the metastases in cases of sensitivity to the chemotherapeutic agents.

However, we learned from this case that irreversible cardiac arrest during uncomplicated pulmonary resection in noncardiac patients presenting large masses, principally those with hilar involvement, might be due to tumor embolization to the pulmonary artery or tumor invasion of the cardiac chambers. In cases such as the one presented here, perioperative transesophageal echocardiography is indicated as a diagnosis tool. If this method is not available, digital palpitation within the cardiac chambers (in the case of the mitral valve, through the left atrium) can be performed using purse-string suture of the chamber wall. Once the presence of the tumor in the pulmonary vessels or within the cardiac chambers has been confirmed, resection of the metastasis, under extracorporeal circulation, should be performed, which will restore normal cardiovascular function. Subsequently, the pulmonary lesion should be treated. These patients should still be monitored for many days in the postoperative period for detection of late embolic episodes, which are treated surgically, if necessary. The patients should still seek the advice of a clinical oncologist to determine whether adjuvant systemic treatment is indicated.

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