

Endovascular resolution of complicated pulmonary pseudoaneurysm after right heart catheterization

Resolución endovascular de pseudoaneurisma pulmonar como complicación del cateterismo derecho

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ABSTRACT

Right heart catheterization with a Swan-Ganz catheter is a commonly used method for the hemodynamic assessment of hospitalized patients in critical care units or else as part of the evaluation of pulmonary circulation in many different diseases. It is often considered a safe procedure with a low rate of complications. Pulmonary pseudoaneurysm is a rare complication although it is associated with a high mortality rate. This is the case of a pulmonary pseudoaneurysm that occurred as a complication associated with the use of a Swan-Ganz catheter and its resolution through percutaneous endovascular treatment.

Keywords: pseudoaneurysm, therapeutic embolization, Swan Ganz catheterization.

RESUMEN

El cateterismo cardíaco derecho con catéter de Swan-Ganz es un procedimiento utilizado para el monitoreo hemodinámico de los pacientes internados en unidades de cuidados críticos o como parte de la evaluación del circuito pulmonar en diversas patologías. Generalmente es una intervención segura y con baja tasa de complicaciones. El pseudoaneurisma pulmonar es una complicación rara, pero de elevada mortalidad. Presentamos un caso de pseudoaneurisma pulmonar como complicación del uso de catéter de Swan-Ganz y su resolución mediante tratamiento percutáneo endovascular.

Palabras clave: pseudoaneurisma, embolización, cateterismo derecho.

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INTRODUCTION

Swan-Ganz (SG) catheter has facilitated the hemodynamic management of patients hospitalized in intensive care units, as well as the intra- and postoperative management of severe patients treated with high-complexity surgeries. Although its routine use has decreased, it is occasionally used for hemodynamic monitoring purposes in intensive therapies, assessment of medically unexplained dyspnea or suspected pulmonary hypertension. It is often a safe procedure. However, the placement and use of the SG catheter is associated with potential risks. One rare complication with a high mortality rate is the formation of pulmonary pseudoaneurysms, which is associated with its rupture or dissection. This is the case of a woman who developed a pulmonary pseudoaneurysm after right heart catheterization in an effort to portray this entity as a complication following the

use of the SG catheter and its resolution through endovascular percutaneous treatment.

CASE REPORT

This is the case of a 55-year-old woman with a past medical history of smoking on oral anticoagulant drugs due to internal jugular vein thrombosis. The patient was in her postoperative period after liver transplant due to primary biliary cirrhosis and on immunosuppressive drugs with mycophenolate, tacrolimus, and corticoid therapy. During transplantation a SG catheter was used for intraoperative hemodynamic management. **The catheter was inserted “in the blind”, that is, without radioscopic or echocardiographic guidance. Also, no guidewires were required or catheter exchange for its placement.** Fifteen days after surgery, the patient started having episodes of persistent cough without hemoptysis or episodes of desaturation in the blood gas analysis. The physical examination confirmed the presence of right pulmonary baseline hyperventilation without other clinically significant findings. The multislice helical computed tomography (CT) coronary angiography revealed the presence of a 20 mm nodular image with homogeneous enhancement after the administration of contrast at right lower pulmonary lobe level (**Figure 1**). Also, laminar right pleural effusion was revealed, which had already been found in different studies prior to transplantation. Considering the patient's recent history of pulmonary catheterization, a pulmonary arteriography was performed to confirm or discard the presence of a possible vascular lesion as the complication associated with the placement of the SC catheter. A 6-Fr RadiofocusR introducer sheath (Terumo Corporation, Tokyo, Japan) was inserted via right common femoral vein. One 5-Fr pigtail catheter mounted on a 0.035-in J-tip guidewire was advanced until it reached the right pulmonary artery infe-

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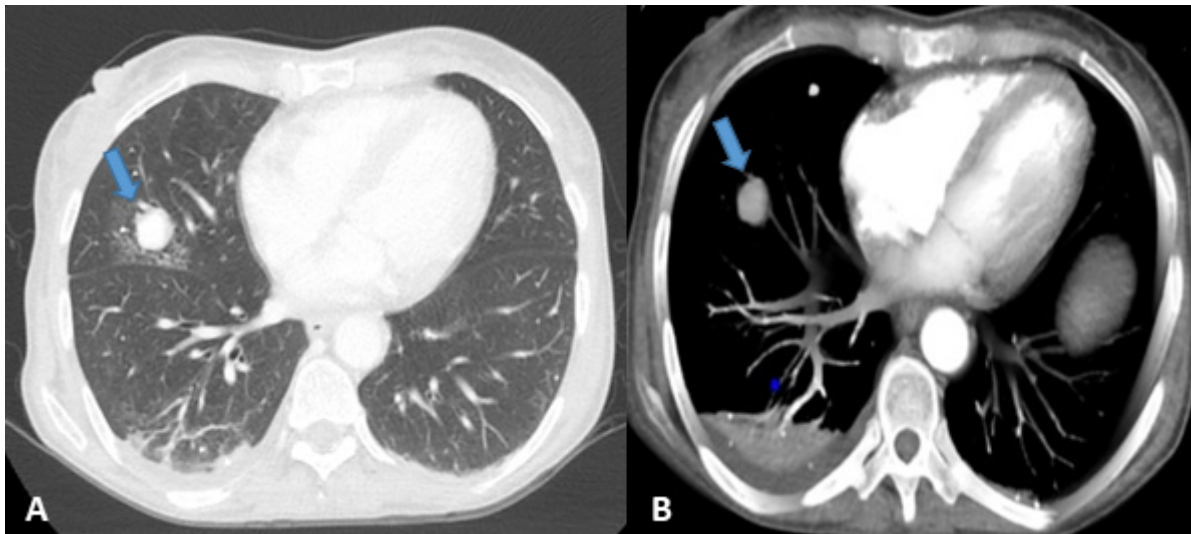


Figure 1. Axial view (A) and 3D reconstruction (B) of thoracic multislice computed tomography images showing a 20 mm nodular image with homogeneous enhancement after the administration of contrast located at right pulmonary inferior lobe level (blue arrow).

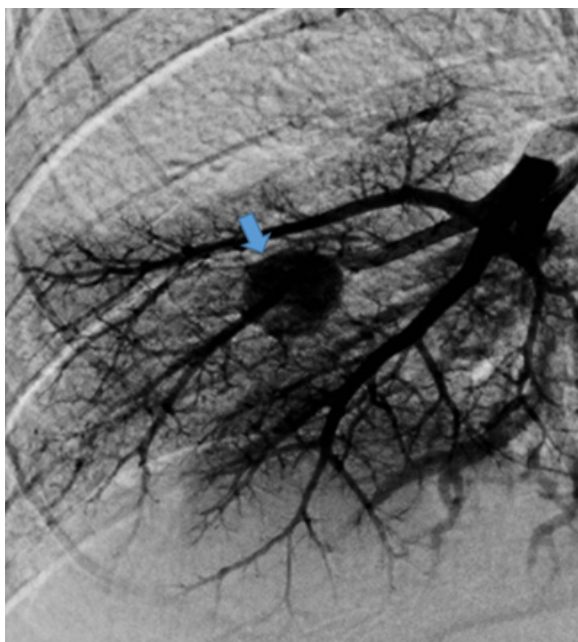


Figure 2. Anteroposterior right pulmonary angiography showing a pseudoaneurysm in right lateral segmental branch (inferior lobe).

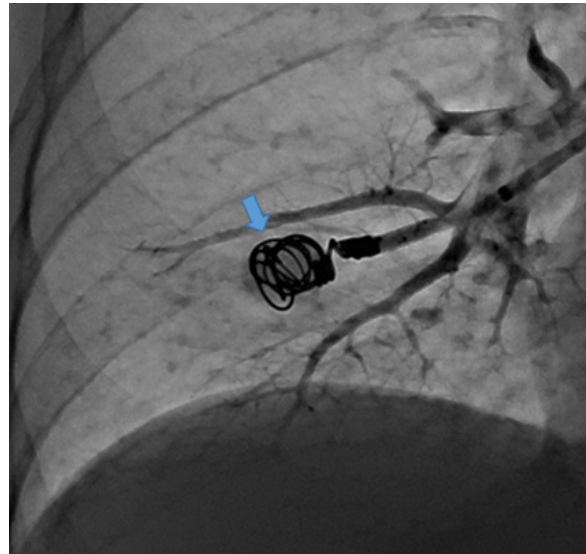


Figure 3. Anteroposterior pulmonary angiography showing micro-coil migration inside the pseudoaneurysm that successfully excludes the pseudoaneurysm from pulmonary circulation (blue arrow).

rior lobar branch. Afterwards, an arteriography identified the presence of a pseudoaneurysm at right anterior segmental branch level (segment 8b) (**Figure 2**). Afterwards, the femoral introducer sheath was exchanged for a 6-Fr DestinationR sheath (Terumo Corporation, Tokyo, Japan) via femoral vein. Then, a 5-Fr MPA 1 Impulse™ multipurpose catheter (Boston Scientific, MA, United States) was used for selective catheterization. The branch was embolized using four 9 mm × 2.7 mm 2D Helical-35 micro-coils (Boston Scientific, MA, United States). After releasing the micro-coils, the exclusion of the pseudoaneurysm was confirmed (**Figure 3**). Patient's progression was good and without postoperative complications. The patient was released from the hospital 11 days later. The control coronary computed tomography angiography performed at 30 days confirmed the absence of opacification in the target lesion (**Figure 4**).

DISCUSSION

The SG catheter was designed thanks to the ingenuity of two doctors, Dr. Jeremy Swan, a cardiologist born in Ireland (1922-2005), and Dr. Willam Ganz, a cardiologist born in Czechoslovakia (1919-2009). The SG catheter is a tool that has facilitated the hemodynamic management of patients hospitalized in intensive care units (ICU).¹ This device consists of a multiple branch catheter capable of measuring cardiac intracavitary pressures (right atrium, pulmonary pressures, pulmonary capillary pressure), estimating cardiac output, and obtaining “indirect” parameters like pulmonary and systemic vascular resistances, cardiac index, etc.² Although it has not been confirmed yet that it reduces mortality rate or the length of stay of critically ill patients, it is still a valuable tool to determine the patient's hemodynamic status and prescribe the proper therapy.

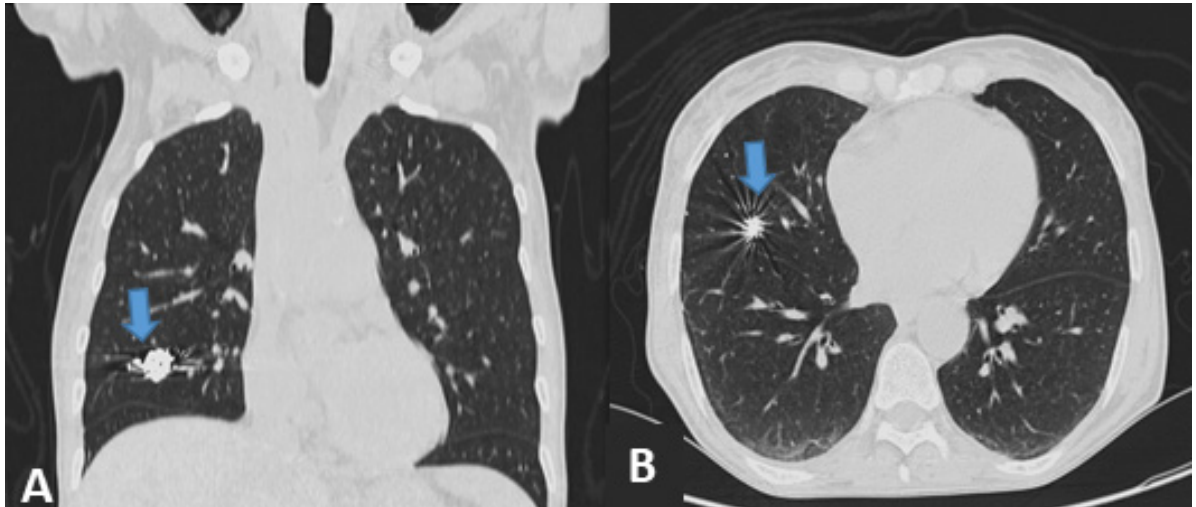


Figure 4. Coronal (A) and axial (B) views of thoracic multislice computed tomography images of pulmonary window showing the presence of coils and lack of aneurysmal sac opacification (blue arrow).

Pulmonary artery catheterization is an invasive procedure that is often performed without fluoroscopic control. At times, its use has been associated with different complications.³ A systematic case review informed that the main complications associated with SG catheter insertion occur in 3% to 17% of the cases.⁴ Atrial and ventricular arrhythmias, and intracardiac rolling have been among the most common complications reported. Pneumothorax, carotid or subclavian artery puncture, and balloon tears have also been reported, but to a lesser extent.⁴ Episodes of coronary embolisms, pulmonary hemorrhages, and pulmonary artery ruptures with formation of pseudoaneurysms have been reported as the least common complications with the highest possible risk.⁴ The latter has been described in 0.05% to 0.2% of the cases being the mortality rate reported due to massive hemoptysis of up to 50%.⁴ There is a series of risk factor predisposing to vascular ruptures like anticoagulation, pulmonary hypertension, long courses of corticoids, hypothermia during surgery, intraoperative cardiac manipulation, age > 60 years, and feminine sex.^{4,5} However, the exact mechanism of damage to the arterial wall is still unknown, but it could be associated with balloon hyperinflation and/or vascular perforation directly induced by the tip of the catheter on the vascular wall. On the other hand, pulmonary arterial hypertension would create a pressure gradient through the balloon towards the periphery where arterioles are smaller and more fragile, thus increasing the chances of vascular damage. Although anticoagulant therapy does not increase the risk of injury *per se*, it can inhibit the capacity of the anticoagulation system to seal the defect.⁵

Although pulmonary artery pseudoaneurysms have been reported more frequently after vascular trauma, and in patients with tuberculosis (Rasmussen aneurysms), these can be associated with pulmonary abscesses, septal embolisms, systemic vasculitis, bronchiectasis, and pulmonary neoplasms.⁶

Regarding clinical signs, these patients often present with hemoptysis, and the appearance of an infiltrate of poor demarcated borders on the thoracic x-ray being the infiltrate undistinguishable from a pulmonary infarction at the beginning of the examination. A persistent denser central region is often seen as associated with the pseudoaneurysm itself. Presentation often occurs within the first 24 hours after cardiac catheterization. However, it has been reported up to 14 days later. The right pulmonary artery location is the most common of all, and it occurs in 93% of the cases, often in mid and inferior lobes.^{4,5} Not so frequently though, patients remain asymptomatic and no cases of cough signs like our case have been described in the medical literature.

The diagnostic method of choice is thoracic coronary computed tomography angiography with opacification protocol of pulmonary arteries. It not only allows us to recognize this vascular lesion, but also to rule out other possible causes.⁷ In addition, pulmonary angiography is the method of reference to diagnose pseudoaneurysm and facilitates the embolization of the aneurysmal sac excluding it from the circulation. Catheter-directed embolization has become the treatment of choice as it is a fast, and safe procedure associated with low morbidity and mortality rates in these patients displacing pulmonary resection (lobectomy) that has become a second therapeutic option.^{7,8}

CONCLUSION

Ruptured pulmonary arteries and the formation of pseudoaneurysms are among the most serious complications associated with the use of the SG catheter. Patients with this complication can remain asymptomatic or develop hemoptysis right after the procedure or a few days later. The reference diagnostic test here is pulmonary angiography and the treatment of choice is transcatheter embolization. Proper training to learn how to place the SG catheter and knowing the balloon inflation pressure both reduce the rate of vascular complications.

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