Complications of Flow-Directed Balloon-Tipped Catheters*

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Acute or short-term complications following the use of flow-directed balloon-tipped catheters are well recognized. Long-term sequelae are rarely reported. We report herein an early complication of pulmonary arterial rupture with infarction followed by the delayed development of a pulmonary arterial aneurysm. (Chest 1990; 97:227-28)

The reported complications related to the use of flow-directed balloon-tipped catheters are extensive and well documented. The early occurrence of a symptomatic pulmonary infarction or rupture leading to the subsequent formation of two asymptomatic pulmonary artery pseudoaneurysms is herein described.

Case Report

A 75-year-old white woman with a history of ischemic cardiomyopathy and congestive heart failure (New York Heart Association class II) was hospitalized because of a traumatic hip fracture. The preoperative evaluation revealed physical signs and symptoms of moderate congestive heart failure. For this reason, operative correction was delayed and therapy including diuretics and afterload reducers was instituted after a Swan-Ganz catheter was placed through a right internal jugular approach. Initially some difficulty was encountered in obtaining an accurate pulmonary capillary wedge pressure. A chest x-ray film demonstrated the catheter tip to be located in the middle third of the pulmonary artery. Pressures at this time were 49/21 mm Hg (pulmonary artery systolic/diastolic) with a wedge pressure of 19 mm Hg.

With intensive medical treatment, the patient improved over the following four days, and the Swan-Ganz catheter was temporarily removed. Intraoperative and postoperative volume management was considered essential because of the patient's precarious cardiac condition; prior to surgery, a second Swan-Ganz catheter was inserted through a right internal jugular approach. Difficulty again was encountered in obtaining the capillary wedge pressure. The catheter was carefully advanced to what was felt to be a maximally safe distance; however, a satisfactory wedge tracing could not be obtained. The balloon was then deflated and reinflated without difficulty or documented increased resistance to inflation.

Pulmonary arterial diastolic pressures were followed because of the difficulty encountered in obtaining a wedge pressure. Scant hemoptysis was documented one hour postoperatively. A chest x-ray film revealed a wedge-shaped infiltrate (Fig 1) and a small effusion in the right lung field distal to the Swan-Ganz catheter tip. The catheter was promptly removed while the patient was under close medical observation. An uneventful recovery led to discharge nine days postoperatively.

Three weeks postoperatively, the patient was evaluated in the emergency room for a recurrence of hemoptysis. Chest x-ray film at this time showed two nodular densities in the right lower lobe (Fig 2). A ventilation-perfusion scan demonstrated a perfusion defect in the right lower lung field that was consistent with the mass seen on chest x-ray film. The patient was followed up as an outpatient.

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outpatient and did well until ten weeks later, when she returned to the emergency room complaining of generalized weakness and temperature of 38.5°C for one day. Chest x-ray film at the time revealed an increase in size and in density of these two nodules.

They now measured 7 cm and 3 cm, respectively. A CT scan confirmed the presence of two well-circumscribed nodular soft-tissue densities and suggested the possibility of metastatic nodules. A fine-needle aspiration was attempted under fluoroscopic guidance. When the larger of the two lesions was entered, brisk blood return was noted. A small amount of contrast material injected through the biopsy needle filled the lesion and revealed distal runoff, suggesting the presence of a pulmonary artery aneurysm.

At the time of pulmonary arteriography, the pulmonary artery pressures had increased to 60/29 mm Hg with a mean of 40 mm Hg. With manual injection, contrast completely filled and passed through the lesion with flow to the distal pulmonary arterial tree, confirming that the lesions were aneurysms. Later that day, the patient developed a leak in the large aneurysm and a right hemotorax, requiring chest tube drainage and exploratory surgery leading to a right lower lobe lobectomy. Two pseudoaneurysms of the pulmonary artery were documented surgically and confirmed by pathologic analysis. No thrombus was found, and the routine, fungal, and acid-fast cultures were negative.

Discussion

The use of flow-directed balloon-tipped pulmonary catheters for the monitoring of hemodynamic parameters in high-risk and critically ill patients is well accepted and widely used.\textsuperscript{1} The more common early complications include local and systemic infections, balloon rupture, and arrhythmias.\textsuperscript{2,3} The more serious but less frequent complications include pulmonary arterial occlusion, infarction, and pulmonary artery rupture.\textsuperscript{4,5} The vast majority of these complications are noted during or soon after catheter placement. The reported late complications are asymptomatic valvular damage or vascular thrombus discovered at autopsy.\textsuperscript{6} This case illustrates two serious complications of pulmonary artery catheters: the initial pulmonary infarction followed by the development of two pulmonary artery pseudoaneurysms.

In the literature, three cases of pseudoaneurysms from balloon-tipped catheters have been reported.\textsuperscript{7} Only one, however, was proven by pathologic inspection. To our knowledge, this represents the only case of multiple lesions, thus leading to the assumption of metastatic neoplasm.

Currently there are several ways to minimize the occurrence of a pseudoaneurysm with infarction after the use of a Swan-Ganz catheter. At the time of introduction, the balloon is inflated in the right atrium and the catheter is floated to the pulmonary artery and pulmonary artery-occluded position. The wedge position is confirmed by oximetry. The pressure is recorded and the balloon is deflated so that a pulmonary artery tracing is recorded. If there is good correlation between the pulmonary artery and the diastolic pressure, and the pulmonary wedge pressure, further inflation of the balloon in the pulmonary artery to measure the wedge pressure can be avoided. In the majority of cases, a pulmonary artery mean pressure or a pulmonary artery diastolic pressure provides sufficient clinical information to assess the adequacy of left heart filling pressures after these correlations are made. It is important, however, to always assess the waveform such that you can detect unexpected distal migration of the catheter. If the pulmonary artery diastolic pressure does not correlate with the wedge, and wedge pressure measurements are necessary, and if an unusually small volume of air is required to inflate the balloon, an excessively distal catheter placement should be suspected.

The incidence of pulmonary infarction associated with the use of pulmonary artery catheters continues to be significant, as high as 7.2 percent in some series.\textsuperscript{8} Follow-up evaluation for delayed vascular complication should be considered regularly, particularly in those at a high risk, eg, patients with pulmonary hypertension or who show evidence of pulmonary infarction or pulmonary artery rupture. If solitary or multiple nodular densities develop in an area of lung previously subjected to pulmonary artery catheterization, such lesions should be evaluated for their vascularity prior to any invasive diagnostic procedure.

References