Pulmonary artery catheter–induced perforation treated with coil embolization

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The past 40 years have taught us much about the use of pulmonary artery catheters and their complications. Pulmonary artery rupture carries high morbidity and mortality, and therefore a high index of suspicion and timely management are key to the survival of patients who suffer from this rare complication. While surgical therapy has been considered the mainstay of treatment, endovascular therapy is feasible when surgery is not possible or desirable, as demonstrated in our patient. It is unknown which approach is optimal.

We present a case describing the diagnosis and management of a woman who underwent diagnostic right-sided heart catheterization resulting in iatrogenic left lower lobe pulmonary artery (PA) branch perforation managed utilizing endovascular coil embolization.

CASE HISTORY

A 74-year-old woman was admitted to the hospital with dyspnea and volume overload, as evidenced by pulmonary vascular congestion on chest x-ray, as well as a B-type natriuretic peptide level of 376 pg/mL and lower extremity edema on examination. She had a body mass index of 45 kg/m² and a history of cerebrovascular accident, coronary artery disease, and atrial fibrillation treated with warfarin. A transthoracic echocardiogram revealed an ejection fraction of 65% with increased right atrial and right ventricular sizes and a right ventricular peak systolic pressure of 60 mm Hg. Despite aggressive diuresis, the patient remained dyspneic and therefore the decision was made to perform diagnostic heart catheterization.

The patient's anticoagulation was discontinued and the international normalized ratio was 1.8 on the day of the procedure. Right-sided heart catheterization via a right femoral vein approach revealed a right atrial pressure of 29/27, right ventricle pressure of 84/17, PA systolic pressure of 78/39, and PA wedge pressure of 36 mm Hg. The PA catheter balloon was wedged in the left lobe without incident, but it was noted upon deflation of the balloon that the PA catheter dove deep into the left lower lobe lung field, and this was subsequently pulled back. Given the elevated pulmonary wedge pressure in the presence of normal systolic function, we then proceeded with left-sided heart catheterization via a right femoral artery approach. Once the left ventricle was entered with

Figure 1. Development of large left-sided hemothorax noted on fluoroscopy.

a pigtail catheter, we proceeded with reinflation of the PA catheter balloon to obtain simultaneous wedge and left ventricular diastolic pressures to evaluate for possible mitral valve disease.

At this time the patient was noted to have a small amount of hemoptysis, which subsequently progressed to massive hemoptysis. The patient was emergently intubated with a dual lumen endotracheal tube. Fluoroscopy of the chest wall revealed a large left-sided hemothorax (*Figure 1*). Immediate administration of fresh frozen plasma and blood products was initiated. Vasopressor support was administered with multiple rounds of intravenous epinephrine followed by a norepinephrine infusion. Selective arteriography of the left PA revealed an actively extravasating branch in the left lower lobe (*Figure 2a*). The branch was embolized with four 5/3 0.035 Tornado Platinum coils (Cook Medical, Bloomington, IN), which resulted in cessation of flow on postembolization arteriography (*Figure 2b*). The left hemothorax was treated with fluoroscopic-guided chest tube placement at the same time.

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Figure 2. Arteriography images (a) showing the actively extravasating branch of the left lower lobe pulmonary artery subselected during pulmonary arteriography and (b) after coil embolization of the previously extravasating branch of the left lower lobe pulmonary artery.

The patient was subsequently transferred to the intensive care unit (ICU) where her stay was further complicated by the development of loculations consisting of pus and blood in the left lower lobe, resulting in concomitant pneumonia and acute respiratory distress syndrome. Subsequent fiberoptic bronchoscopy with clot evacuation was then performed with placement of a second chest tube. She remained in the ICU for approximately 7 days, after which she was successfully extubated and transferred to the medical floor in stable condition. Although she suffered great morbidity as a result of a rare complication that occurred during her catheterization procedure, emergent coil embolization saved her life and led to her eventual discharge from the hospital on day 14.

DISCUSSION

The use of PA catheters to estimate right-sided heart and PA pressures was first described in 1970 and expanded our understanding and guided our therapies of the most complex cardiovascular patients (1). Documented complications including venous damage, valvular damage, arrhythmias, catheter knotting, balloon rupture, pulmonary embolism, pulmonary hemorrhage, PA rupture, bacteremia, and death usually arise either as a result of insertion or of maintenance of the catheter (2–4). While the rate of major/potentially life-threatening complications (ventricular arrhythmias, endocarditis, valve rupture, septicemia, pulmonary hemorrhage/infiltrates) and minor complications of this procedure has been reported to be as high as 23%, a retrospective chart review involving 32,442 inpatients revealed an observed PA rupture rate of 0.031% of catheter insertions (5, 6). The most common risk factors leading to PA rupture, all of which were present in our patient, include systemic anticoagulation, pulmonary hypertension, female gender, and age >60 years. The overall mortality rate from PA rupture approaches 70% (6). In the intraoperative setting (e.g., coronary artery bypass surgery),

surgical management of PA rupture utilizing lobectomy, pneumonectomy, and hilar clamping with direct arterial repair or PA ligation are some of the options available to the surgeon (6).

More recently a less invasive option for treatment that has emerged is transcatheter embolization utilizing steel coils, liquids (sobutyl-2-cyano-acrylate), absorbable gelatin sponges, or detachable balloons (7). The stainless steel coil, introduced in 1975 by Gianturco et al, was initially intended for arterial occlusions, control of hemorrhage, and management of arteriovenous fistulas, malformations, and aneurysms (8). While catheter-based embolization has been used extensively for these indications, it has only recently been described for the treatment of PA perforation (9).

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