An 80-year-old woman was evaluated in the emergency room for a two-day history of passing blood in the stool. She had a history of sigmoid resection for an adenocarcinoma two years previously. A peripheral intravenous line and a left subclavian catheter were placed, and she was taken to the radiology department for a chest film (Fig 1). While sitting for the roentgenogram, she suddenly became hypotensive and unresponsive. She responded quickly to assisted ventilation with oxygen via an anesthesia bag, and was transferred to the intensive care unit. An electrocardiogram showed sinus tachycardia with atrial premature complexes and right bundle branch block. Arterial blood gas levels with the patient breathing oxygen at 4 L/min by nasal cannula showed: PaO₂, 66 mm Hg; PaCO₂, 42 mm Hg; and pH, 7.40.

*From the Division of Thoracic Diseases and Internal Medicine, and Critical Care, Mayo Clinic, Rochester, MN. (Chest 1988;94:1063-4)
Reprint requests: Dr. Peters, Mayo Clinic, Rochester, MN 55905
Diagnosis: Pulmonary air embolism

The initial chest film in the upright position shows the left subclavian catheter and an air-fluid level within the pulmonary outflow tract and left main pulmonary artery. A film taken later the same day (Fig 2) shows that the air is no longer present, but that diffuse pulmonary infiltrates have developed. A pulmonary artery catheter was also placed. The initial measurements included systemic blood pressure, 115/60 mm Hg; pulmonary artery pressure, 20/16 mm Hg; pulmonary artery wedge pressure, 4 mm Hg; and cardiac index, 2.25 L/min/m². She improved with supportive care and was discharged from the hospital six days later.

Air embolism is a recognized complication of central intravenous catheterization. Air may enter the circulation whenever the venous pressure is subatmospheric, or if air is introduced under positive pressure. This is a relatively common occurrence during neurosurgical procedures, especially in the sitting position. Venous air embolism may occur less frequently during a variety of procedures, including surgery of the head and neck, thoracic or cardiovascular surgery, transthoracic needle aspiration, or during obstetric procedures.

Following air embolism, nonhydrostatic pulmonary edema may develop rapidly, as was observed in this case. The radiographic finding of an air-fluid level within the central pulmonary arteries is quite rare, but has been reported recently in a similar case. Physiologic changes associated with air embolism typically include increased pulmonary artery pressure and pulmonary vascular resistance, normal left atrial pressure, and arterial hypoxemia. Hypotension and cardiovascular collapse may be fatal. Paradox systemic embolization may also occur by passage of air through a patent foramen ovale, or across the pulmonary capillaries.

Doppler ultrasonic recording from the heart, by a precordial or esophageal probe, has become a useful tool for intraoperative monitoring for air embolism in high risk patients. In placing a central intravenous catheter, care must be taken with all tubing connections, especially with a patient in the sitting position or during transport, when accidental air entry may occur.

If air embolism is quickly recognized, treatment may include identification and elimination of the site of air entry, aspiration of air from a right atrial or pulmonary artery catheter, positioning of the patient on the left side to retain air within the right heart, 100 percent oxygen, and increasing intrathoracic pressure with mechanical ventilation. A multiple port central venous-right atrial catheter has been shown recently in an animal model to allow greater retrieval of venous air, with better survival following massive air embolism. Hyperbaric oxygen therapy may also be of benefit in severe cases of air embolism, especially with cerebral involvement, by reducing bubble size, accelerating resorption of nitrogen, and improving oxygenation. However, it is not established which patients might benefit most from this therapy. Most patients recover with supportive care. Since many cases are undiagnosed and untreated, the actual rates of severe complications and mortality are not known.

References

2. Perschau BA, Munson ES, Chapin JC. Pulmonary interstitial edema after multiple venous air emboli. Anesthesiology 1976; 45:364-68

Figure 2

Roentgenogram of the Month (Steve G. Peters)