The Role of Interventional Radiologists in the Use of Extracorporeal Membranous Oxygenation in the Catheter-Directed Treatment of Pulmonary Embolism

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ABSTRACT

Patients with pulmonary embolism who are in hemodynamically unstable condition present a special challenge to the interventionalist. When treating such patients, extracorporeal membranous oxygenation (ECMO) can help to stabilize these patients' condition; however, specific criteria for its use do not exist. Two patients are presented here to familiarize the reader with the use of ECMO and to demonstrate its utility for the interventional radiologist.

ABBREVIATIONS

ECMO = extracorporeal membranous oxygenation, PE = pulmonary embolism, PESI = pulmonary embolism severity index

Pulmonary embolism (PE) is a common cause of cardiovascular mortality, with an annual incidence in the United States of more than 600,000 (1). The International Cooperative Pulmonary Embolism Registry reported a 90-day mortality rate of 14% for nonmassive PE and a mortality rate of 52% for massive PE, with similar rates reported by other authors (2,3). Extracorporeal membranous oxygenation (ECMO), also called extracorporeal life support, has been reserved for critically ill patients or those in unstable condition, and is often initiated after cardiac arrest (4,5). Although the consensus guidelines from the American Heart Association and the European Society of Cardiology outline other treatment recommendations, they do not specifically address the use of ECMO in catheter-directed therapy (CDT) of PE (6,7).

ECMO has been shown to be an effective adjunct to CDT (8), and its use has been described preoperatively, intraoperatively, and postoperatively in the surgical literature (4,5,9). This report presents two cases in which interventional radiologists were central to considering and initiating ECMO to emphasize the need for familiarity and experience in our specialty with the technique as part of PE care.

CASE REPORTS

Case 1

A 75-year-old woman was admitted with tachycardia and acute shortness of breath requiring 10 L of oxygen 3 weeks after lumbar fusion surgery. Computed tomographic (CT) pulmonary angiography demonstrated occlusive emboli in the right main, left upper, and lower lobar pulmonary arteries and bowing of the interventricular septum. Her troponin I level was increased at 9.04 ng/mL, and her PE severity index (PESI) score was 295 (10%–24.5% 30-d mortality rate). Given the recent surgery, unfractionated intravenous heparin was started and an inferior vena cava filter was placed. Her anticoagulation was monitored with partial thromboplastin time, which was within the therapeutic range during treatment. On hospital day 4, she was transitioned to subcutaneous enoxaparin injections. On hospital day 5, her blood pressure decreased from 114/76 mm Hg to 81/51 mm Hg, requiring 2 μg/min of norepinephrine, and her oxygen saturation decreased to 89% despite 6 L of 100% oxygen delivered by nonrebreather mask. She was referred for CDT.

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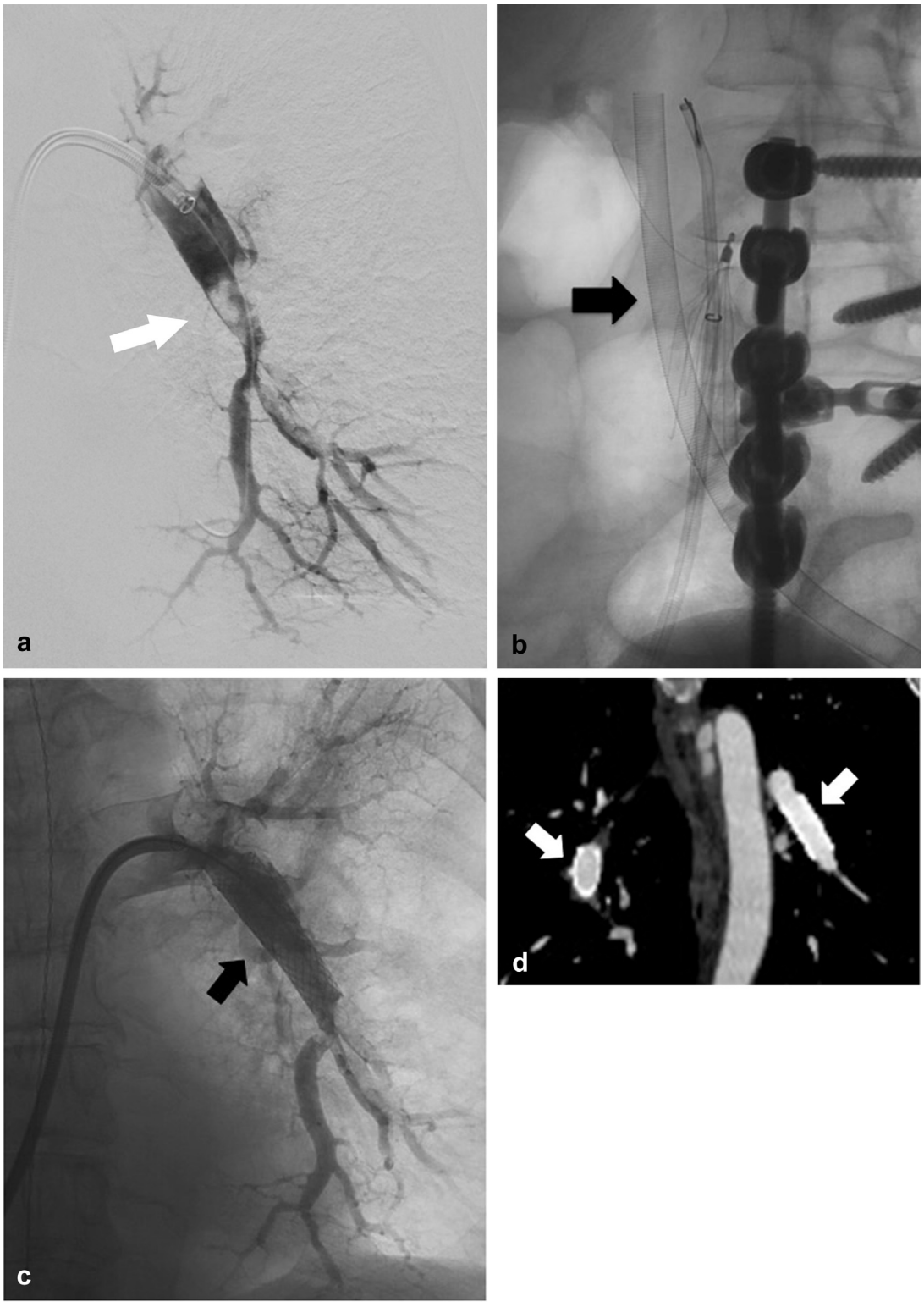

Figure 1. Images from case 1, a 75-year-old woman with massive PE despite anticoagulation. **(a)** Digital subtraction angiogram demonstrates persistent thrombus in the left main pulmonary artery after CDT (arrow). **(b)** Digital subtraction image demonstrates placement of an ECMO cannula in the inferior vena cava (arrow). Cannula insertion displaced one caval filter leg cephalad. This was addressed later with filter repositioning. **(c)** Digital subtraction pulmonary angiogram demonstrates placement of a Wallstent in the left lower-lobe pulmonary artery (arrow). **(d)** CT pulmonary angiography at 10-month follow-up demonstrates patency of the pulmonary artery stents (arrows).

Aspiration (Indigo; Penumbra, Alameda, California) and rheolytic thrombectomy (Possis; Bayer HealthCare, Whippany, New Jersey) were performed, with little effect on the thrombus (Fig 1). Hypotension gradually increased to a systemic blood pressure of 77/52 mm Hg, and respiratory arrest developed. Mechanical ventilation and