nine of 21 (43%) cases of asymptomatic mild wall thickening on imaging performed after the procedure but no instances of perforation. Similarly, Chopra et al (2) described a series of eight patients with tumors near the gallbladder treated with radiofrequency (RF) ablation and reported no cases of cholecystitis or perforation. In contrast, Lee et al (3) described gallbladder wall perforation in a porcine model using RF ablation when the electrode was placed parallel and within 5 mm of the gallbladder wall. Despite the apparent safety of thermal ablation to treat hepatic tumors adjacent to the gallbladder, IRE was chosen in this case to minimize any potential of thermal injury resulting from RF ablation, cryoablation, or microwave ablation (3).

Although some authors have shown in porcine models that high-energy intensity IRE can lead to slight elevations in local temperatures, the contributions of thermal effects in clinical practice remain unknown (4). The primary mechanism of action of IRE is through irreversible disruption of cellular membranes with resultant cellular death through apoptosis. This case demonstrates that in addition to RF ablation and cryoablation, IRE may be another ablative option to treat tumors adjacent to the gallbladder. Additional research is necessary to assess further the safety, efficacy, and long-term outcomes of IRE for treatment of liver lesions adjacent to the gallbladder and other structures.

**REFERENCES**


Vacuum-Assisted Thrombectomy of Massive Pulmonary Embolism

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Editor:
Massive and submassive pulmonary embolism (PE) represent a source of significant morbidity and mortality in the United States (1). Mechanical thrombectomy is one potential treatment option that is particularly valuable in patients with relative or absolute contraindications to fibrinolytic agents. The present case report discusses an initial experience with a newly approved vacuum-assisted suction mechanical thrombectomy device, the Indigo 8-F aspiration catheter (Penumbra, Alameda, California), in the setting of massive PE. Institutional review board approval is not required for case reports.

A 39-year-old woman delivered a term infant by uneventful Caesarean section following an uncomplicated pregnancy. Shortly after returning to the recovery area, she lost consciousness and developed bradycardia, which was initially treated with bag-valve-mask ventilation, oxygen, and atropine. Despite these measures, her condition progressed to complete heart block and required intubation for declining respiratory status. During intubation, she experienced pulseless electrical activity arrest, and cardiopulmonary resuscitation was initiated. Following successful resuscitation, she was transferred to the intensive care unit, where vasopressors and intravenous fluid boluses were required to maintain adequate perfusion. An echocardiogram demonstrated stigmata of PE, including severe right ventricular dilation and decreased right heart function. Systemic tissue plasminogen activator was not given because of her recent Caesarean section and persistent vaginal bleeding. She was emergently administered extracorporeal membrane oxygenation, and heparin therapy was initiated. A computed tomography examination (Fig 1) demonstrated a massive PE, with occlusive thrombus within the right pulmonary artery (PA) and nonocclusive thrombus within the left PA.

She was transferred to a tertiary-care center and taken immediately to the interventional radiology angiography suite. Initial pulmonary angiogram (Fig 2a) with an angled pigtail catheter (Cordis, Fremont, California) demonstrated complete embolic occlusion of the right PA and nonocclusive thrombus within the left PA branches. An 8-F Indigo CAT 8 XTORQ 115-cm device (Penumbra) was advanced through a 90-cm, 8-F Destination sheath (Terumo, Tokyo, Japan) and used to perform mechanical thrombectomy. Multiple passes were made with a separator wire, used to break up the thrombus and allow it to be suctioned through the catheter, and a direct aspiration first-pass technique, which aims to attach a large thrombus to the catheter tip by suction and subsequently pull it through the sheath (2). These maneuvers resulted in incremental flow restoration to the inferior right PA (Fig 2b), the middle and superior right PAs, and lower-lobe left PA (Fig 2c). Given the reduction in angiographically apparent thrombus, the procedure was terminated. The patient’s initial main PA peak systolic pressure was increased at 39 mm Hg but had returned to 26 mm Hg the following day, as measured with a Swan–Ganz catheter. The estimated blood loss was 200 mL, primarily from the aspiration catheter. A post-procedural echocardiogram demonstrated normalization of right ventricular size with return of normal wall motion and resolution of leftward septal deviation. Continued hemodynamic stability allowed extracorporeal membrane oxygenation decannulation the following day, at which time an inferior vena cava filter was placed concurrently. Her postprocedural course was complicated by abdominal compartment

Figure 1. CT scan shortly after resuscitation demonstrates PE. Axial (a) and coronal (b) CT images demonstrate occlusive central right pulmonary thrombus (white arrows, a and b). There is also nonocclusive thrombus in the left PAs (black arrow, a).
syndrome secondary to continued uterine bleeding, requiring laparotomy with a surgical washout and decompression.

After being hospitalized for approximately 6 weeks, the patient was discharged to a transitional care unit. She required physical therapy for deconditioning, but at 2 months’ follow-up she exhibited no neurologic sequelae and was expected to make a full recovery.

This is a report of an initial experience with the newly released Indigo CAT 8 aspiration catheter. Other authors have reported experiences with other suction thrombectomy devices in the setting of PE (3,4), including the Aspirex thrombectomy catheter (Straub Medical, Wangs, Switzerland) (3) and the AngioVac cannula (AngioDynamics, Latham, New York) (4). The Indigo catheter, which has an 8-F outer diameter and 6.7-F inner diameter, is a larger catheter than the Aspirex system, and its flexible catheter design provides greater trackability than the AngioVac system. The catheter also comes in three different tip designs, ranging from straight to angled, allowing rotation to cover a circle with a 25.4-mm circumference (Fig 3). The angulated models have the added benefit of conferring a degree of “directability.”

The present initial experience with the Indigo catheter was promising. If results with this device continue to be favorable, it will be important to investigate what role suction thrombectomy should play in catheter-directed treatment of massive and submassive PE. Patients with coexisting conditions resulting in an absolute or relative contraindication to catheter-directed thrombolytic therapy are a natural subgroup of patients requiring further study. The benefit of rapidly relieving mechanical obstruction with suction thrombectomy, as compared with the delayed effects of fibrinolytic agents, in patients with hemodynamic collapse secondary to massive PE will also merit additional analysis.

REFERENCES