The Combination of Thrombolytic Infusion and Pulsed Ultrasonic Energy Shows Potential to Improve Outcomes

Hello, and welcome to the November 2019 edition of Vascular Disease Management. This month, I have chosen to comment on the article entitled, “Acoustic Pulse Thrombolysis Treatment Strategies for Acute limb ischemia: An Observational Single Center Study” by Bailey Ann Estes, BSN, RN-BC, RCIS, and colleagues. The authors report on 19 patients presenting with acute limb ischemia (ALI) who were treated with low-dose thrombolytic therapy, coupled with the Ekos acoustic pulse catheter (Boston Scientific) to achieve rapid thrombolysis.

I have chosen to comment on this article because ALI represents one of the most severe manifestations of limb ischemia. ALI occurs when there is sudden cessation of blood flow to a limb. It is associated with high rates of amputation and mortality, and it must be treated as a true medical emergency. There are different clinical presentations of acute limb ischemia related to the etiology of the ischemia, the severity of the ischemia, the ischemic time until presentation, the degree of ischemic damage, and the overall health of the patient.

When there has been extensive end organ damage, primary amputation may be required. When limb salvage is feasible, prompt restoration of blood flow is essential. Once flow restoration has been achieved, intensive medical therapy and observation is required, as patients may develop compartment syndrome or metabolic disorders, such as lactic acidosis or renal failure secondary to myoglobinuria, resulting from “washout” of the ischemic limb. Historically, patients presenting with ALI were treated with either surgical embolectomy or bypass, but thrombolytic therapy coupled with endovascular intervention has emerged as a viable treatment option in many patients presenting with acute symptoms and a possibly viable limb. Interventional outcomes are closely related to the rapidity of establishing flow, the avoidance of bleeding complications, and the treatment of reperfusion complications.

Acoustic pulse therapy coupled with thrombolytic infusion has been demonstrated to reduce the total dosage of thrombolytic drug and the time required to achieve thrombolysis. The Ekos catheter is a 6 French catheter with side holes available in infusion lengths of 6-50 cm. After placement of the catheter over a .035-inch guidewire placed across the area to be treated, the wire is withdrawn. A single catheter the size of the withdrawn wire containing a series of ultrasound transducers is placed via that guidewire lumen into the catheter. The transducers are connected to an external power source that when activated energizes the transducers to emit low-energy ultrasound (2.2 MHz). The catheter has two infusion lumens. The smaller, drug infusion lumen is capable of delivering 35 cc/hour. The larger flush/cooling lumen can deliver up to 150 cc/hour of heparinized saline to mitigate against the heat production that is associated with ultrasonic energy creation. The energy helps to drive more effective drug penetration of the thrombus and has been demonstrated to facilitate unwinding of thrombus. The time to thrombus dissolution varies based on age of the thrombus, volume of thrombus, distal flow, and thrombogenicity status.

Ideally, the infusion treatment time should be as short as possible to achieve the desired thrombus removal. The infusion is often given in arbitrary time intervals (such as an overnight infusion), but better monitoring capability of the establishment of distal flow may have the potential to reduce the total lytic infusion dose and time. Shorter infusions with less lytic dosage may lessen the risk of bleeding complications.
The combination of thrombolytic infusion and pulsed ultrasonic energy has shown promise in the treatment of venous thrombosis, peripheral arterial thrombosis, thrombotic arterial emboli, and pulmonary embolus therapy. Decreasing the total amount of thrombolytic needed as well as decreasing the thrombolytic infusion time has great potential to improve outcomes. Mitigation of bleeding complications and decreasing the time to reperfusion are the goals of pulsed acoustic therapy with low-dose thrombolytics.