



## Chapter 3.2

# Endovascular Resuscitation in the Emergency Department

Thoughts of emergency medicine doctors with REBOA and EVTm interest

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A significant member of the trauma team both in the pre-hospital setting as well as in the trauma bay in the emergency department is the emergency physician. Traditionally the role of the emergency physician is to resuscitate and stabilize the patient while working with the surgical trauma team to decide whether or not the patient needs surgical repair for his injuries. Part of the decision making tree for an EM physician is to also work with the attending surgeon to manage where the patient should ultimately go for definitive treatment. This may include transferring a patient to a higher level of care which in some circumstances can be risky for both the patient and the EMS crew. In the setting of a trauma centre with an in house trauma team, the most efficient management is for the emergency and physician and surgeon to work together as a team. In the new era of trauma management, fewer patients are going directly to the operating room for the traditional laparotomy. This new push is a result of better imaging technology, research in trauma management, the surge of interventional radiology, and the new role of EVTm. The skills set of the emergency physician is constantly evolving and expanding. EVTm will become paramount for the emergency physician to not only understand,

but to also learn and utilize in the emergency department as part of modern management of the hemorrhaging trauma patient. Given the new research and advances with the partial occlusion REBOA catheter, longer transport times with a REBOA catheter in place is now feasible.

For example, a victim of blunt trauma from a high speed motor vehicle collision will more likely end up initially in a level II, III, or IV trauma center (no 24/7 trauma surgeon, IR or vascular surgeon on call). In the setting of an unstable pelvic fracture that needs to be transferred to a higher level of care for definitive management, the emergency physician this patient will be skillful at placing an ultrasound guided introducer catheter and endovascular occlusion device (REBOA) that can be used for a temporary hemorrhage control while also resuscitating with blood products and then transferring the patient. This can be done by any emergency physician, and has the potential to save lives when hemorrhaging patients present to more rural emergency departments with long transport times.

When considering EVTm as an adjunct or temporary measure for the hemorrhaging patient, the emergency physician is considered an integral member of the team, and **should be trained in basic EVTm**. Currently emergency physicians are on the forefront of using the new US FDA approved ER REBOA (Prytime) for non-compressible hemorrhage of the torso. Most recently, the ER REBOA catheter was used successfully by both a U.S. emergency physician and a surgeon in the battlefield in the Middle East. As new technology is brought into play with the use of catheters that can measure “partial” occlusion, the REBOA catheter might play an important role as a temporizing measure to get hemorrhaging patients transferred from a community hospital to a level 1 trauma center. Due to its ease of use, it also has a promising role in the pre-hospital setting. Its use at smaller institutions without surgical support and in the field makes it a crucial part of the developing skillset of the emergency physician.

The use of focused bedside ultrasound has been rapidly integrated into emergency medicine training programs across the United States and proficiency is now a requirement for all trainees. The importance of ultrasound extends far beyond the focused assessment with sonography in trauma (FAST) exam. Ultrasound can assist in the diagnosis of a traumatic condition requiring or excluding EVTm, attaining **vascular access** for EVTm, and confirm-

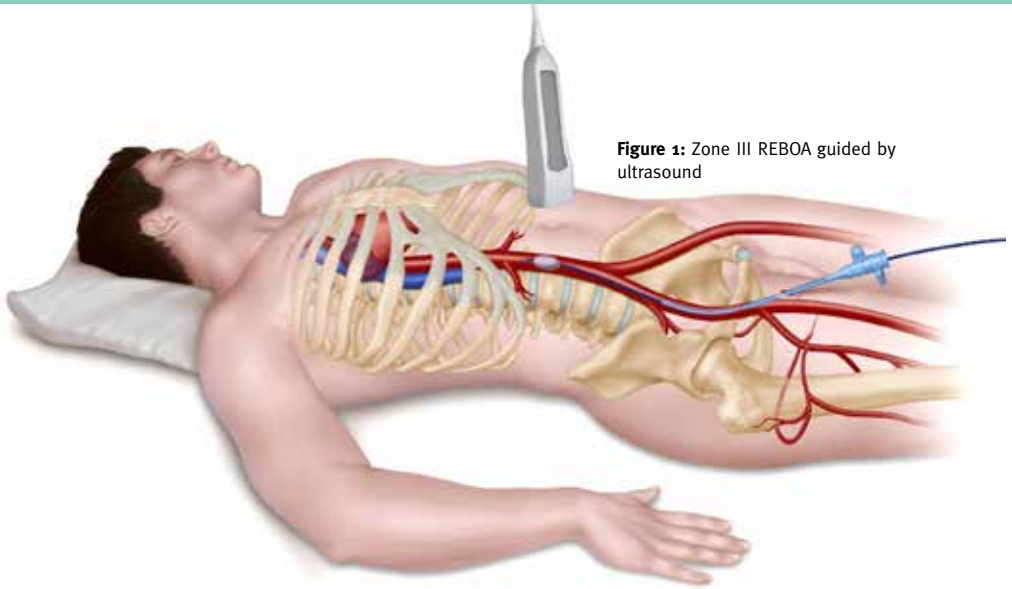


**Figure 1:** Zone III REBOA guided by ultrasound

ing placement of EVTMs. Its portability allows the technology to travel with the physician, making it extremely useful in both the pre-hospital and battlefield settings.

A critically ill patient often cannot be transported from the trauma bay to the radiology department for definitive imaging and thus a diagnostic methodology that can be employed at the bedside is invaluable. The FAST exam allows the efficient identification of a non-compressible hemorrhage that may be amenable to EVTMs in the shocked patient. While its use in the abdomen has been popularized, emergency physicians are capable of using ultrasound to check for thoracic and vascular injuries that may preclude the use of EVTMs techniques such as REBOA. Ultrasound can readily identify a pericardial effusion, hemothorax, pulmonary contusion or hemorrhage, and can be used to assess the thoracic and abdominal aorta for signs of injury. Bedside ultrasound has enabled emergency physicians to become leaders in vascular access and its use has been consistently demonstrated to be superior to blind approaches concerning both venous and arterial access. Ultrasound is utilized for central venous access at the femoral vein, the subclavian (both infra-clavicular and supra-clavicular approaches), and the internal jugular, while it also improves femoral and radial artery cannulation success. In regards to femoral arterial

access, not only does it improve time to cannulation, but it also improves first time success rate and decreases accidental venous cannulation. This skill becomes even more critical in the shocked or cardiac arrest patient with collapsed vessels.

Historically, EVT techniques such as REBOA have required fluoroscopy for confirmation of proper placement, however ultrasound is now beginning to play a major role in this area as well. By inflating vascular balloons with contrast dye, ultrasound can readily identify their position within the aorta. With the deployment of REBOA and other EVT techniques in the pre-hospital and battlefield setting, ultrasound has become the most practical imaging modality for the confirmation of device placement.

The use of EVT by emergency physicians may allow for the dissemination of these techniques into other non-surgical areas of medicine, most notably in medical cardiac arrest. Through the cessation of distal flow, one can effectively cause the selective perfusion of the heart and brain. During a low flow state such as cardiac arrest, balloon occlusion of the aorta redistributes cardiac output and increases flow to these critical organs. Increased coronary flow improves the chances of return of spontaneous circulation while increased cerebral flow helps maintain neurologic preservation during resuscitation. The use of balloon occlusion during non-traumatic cardiac arrest is supported by a multitude of animal studies, limited case reports in humans, and is currently undergoing prospective trial development in humans.

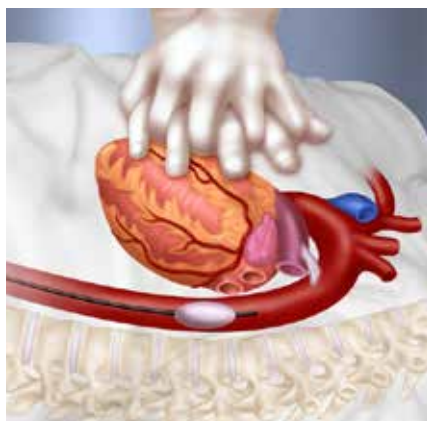


**Figure 2:** CPR with Zone I REBOA in place.