

Resuscitative Endovascular Balloon Occlusion of the Aorta: Indications, Outcomes, and Training



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KEYWORDS

- Resuscitative endovascular balloon occlusion of aorta • Hemorrhagic shock
- Aortic occlusion • Aortic balloon • Noncompressible torso hemorrhage
- Resuscitative thoracotomy

KEY POINTS

- Resuscitative endovascular balloon occlusion of aorta (REBOA) is an adjunct to trauma hemorrhage control; it provides early aortic occlusion to improve blood pressure and stabilize patients to undergo definitive hemorrhage control.
- The 2 main indications for REBOA use in trauma are hemorrhagic shock related to pelvic hemorrhage or abdominal/torso hemorrhage.
- REBOA is deployed in aortic zone III for pelvic hemorrhage and zone I for abdominal or truncal hemorrhage; zone II is a zone of no occlusion.
- After REBOA placement and balloon inflation, definitive hemostasis must be achieved either in the operating room, hybrid suite, or interventional radiology.
- Appropriate implementation of REBOA requires adequate endovascular inventory (a REBOA kit) and a clear concise REBOA protocol so that the REBOA procedure is standardized. Advanced education and training are required for all practitioners responsible for REBOA insertion.

INTRODUCTION

Aortic balloon occlusion has been successfully used for ruptured abdominal aortic aneurysm control with increased survival,¹ aortoenteric fistula aortic hemorrhage control,² postpartum or abdominal/pelvic surgery hemorrhage,³ hemoperitoneum owing to splenic artery aneurysm,⁴ gastrointestinal hemorrhage, and for control of vascular injuries. Aortic balloon occlusion for treatment of ruptured abdominal aortic aneurysm is now the standard of care.⁵ However, the use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in trauma is relatively new. REBOA is an adjunct to trauma hemorrhage control, providing early aortic occlusion to improve blood

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pressure and transiently stabilize patients to undergo definitive hemorrhage control. REBOA must be in the armamentarium of the trauma surgeon to assist in achieving prompt hemostasis.

HISTORY

Resuscitative balloon occlusion of the aorta for the treatment of traumatic hemorrhagic shock was first reported in 1954 by Lieutenant Colonel Carl W. Hughes, US Army (Walter Reed Army Medical Center) in 3 critically injured soldiers (Fig. 1). It was reported that, "It was arbitrarily decided that the catheter would be used only in moribund cases with evidence of intra-abdominal bleeding in which blood pressure could not be obtained after administration of 10 units of blood."⁶ All patients died from major injuries and he recommended earlier use of aortic balloon occlusion may be beneficial.

In 1986, a preliminary report of the use of Percluder occluding aortic balloon in 23 patients included 15 trauma patients. Although all patients had an increase in arterial pressure with aortic occlusion, only 2 of the 15 trauma patients (13%) were long-term survivors.⁷

In 1989, Shaftan and colleagues⁸ reported the use of intraaortic balloon occlusion in penetrating abdominal trauma in 21 patients with variable outcomes: group 1 (n = 5) cardiac rhythm, no systolic blood pressure (SBP), no survivors; group 2 (n = 6) SBP of less than 80 mm Hg, 3 survivors (50%); and group 3 (n = 10), hemodynamic deterioration to SBP of 80 mm Hg, 4 survivors (40%). These early REBOA patient series were fraught with problems related to delayed implementation of REBOA and prolonged aortic occlusion.

A recent systematic review of REBOA use in the management of hemorrhagic shock identified 41 studies with 857 total patients. Clinical settings included postpartum hemorrhage (n = 5), upper gastrointestinal bleeding (n = 3), pelvic surgery (n = 8), trauma (n = 15), and ruptured aortic aneurysm (n = 10). The overall mortality rate was 49.4%. REBOA did increase the SBP by 53 mm Hg in all patients.⁹ However, it is not possible to determine whether REBOA had any positive impact on the ultimate outcome from these reports.

The first report of intraaortic balloon occlusion without fluoroscopy for the treatment of life-threatening hemorrhagic shock from pelvic fracture in 13 patients was published

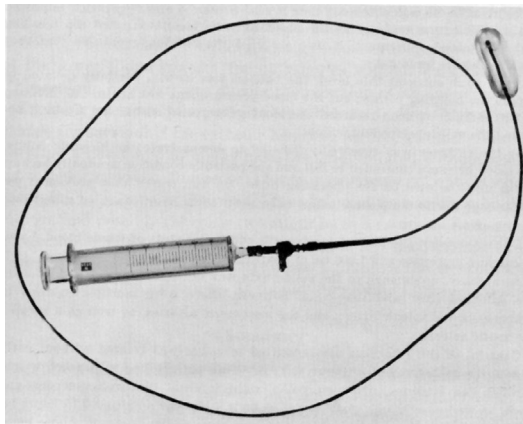


Fig. 1. Lt. Col. Carl W. Hughes' original balloon catheter for aortic occlusion. (From Hughes CW. Use of an intra-aortic balloon catheter tamponade for controlling intra-abdominal hemorrhage in man. *Surgery* 1954;36:65–8.)

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