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SCIENTIFIC LETTER

First experience with the use of REBOA in abdominal and pelvic trauma: Report of 2 cases☆

Primera experiencia con el uso de REBOA en traumatismo abdominal y pélvico: a propósito de 2 casos

To the Editor,

Over the last few years, the treatment of hemorrhagic shock in the management of severe trauma has evolved significantly with the development of resuscitation with damage control. In the management of non-compressible torso hemorrhage (NCTH), the resuscitative endovascular balloon occlusion of the aorta (REBOA) has gained interest as a percutaneous technique to complement the resuscitation thoracotomy (RT).[1] The use of REBOA to treat NCTH seems to improve results compared to RT[2] acting as a bail-out technique in a subgroup of patients with severe trauma in whom its use can reduce the high mortality rate associated with standard treatment.[3] However, it is an invasive technique associated with several complicaciones[4] (like distal ischemia, thrombosis or vascular damage).

Last month, our level I trauma center received a REBOA kit (REBOA Medical AS, Bastad, Norway) (Reboa Medical brand, an 8 mL balloon, and a 6-Fr introducer sheath), and we have developed a protocol to implement it during the early care of the patient observing the necessary indications, contraindications, material, and action plan. Also, the healthcare personnel involved has been briefed and trained (through video recording and, recently, with a lab to perform the simulations). Therefore, we present our experience with our first 2 cases (summary shown on Table 1).

Case #1. This is the case of a 44-year-old male who fell off a 7th floor. The emergency medical services informed of respiratory failure with signs of right-sided blunt chest trauma, adequate hemodynamic situation, and a normal level of consciousness without other relevant data in the preliminary notice.

Upon arrival to the emergency room the patient showed a patent airway, tachypnea with hypophonesis in the right lung base without capture of SpO2, tachycardia at 130 bpm with systolic arterial pressure (SAP) of 110 mmHg that later went down to <80 mmHg with data of peripheral hypoperfusion. The patient was intubated and treated with central venous catheterization followed by noradrenaline and the implementation of a massive hemorrhage protocol (MHP). Thoracic and pelvic X-rays showed no obvious findings, and positive FAST exam. Given the patient's progressive hemodynamic instability despite vasoactive support and massive transfusion, it was decided to implant the REBOA kit into zone I via the previously canalized femoral artery with radiological confirmation according to our protocol (X<- ->-ray after inflation with contrast). This allowed the patient's transfer to the operating room to perform an exploratory

Table 1 Summary of REBOA cases.

	Case #1	Case #2
Age	44 years	67 years
Injury mechanism	Fall	Fall
ISS	57	43
MABP (mmHg) before REBOA inflation	50	45
Suspected hemorrhagic site	Abdominal	Pelvic
Inflation zone	Zone I	Zone III
Destination after inflation	Damage control surgery	Arteriography
Inflation time	48 min	67 min
ICU stay	21 days	31 days
Outcomes	Hospital discharge	Hospital discharge. Physical disability
Severe complications associated with the technique	None	Compartmental syndrome in RLE (fracture + perfusion)

ISS, Injury Severity Score; MABP, mean arterial blood pressure; ICU, intensive care unit; REBOA, resuscitative endovascular balloon occlusion of the aorta; RLE, right lower extremity.

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laparotomy that confirmed the presence of mesenteric arterial bleeding with hypoperfused bowel loops. Damage control resection surgery was performed that progressively stabilized the patient's hemodynamic status followed by deflation of the REBOA kit after 48 min of continuous total occlusion A computed tomography (CT) scan was performed after the procedure. It revealed the presence of an unstable left thorax with hemopneumothorax (afterwards, endothoracic drainage was inserted), mild rachidial and orthopedic trauma with right distal fractures of ankle and radius. A vascular study of the lower extremities was performed, REBOA-induced vascular obstruction was ruled out, and the REBOA kit was removed after achieving preserved stability.

During the ICU stay, the patient developed post-traumatic shock with early multiple organ dysfunction syndrome that required surgical review after 48 h followed by prolonged weaning in the chest trauma setting and eventually percutaneous tracheostomy. The patient was discharged from the ICU on day 21 and from the hospital on day 28 with good functional outcomes.

Case #2. This is the case of a 67-year-old male who fell off a 39-feet height. The emergency medical services confirmed the presence of respiratory failure, SAP of 65 mmHg without tachycardia, a low level of consciousness with Glasgow Coma Scale of 10 points, and a grade III open fracture at right ankle level. Support therapy was initiated with serum therapy, noradrenaline, and orotracheal intubation. During the transport of the patient, the emergency medical services confirmed the presence of persistent instability, and the MHP had to be preactivated.

SAP of 60 mmHg with filiform pulse was confirmed at the examination room, which is why a subclavian introducer sheath was used for the infusion of noradrenaline. Also, the MHP was activated. Right endothoracic drainage was inserted after confirming the presence of pneumothorax on the X-ray. Also, the X-rays of the pelvis performed confirmed the presence of diastasis pubic symphysis, and negative FAST exam. After early stabilization, the MHP was interrupted, and the patient had to be transferred for a CT scan. While performing the CT scan, the patient suffered from a cardiac arrest in ventricular fibrillation that required 25 min of advanced life support until spontaneous circulation was recovered with increased vasopressors and MHP reactivation. The physical examination was completed after confirmation of comminuted sacral fracture with presence of a significant presacral hematoma, and bilateral rib fractures without significant findings on the cranial CT scan. Given the patient's preserved hemodynamic instability it was decided to implant the REBOA kit into zone III with the same technology used in case #1 (via right femoral access). Stability was regained 15 min after inflating the REBOA kit, the MHP was deactivated, and the patient transferred to the interventional radiology room for further embolization of the arterial bleeding sites (hypogastral and lumbar branches). This consolidated the patient's hemodynamic status allowing the deflation of the REBOA kit after 67 min of continuous total occlusion.

During the ICU stay the patient also had complications like multiple organ dysfunction syndrome and prolonged weaning that required percutaneous tracheostomy. Also, the patient's right leg developed compartmental syndrome that required fasciotomy within the first 12 h and several reinterventions. Despite of this, the appearance of a septic focus led to the leg amputation at supracondylar level. The patient was discharged from the ICU 31 days after admission in good neurological situation. Arthrodesis of the sacral fracture was induced at the hospital floor, and the patient was discharged to a rehabilitation center in situation of major dependence due to physical disability.

In conclusion, our early experience with the REBOA kit has been positive regarding the in-hospital survival rates in both cases, but still with some of the complications reported in the medical literature available[5] (probably due to prolonged times with total occlusion and insertion into the damaged extremity). As far as the authors of this article is concerned, these cases are the first ones ever reported in traumatology in Spain. We should mention the importance of implementing a healthcare protocol for the proper performance of a highly complex not-that-common technique like this one. Training, practice, and case review are essential to achieve optimal outcomes.[5] Probably, the most relevant aspect regarding the benefits of the REBOA kit and the main field of study is the selection of patients, the availability of resources, and proper training.

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