



The use of prehospital REBOA in patients suffering from hemorrhage due to abdomino-pelvic trauma

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Abstract

The current treatment of these sorts of traumatic injuries revolves around swift, if not immediate, transport to the nearest trauma center. With the focus on decreasing pre-hospital time in order to expedite hemorrhage control, treatment of non-compressible hemorrhage depends initially on non-operative methods of stabilizing the patient such as aggressive fluid resuscitation. The life of the patient is dependent upon what happens between arrival of EMS on the scene and arrival of the patient to the hospital for definitive surgical intervention. Employing a team to the field capable of hemorrhage control rather than damage control caused by hemorrhage would have an immense effect on the improvement of survival in such injuries. While the basis of definitive hemorrhage control will always be conducted under a hospital/surgical setting, temporary control of hemorrhage can be established with the use of tools such as the REBOA and could bridge the gap between the point of injury and definitive surgical intervention at a trauma center.

Introduction

Exsanguination due to hemorrhage is the leading cause of death in victims of abdomino-pelvic trauma and one that is heavily dependent on time and the techniques at the hands of the resuscitative team to help in stabilizing vitals and maintaining as much control of the damage as possible before transport to the operating room. REBOA is a balloon catheter that is placed into the common femoral artery to occlude the aorta proximal to site of injury. Implementation of this device at point-of-injury could stabilize the patient and effectively increase critical time allowed for transport to a site of definitive care by preventing pre-hospital cardiac arrest due to hypovolemia.

Methods

A thorough review of the literature was performed using ClinicalKey, PUBMED, Google Scholar, and ScienceDirect. Nine articles were selected utilizing exclusion criteria of publication date, type of injury, and patient demographics. The articles were evaluated and compared via study design, results, and weighted significance to the topic as a whole.

Results

Alarhayem, A. Q., Myers, J. G., & Dent, D. (2016). Time is the enemy: Mortality in trauma patients with hemorrhage from torso injury occurs long before the "golden hour". *The American Journal of Surgery*, 212(6).

- Pre-hospital time

Morrison, J. J., & Ross, J. D. (2014). Resuscitative endovascular balloon occlusion of the aorta: A gap analysis of severely injured UK combat casualties. *Shock*, 41(5).

- Establish need for REBOA

Lendrum, R., Perkins, Z., & Chana, M. (2019). Pre-hospital Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for exsanguinating pelvic haemorrhage. *Resuscitation*, 139.

- REBOA in use in UK

Study	Design	Total N	Population Demographics	Disease at Baseline	Length of Dx at Baseline	Control	Tx Regimen	Outcome Measure
Lyon, R. F., & Northern, M.	CS	1	1 25 y/o Male	Non-compressible torso hemorrhage	Unknown	N/A	REBOA	AIS, VS, SBP
Joseph, B., Ibraheem, K., & Haider, A.	RCS	87	44 PT 43 BT *87 completed study	Non-compressible torso hemorrhage	N/A	Resuscitative thoracotomy	Autopsy to determine if REBOA applicable	ISS, ZO, VS, SBP
Manley, J. D., & Mitchell, B. J.	CS	4	3 PT GSW 1 PT explosive; all male	Non-compressible torso hemorrhage due to PT	N/A	N/A	Pre-hospital REBOA by multidisciplinary resuscitative team	SBP, ZO, VS, AIS, TUT, TEO, COMP, procedure performed upon arrival at hospital, TEO
Alarhayem, A. Q., Myers, J. G., & Dent, D.	RCS	42,135	N/A	Non-compressible torso hemorrhage	N/A	Short PHT vs long PHT	PHT measured in 15-minute increments	PHT, TUT, SBP, VS, AIS, mortality, BT, PT, ZO
Morrison, J. J., & Ross, J. D.	GA	1,317	925 no indication 148 had CI 244 no indication	Non-compressible torso hemorrhage	N/A	No REBOA/ other methods of hemorrhage control	N/A	AIS, SBP, TUT, mortality, VS, BT, PT, ZO, COMP, procedures performed at hospital
Reva, V. A., & Horer, T. M.	CS	2	2 male Sus Scrofa	Non-compressible torso hemorrhage	N/A	N/A	Pre-hospital REBOA	PHT, ZO, VS, SBP, TEO
Toshikazu, A., & Masatoshi, U.	RCS	840	607 REBOA 233 AO	Non-compressible torso hemorrhage	N/A	Aortic cross clamping	Torso hemorrhage control	TUT, SBP, VS, AIS, mortality, COMP
Wasieck, P. J., Li, Y., & Yang, S	RCS	28	28 ER-REBOA patients	Non-compressible torso hemorrhage	N/A	N/A	ER-REBOA	NTH, PHT, AO, TUT, VS, SBP
Lendrum, R., Perkins, Z., & Chana, M.	RCS	21	18 trauma patients 3 non-trauma	Non-compressible torso hemorrhage	N/A	N/A	Pre-hospital REBOA	NTH, COMP, TUT, SBP

Key: RCS: Retrospective Control Study, Case Study (CS), Gap Analysis (GA), Injury Severity Score (ISS), Abbreviated Injury Scale, Blunt Trauma (BT), Penetrating Trauma (PT), Noncompressible Torso Hemorrhage (NTH), Prehospital Time (PHT), Aortic Occlusion (AO), Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA), Vital Signs (VS), Zone of Occlusion (ZO), Systolic Blood Pressure (SBP), Time Until Treatment (TUT), Complications (COMP), Time Elapsed of Occlusion (TEO)

Discussion

The REBOA was shown to have significant positive outcomes in patients in each study. However, there is a lack of data specific to REBOA's use in pre-hospital situations. The studies pertaining to pre-hospital REBOA have low population sizes and therefore carry less statistical weight. However the downstream effects of REBOA placement have been shown to be statistically significant in studies holding heavy weight in terms of sample size.

Conclusion

Use of pre-hospital REBOA could greatly contribute to the time allowed for resuscitative teams to try to regain control of vitals. Ultimately, the pre-hospital and pre-operative interventions available affect the capacity of surgeons to work to control the hemorrhage and limit the extent of cardiac shock. REBOA is a crucial tool that should be further explored in order to improve mortality.