REBOA is Associated with Death and Chi Chi

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Location | St. Michael's Hospital

The Argument

- No good data support benefit
- Most data increased death, morbidity
- Papers written solely on complications
- Use not increasing
- Technology not ready yet
  - Maybe someday

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Trauma Surgery & Acute Care Open

Joint statement from the American College of Surgeons Committee on Trauma (ACS COT) and the American College of Emergency Physicians (ACEP) regarding the clinical use of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)

Megan Brenner,[1] Eileen M Bulger,[2] Debra G Perina,[3] Sharon Henry,[1] Christopher S Kang,[4] Michael F Rotondo,[5] Michael C Chang,[6] Leonard J Weireter,[7] Michael Coburn,[8] Robert J Winchell,[9] Ronald M Stewart[10]

GENERAL OBSERVATIONS

- No current, high-grade evidence clearly demonstrates REBOA improves outcomes or survival compared to standard treatment of severe hemorrhage.[5–10]

Brenner M et al. *TSACO* 2018;3:1 – 3.

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QUALITY ASSURANCE, MAINTENANCE OF COMPETENCE, PERFORMANCE IMPROVEMENT AND PATIENT SAFETY

- REBOA will be uncommon in most settings. As such and given that the benefits of REBOA are as yet unproven, patient safety and performance improvement are critically necessary components of a REBOA program.
- After initial training, there should be an ongoing competency program, either through simulation or cadaver labs, attendance at a BEST Course® or Workshop, or completion of the ASSET™ Course 'Introduction to REBOA Module'.
- There should also be a strong quality management program at each institution evaluating (1) each placement for appropriateness and complications to maximize patient safety and (2) availability and timeliness of definitive surgical or angioembolic control of bleeding following REBOA.

Brenner M et al. *TSACO* 2018;3:1 – 3.

Research

JAMA Surgery | Original Investigation

Nationwide Analysis of Resuscitative Endovascular Balloon Occlusion of the Aorta in Civilian Trauma

Bellal Joseph, MD; Muhammad Zeeshan, MD; Joseph V. Sakran, MD, MPH; Mohammad Hamidi, MD; Narong Kulvatunyou, MD; Muhammad Khan, MD; Terence O'Keeffe, MD; Peter Rhee, MD

IMPORTANCE The need for improved methods of hemorrhage control and resuscitation has resulted in a reappraisal of resuscitative endovascular balloon occlusion of the aorta (REBOA). However, there is a paucity of data regarding the use of REBOA on a multi-institutional level in the United States.

Invited Commentary
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Author Audio Interview

Joseph et al. *JAMA Surgery* 2019;154:500 – 508.

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Methods

- TQIP 2015 – 2016
- Placed within 1 hour of admission
- Transfers excluded
- REBOA patients matched 1:2 to no REBOA patients
- Propensity score matching

Joseph et al. *JAMA Surgery* 2019;154:500 – 508.

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Demographics of Groups

Variables	Patients, No. (%)		P Value
	No-REBOA Group (n = 280)	REBOA Group (n = 140)	
Age, mean (SD), y	43 (19)	44 (20)	.88
Male sex	203 (72.5)	104 (74.3)	.76
White race	180 (64.3)	89 (63.6)	.37
Vital signs in the ED			
SBP, mean (SD), mm Hg	106.5 (28.7)	108.8 (32.7)	.65
HR, mean (SD), bpm	104 (27)	102 (30)	.74
GCS score, median (IQR)	13 (3-15)	14 (3-15)	.88
Injury parameters			
Blunt MOI	257 (91.8)	129 (92.1)	.87
ISS, median (IQR)	28 (17-35)	29 (18-38)	.91
h-AIS score, median (IQR)	0 (0-3)	0 (0-3)	.98
Pelvic fractures, total	144 (51.4)	74 (52.9)	.65
With intact posterior arch	45 (16.1)	25 (17.9)	
Incompletely disrupted posterior arch	68 (24.3)	33 (23.6)	
Completely disrupted posterior arch	31 (11.1)	16 (11.4)	

Joseph et al. *JAMA Surgery* 2019;154:500 – 508.

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Outcomes

Variable	Patients, No. (%)		*P* Value
	No-REBOA Group (n = 280)	REBOA Group (n = 140)	
Complications			
Acute kidney injury	9 (3.2)	15 (10.7)	.02
Amputation of lower limb	2 (0.7)	5 (3.6)	.04
Deep venous thrombosis	14 (5.0)	6 (4.3)	.42
Pulmonary embolism	5 (1.8)	2 (1.4)	.28
Stroke	3 (1.1)	2 (1.4)	.37
Myocardial infarction	1 (0.4)	0	.51
Extremity compartment syndrome	2 (0.7)	1 (0.7)	.39
Overall mortality	53 (18.9)	50 (35.7)	.01
Mortality in the ED	5 (1.8)	4 (2.9)	.35
24-h Mortality	33 (11.8)	37 (26.4)	.01
In-hospital mortality after 24 h	15 (5.4)	9 (6.4)	.21

Joseph et al. *JAMA Surgery* 2019;154:500 – 508.

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Research

JAMA Surgery | Original Investigation

Association Between Hemorrhage Control Interventions and Mortality in US Trauma Patients With Hemodynamically Unstable Pelvic Fractures

Tanya Anand, MD, MPH; Khaled El-Qawaqzeh, MD; Adam Nelson, MD; Hamidreza Hosseinpour, MD; Michael DiTillo, DO; Lynn Gries, MD; Lourdes Castanon, MD; Bellal Joseph, MD

IMPORTANCE Management of hemodynamically unstable pelvic fractures remains a challenge. Hemostatic interventions are used alone or in combination. There is a paucity of data on the association between the pattern of hemorrhage control interventions and outcomes after a severe pelvic fracture.

Invited Commentary page 71

Multimedia

Supplemental content

Anand et al *JAMA Surgery* 2023;158:63 – 71.

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Methods

- 2017 TQIP
- Pelvic fracture and ≥ 4u PRBCs in 1st 4 hours
- Received PP, AE, or REBOA
- Backward stepwise regression analysis

Anand et al *JAMA Surgery* 2023;158:63 – 71.

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Baseline Characteristics

Characteristic	No. (%)			
	Overall (N = 1396)	Pelvic AE (n = 774)	Preperitoneal PP (n = 659)	REBOA (n = 126)
Emergency department vital signs, mean (SD)				
SBP, mm Hg	101 (35)	102 (34)	101 (37)	101 (35)
Lowest SBP, mm Hg	71 (25)	71 (23)	71 (27)	65 (27)
HR /min	107 (31)	107 (301)	107 (32)	107 (33)
RR /min	21 (8)	21 (8)	21 (8)	21 (9)

Anand et al *JAMA Surgery* 2023;158:63 – 71.

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Mortality by 1st Intervention

Outcome measure	No. (%) Overall (n = 1236)	Pelvic AE (n = 652)	Preperitoneal PP (n = 618)	REBOA (n = 126)	*P* value
Mortality					
24-Hour	217 (15.5)	78 (12.0)	104 (16.8)	35 (27.8)	<.001[a]
ED	10 (0.7)	4 (0.6)	1 (0.2)	5 (4.0)	<.001[a]
In-hospital	501 (35.9)	218 (33.4)	222 (35.9)	61 (48.4)	.006[a]

Anand et al *JAMA Surgery* 2023;158:63 – 71.

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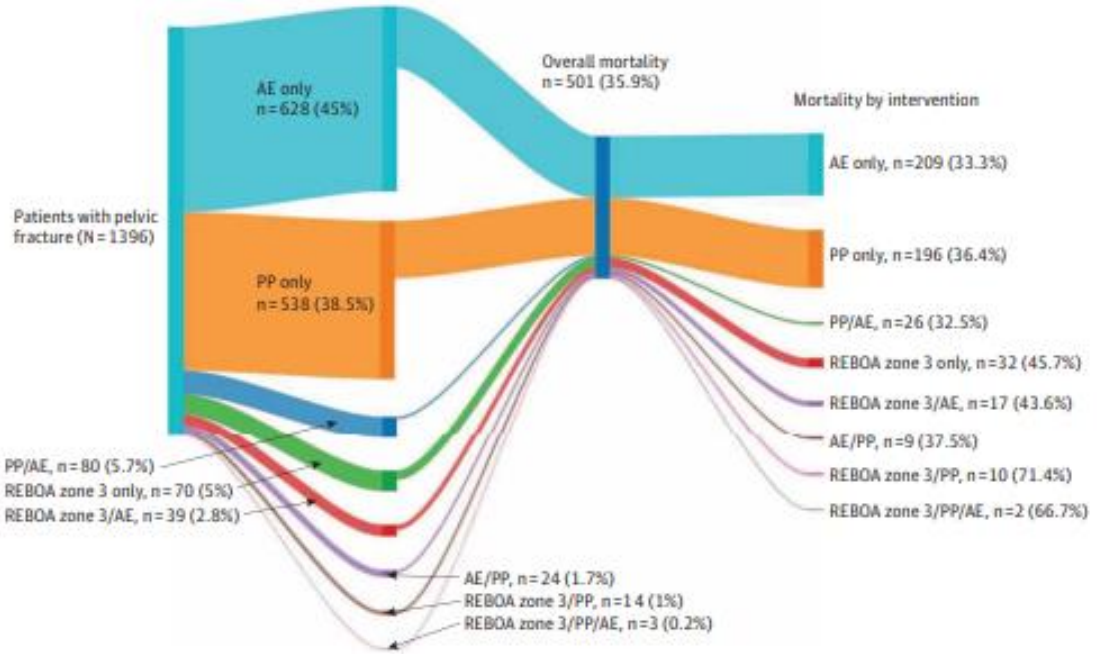
Mortality by Intervention



Anand et al *JAMA Surgery* 2023;158:63 – 71.

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Wiley
Emergency Medicine International
Volume 2024, Article ID 6397444, 12 pages
https://doi.org/10.1155/2024/6397444

WILEY

Research Article

Hemostatic Interventions and All-Cause Mortality in Hemodynamically Unstable Pelvic Fractures: A Systematic Review and Meta-Analysis

XuWen Zheng,[1] **MaoBing Chen**,[1] **Yi Zhuang**,[1] **Jin Xu**,[1] **Liang Zhao**,[1] **YongJun Qian**,[1] **WenMing Shen**,[1] **and Ying Chu**[2]

[1]*Truama Center, Wujin People's Hospital Affiliated with Jiangsu University and Wujin Clinical College of Xuzhou Medical University, Changzhou 213017, China*
[2]*Wujin Institute of Molecular Diagnostics and Precision Cancer Medicine of Jiangsu University, Changzhou 213017, China*

Correspondence should be addressed to Ying Chu; chuying@wjrmyy.cn

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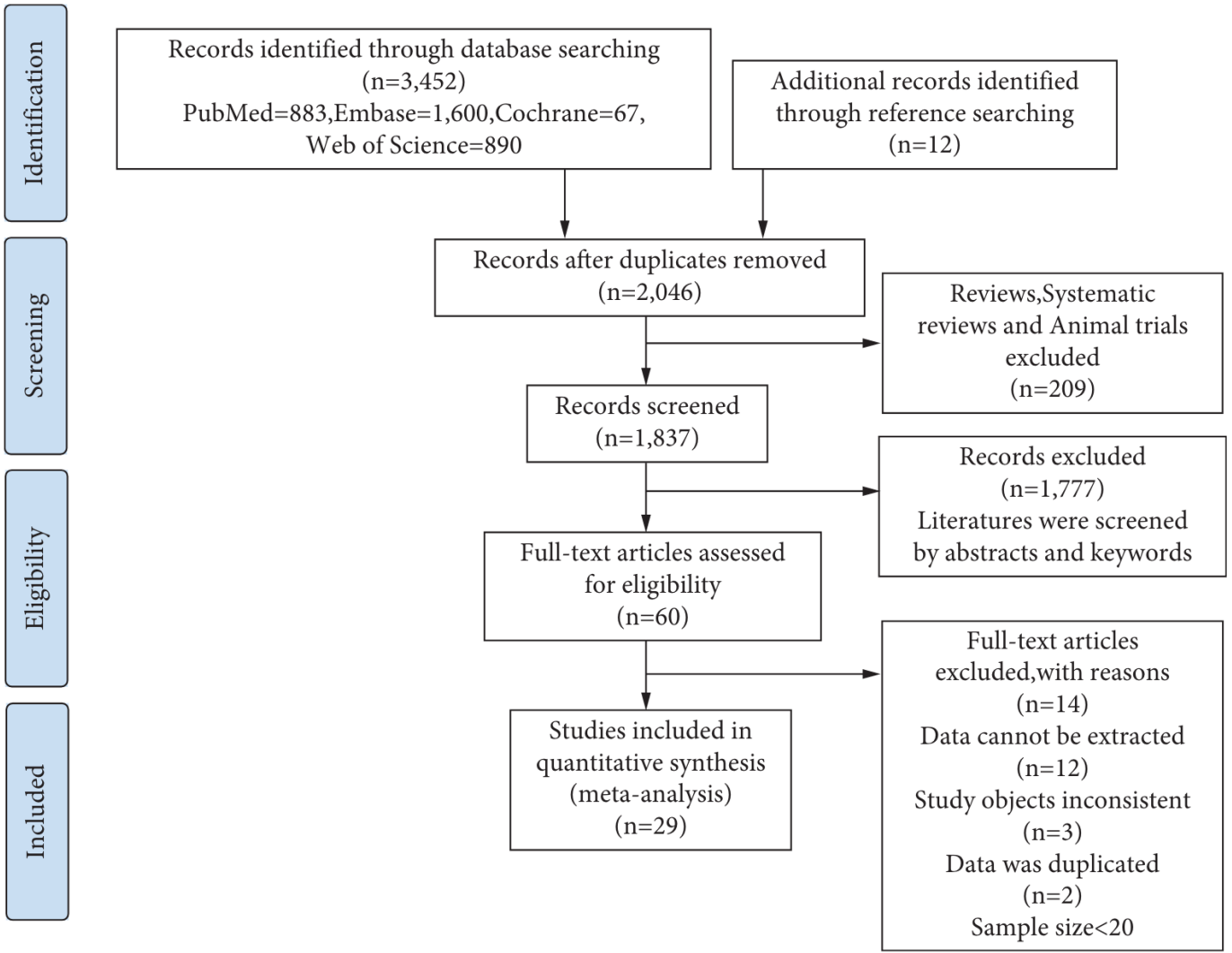
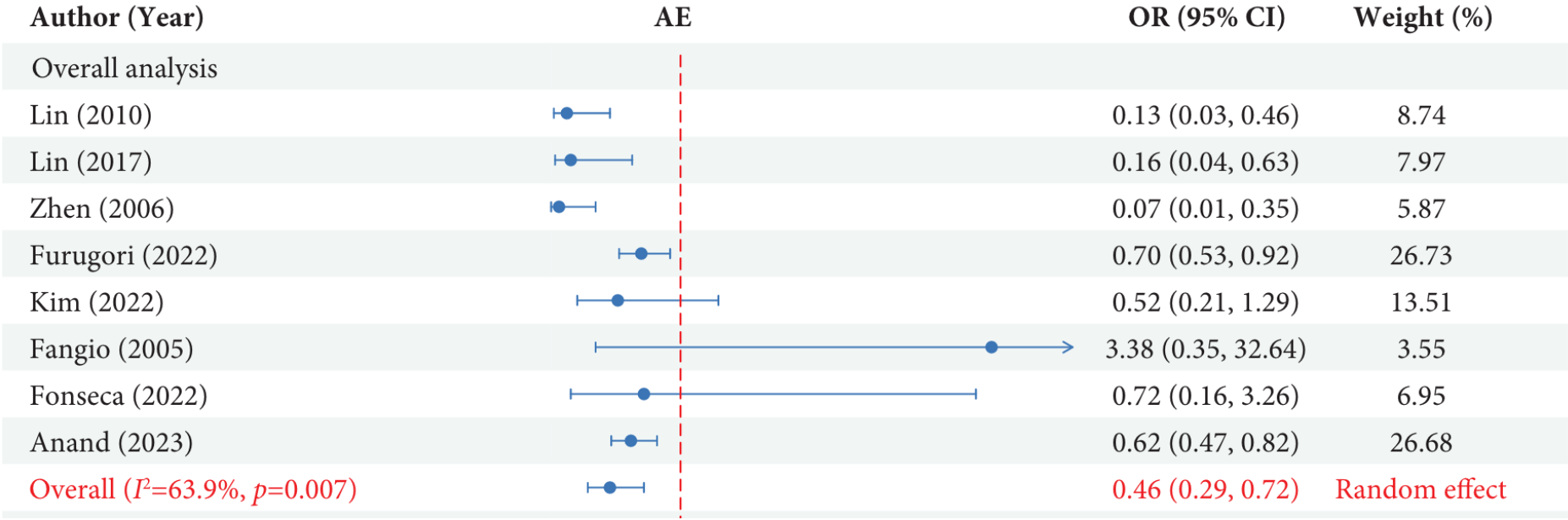

Identification
Screening
Eligibility
Included
Records identified through database searching (n=3,452) PubMed=883,Embase=1,600,Cochrane=67, Web of Science=890
Additional records identified through reference searching (n=12)
Records after duplicates removed (n=2,046)
Reviews,Systematic reviews and Animal trials excluded (n=209)
Records screened (n=1,837)
Records excluded (n=1,777) Literatures were screened by abstracts and keywords
Full-text articles assessed for eligibility (n=60)
Full-text articles excluded,with reasons (n=14) Data cannot be extracted (n=12) Study objects inconsistent (n=3) Data was duplicated (n=2) Sample size<20
Studies included in quantitative synthesis (meta-analysis) (n=29)

OR Death AE

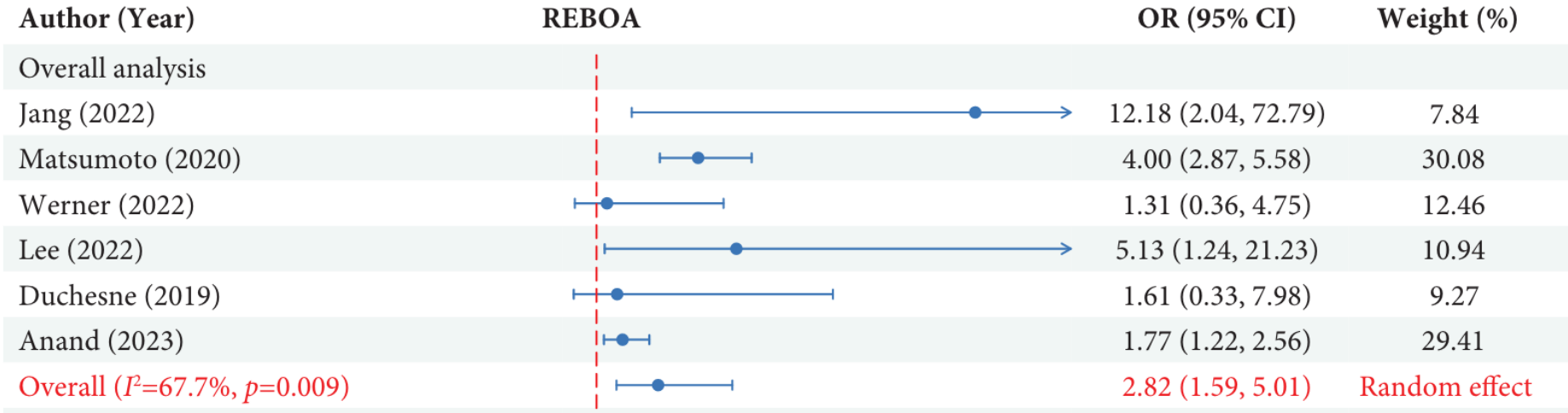
n = 4607



Zheng et al. *Emer Med Int*. 2024. https://doi.org/10.1155/2024/6397444.

OR Death REBOA

n = 5165



Zheng et al. *Emer Med Int*. 2024. https://doi.org/10.1155/2024/6397444.

The pitfalls of resuscitative endovascular balloon occlusion of the aorta: Risk factors and mitigation strategies

Anders J. Davidson, MD, MAS, Rachel M. Russo, MD, MAS, Viktor A. Reva, MD, Megan L. Brenner, MD, Laura J. Moore, MD, Chad Ball, MD, Eileen Bulger, MD, Charles J. Fox, MD, Joseph J. DuBose, MD, Ernest E. Moore, MD, Todd E. Rasmussen, MD, *and* **the BEST Study Group**, *Sacramento, California*

Ribeiro Junior *et al. World Journal of Emergency Surgery* (2018) 13:20
https://doi.org/10.1186/s13017-018-0181-6

World Journal of Emergency Surgery

REVIEW Open Access

The complications associated with Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)

Marcelo A. F. Ribeiro Junior[1*], Celia Y. D. Feng[2], Alexander T. M. Nguyen[2], Vinicius C. Rodrigues[1], Giovana E. K. Bechara[1], Raíssa Reis de-Moura[1] and Megan Brenner[3]

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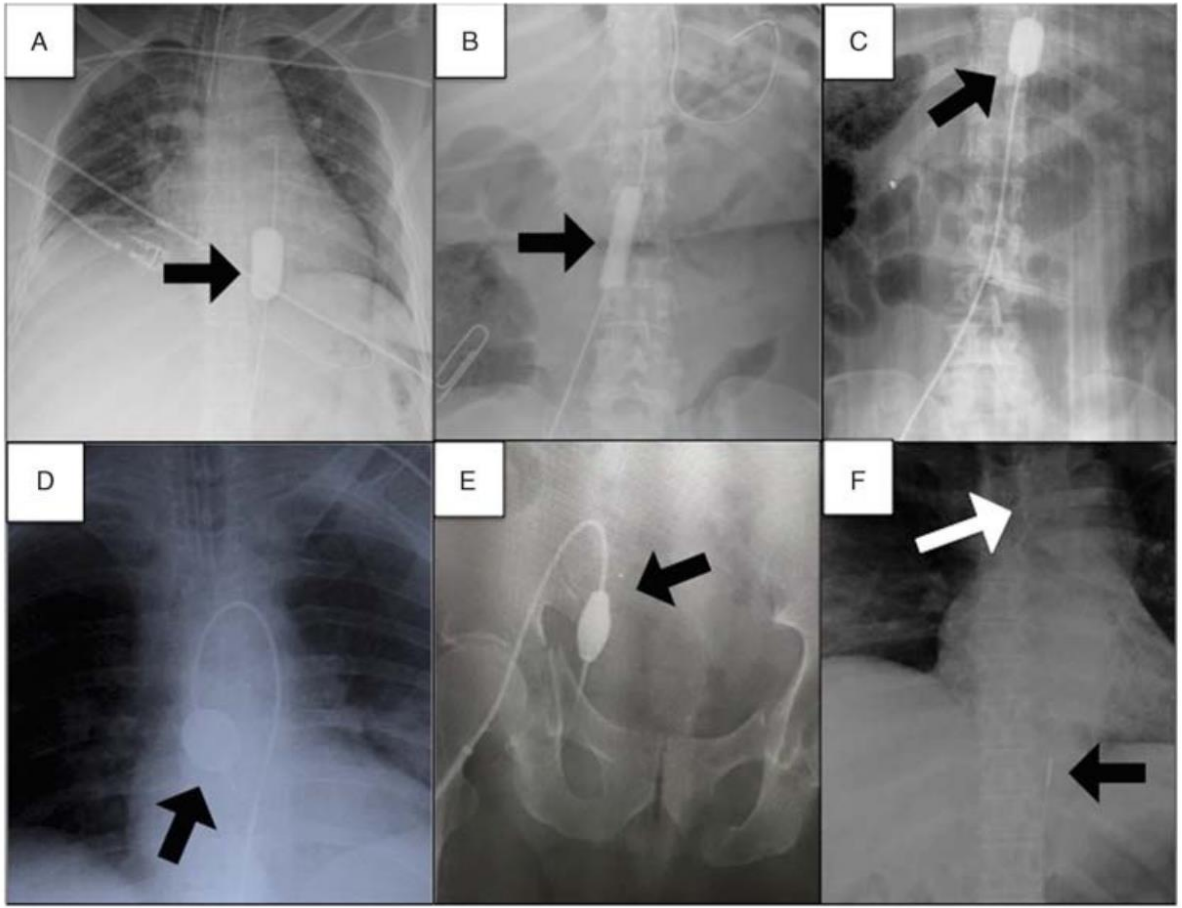

Figure 2. Malposition of REBOA balloons. (*A*) Appropriate position within Zone 1 of the aorta. (*B*) Appropriate position within Zone 3 of the aorta. (*C*) Inadvertent position within Zone 2 of the aorta. (*D*) Inadvertent position within Zone 0 of the aorta. (*E*) Inadvertent position within the ipsilateral internal iliac artery. (*F*) Exacerbation of proximal aortic hemorrhage (white arrow, note widened mediastinum) following inflation of a distally located balloon (now deflated). Black arrows denote balloons.

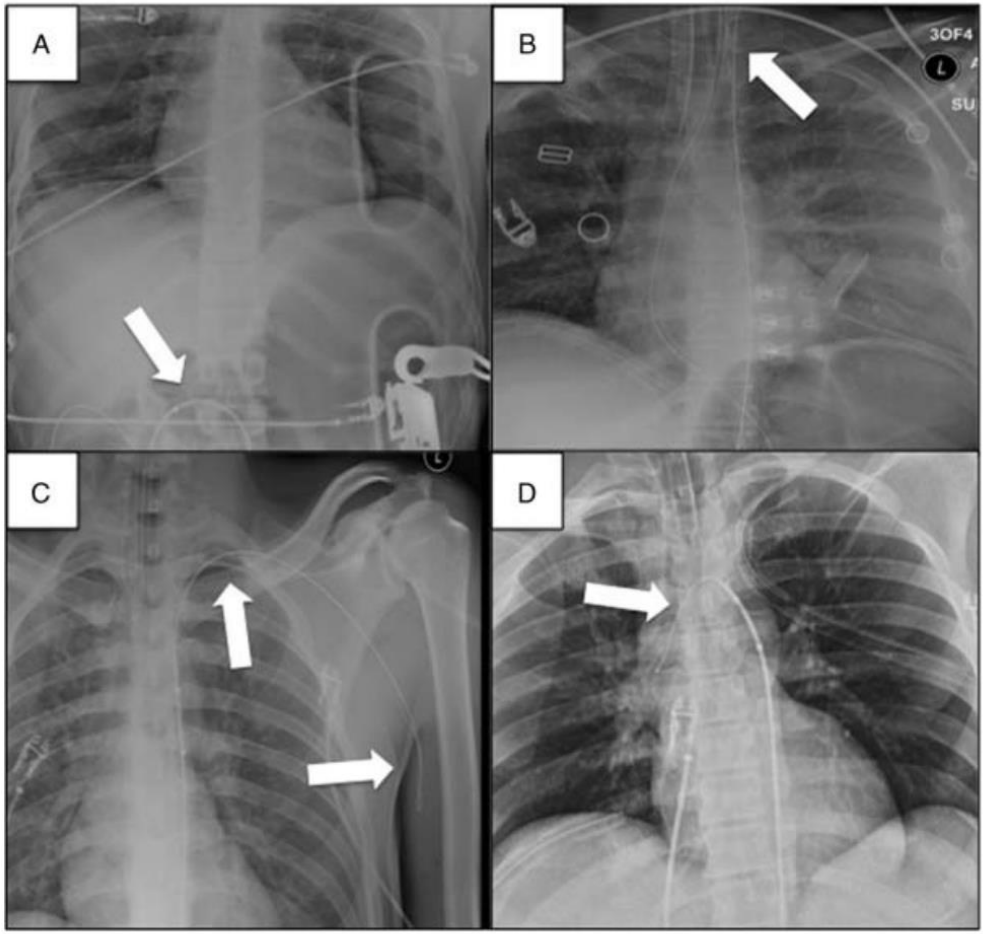

Figure 3. X-ray depictions of wire malposition. (*A*) Exit of the wire through an injury in the aorta. (*B*) Inadvertent advancement of the wire into the left carotid artery. (*C*) Inadvertent advancement of the wire into the left subclavian, axillary, and brachial artery. (*D*) Inadvertent advancement of the wire into the aortic arch. White arrows denote wire.

Ribeiro Junior *et al. World Journal of Emergency Surgery* (2018) 13:20
https://doi.org/10.1186/s13017-018-0181-6

World Journal of Emergency Surgery

REVIEW Open Access

The complications associated with Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)

TQIP Review

Marcelo A. F. Ribeiro Junior[1*], Celia Y. D. Feng[2], Alexander T. M. Nguyen[2], Vinicius C. Rodrigues[1], Giovana E. K. Bechara[1], Raíssa Reis de-Moura[1] and Megan Brenner[3]

Abstract

Non-compressible torso hemorrhage (NCTH) remains a significant cause of morbidity and mortality in the field of trauma and emergency medicine. In recent times, there has been a resurgence in the adoption of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) for patients who present with NCTH. Like all medical procedures, there are benefits and risks associated with the REBOA technique. However, in the case of REBOA, these complications are not unanimously agreed upon with varying viewpoints and studies. This article aims to review the current knowledge surrounding the complications of the REBOA technique at each step of its application.

Keywords: Complications, Radiology, Interventional, Multiple trauma, Abdomen, Shock, Hemorrhagic, REBOA

Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: www.americanjournalofsurgery.com

Original Research Article

An assessment of nationwide trends in emergency department (ED) resuscitative endovascular balloon occlusion of the aorta (REBOA) use – A trauma quality improvement program registry analysis

Hamza Hanif [a,*], Andrew D. Fisher [a,b], Michael D. April [c], Julie A. Rizzo [c,d], Richard Miskimins [a], Joseph D. Dubose [e], Michael W. Cripps [f], Steven G. Schauer [c,g,h,i]

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REBOA Utilization

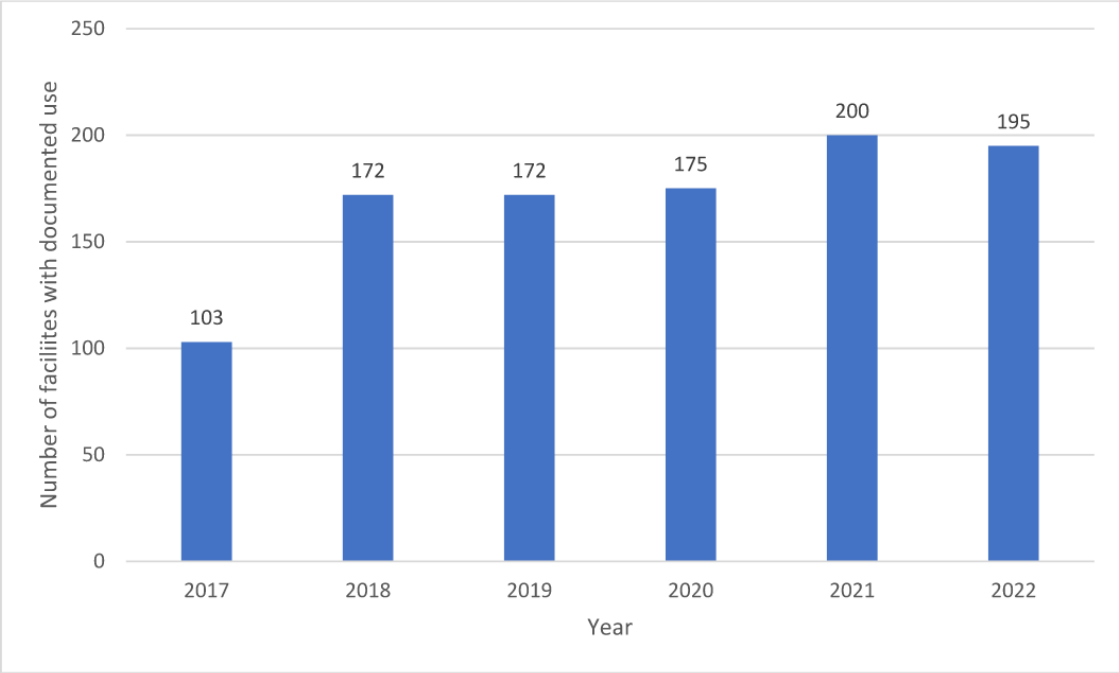

Fig. 1. Number of facilities with reported ED REBOA use.

Hanif et al. *Am J Surg* 2024;238:115898.

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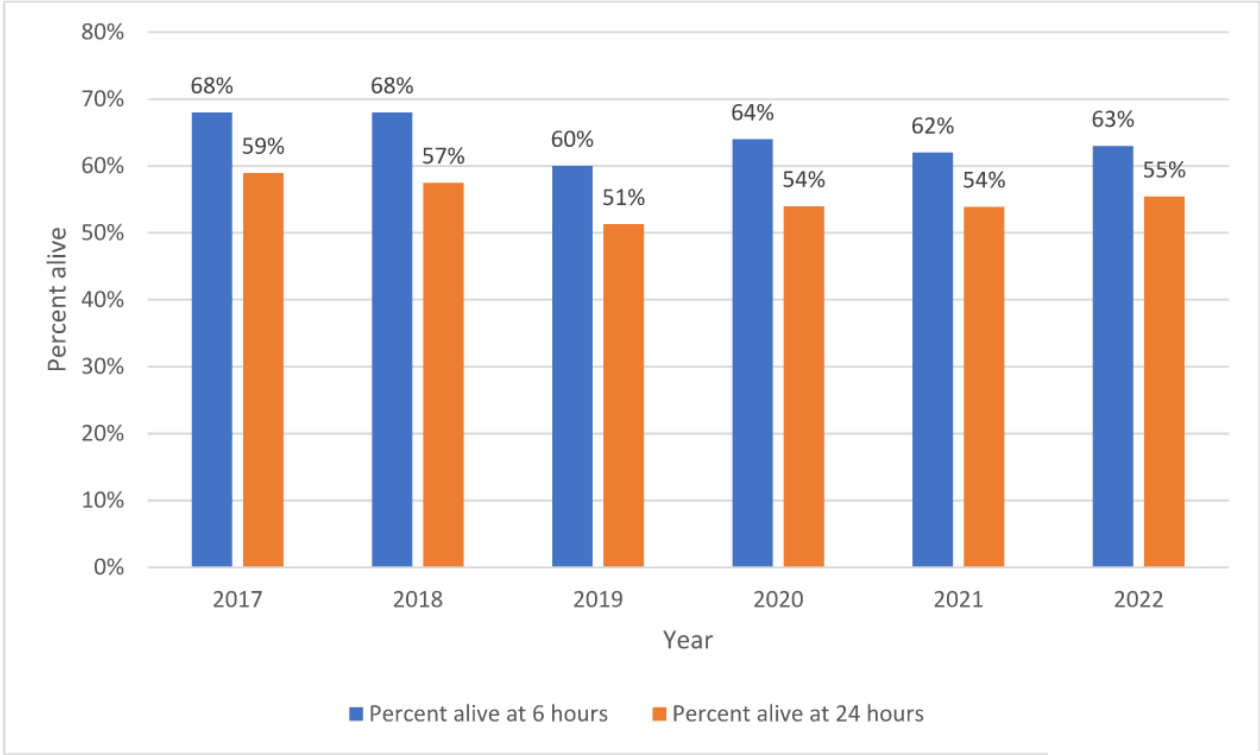
REBOA Outcome



Hanif et al. *Am J Surg* 2024;238:115898.

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Health Technology Assessment

Volume 28 • Issue 54 • September 2024

ISSN 2046-4924

The UK resuscitative endovascular balloon occlusion of the aorta in trauma patients with life-threatening torso haemorrhage: the (UK-REBOA) multicentre RCT

Jan O Jansen, Jemma Hudson, Charlotte Kennedy, Claire Cochran, Graeme MacLennan,

Methods

- Pragmatic, randomized
- Exsanguinating torso trauma
- Standard of care vs SC + REBOA
- Multicenter
- Primary outcome 90 - day mortality
- Bayesian statistics

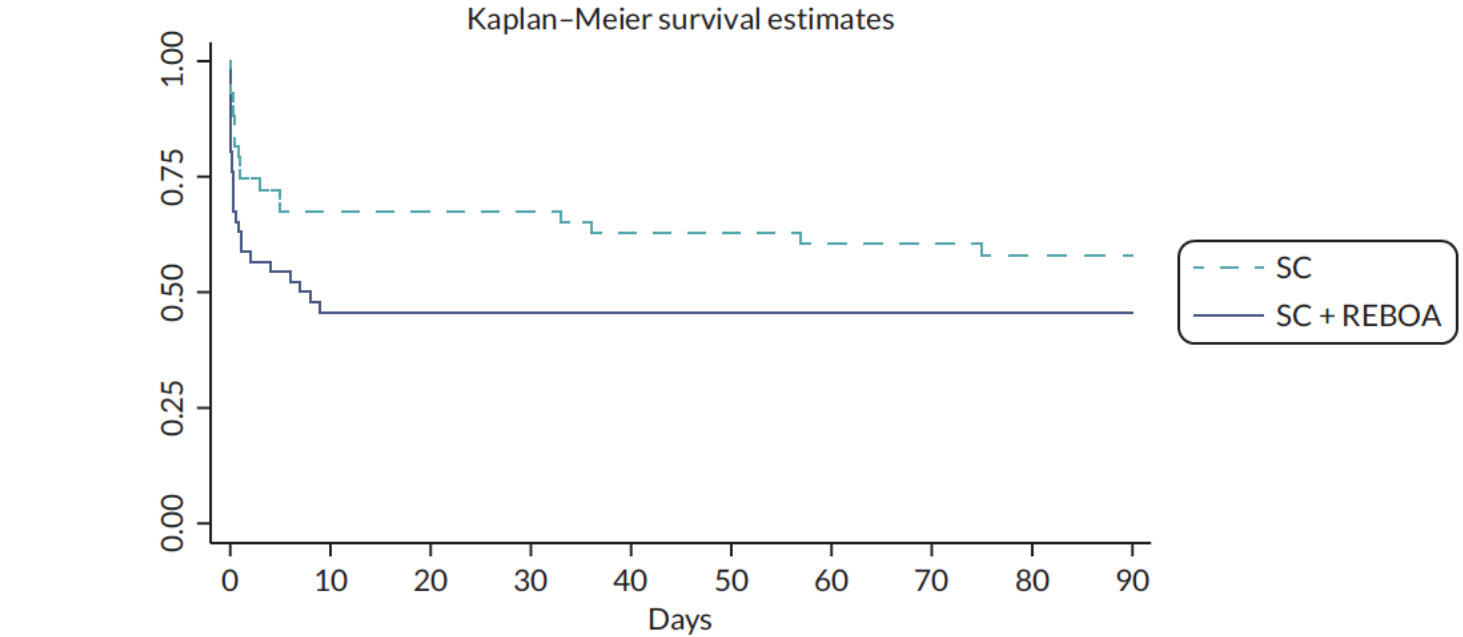
Jansen et al. *Health Technology Assessment* 2024;28:ISSN2024 – 4924.

Patients

	SC + REBOA *N* = 46	SC *N* = 44
Demographics		
Median age (Q1–Q3), years	46 (33–62)	39 (30–56)
Male sex, *n* (%)	28 (61)	34 (77)
Comorbidity		
Median Charlson Comorbidity Index (Q1–Q3); *n*	0 (0–1); 33	0 (0–1); 40
Mechanism of injury		
Blunt, *n* (%)	44 (96)	43 (98)
Penetrating, *n* (%)	2 (4)	1 (2)
Injury severity		
Median ISS (Q1–Q3)	41 (29–50)	41 (29–50)

Jansen et al. *Health Technology Assessment* 2024;28:ISSN2024 – 4924.

Survival



Number at risk										
SC	43	29	29	29	27	27	26	26	25	25
SC + REBOA	46	21	21	21	21	21	21	21	21	21

Jansen et al. *Health Technology Assessment* 2024;28:ISSN2024 – 4924.

MILITARY MEDICINE, 189, S3:284, 2024

A PROMPT Update on Partial REBOA: Initial Clinical Data and Overview of the DoD-Funded Partial REBOA Outcomes Multicenter ProspecTive (PROMPT) Study

Stephen Gondek, MD, MPH; Susan Hamblin, PharmD*; Jessica Raley, PhD†; Jonathan Nguyen, DO, FACS, FACOS‡; Urmil Pandya, MD, FACS§; Juan Duchesne, MD‖; Alison Smith, MD, PhD¶; Ernest Moore, MD**; Lee Anne Ammons, BS**; Andrew Beckett, CD, MD, MSc, FRCSC, FACS††; Matthew Vassy, MD‡‡; Patricia Carlisle, PhD†; Brad Dennis, MD**

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Conclusions - REBOA

- High complication rates
- High morbidity
- Other options - better outcomes
- Clearly not ready for prime time
- Future unclear

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