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Rethinking REBOA: A Meta-Analysis Comparing Partial and Complete Occlusion Strategies

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ADMINISTRATIVE INFORMATION

Support - No.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - The authors declare no conflicts of interest related to this study. This meta-analysis was conducted independently, without external funding or support from any commercial entity. None of the authors have financial relationships, advisory roles, or intellectual property interests associated with REBOA devices or technologies. All data were derived from published literature and analyzed objectively. This disclosure complies with institutional and international guidelines to ensure transparency and integrity in research.

INPLASY registration number: INPLASY202550073

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 23 May 2025 and was last updated on 23 May 2025.

INTRODUCTION

Review question / Objective P – Population Patients with hemorrhagic shock or massive hemorrhage, both traumatic and non-traumatic, who received REBOA as part of their resuscitative management.
I – Intervention Partial REBOA (pREBOA) – a technique allowing controlled distal aortic perfusion while maintaining proximal occlusion for hemorrhage control.
C – Comparison Complete REBOA (cREBOA) – total occlusion of the aorta using balloon catheter, traditional method for hemorrhage control.
O – Outcomes
Primary outcomes:
– 24-hour mortality
– In-hospital mortality

Secondary outcomes:
– Acute Kidney Injury (AKI)
– Multiple Organ Dysfunction Syndrome (MODS)
– Distal embolic/ischemic complications
– ICU length of stay

S – Study design
Observational studies (retrospective or prospective cohorts) comparing outcomes between pREBOA and cREBOA. Random-effects meta-analysis applied.

Rationale Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) has become a critical intervention in the management of patients with non-compressible torso hemorrhage, particularly in trauma settings. While complete REBOA (cREBOA) effectively controls hemorrhage by fully occluding the aorta, it is associated with serious complications such as distal ischemia,

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reperfusion injury, and subsequent organ dysfunction. To mitigate these risks, partial REBOA (pREBOA) was introduced, allowing limited distal perfusion while maintaining proximal pressure. Although pREBOA is theoretically advantageous, evidence regarding its safety and efficacy remains limited and inconsistent, with most studies relying on small, observational datasets. Moreover, clinical adoption varies widely due to the lack of robust comparative data. Therefore, a comprehensive synthesis of current evidence is needed to clarify whether partial occlusion offers clinically meaningful benefits over complete occlusion. This study aims to address this knowledge gap by systematically comparing the outcomes of pREBOA and cREBOA, focusing on mortality, organ dysfunction, ischemic complications, and resource utilization, to inform best practices in trauma care and guide future prospective research.

Condition being studied Non-compressible torso hemorrhage (NCTH) is a life-threatening condition commonly encountered in trauma patients, characterized by bleeding within the thoracic, abdominal, or pelvic cavities that cannot be controlled through external compression. This form of hemorrhage is a leading cause of preventable death in both civilian and military trauma settings. Rapid blood loss from NCTH can result in hemorrhagic shock, organ failure, and death if not promptly managed. Traditional resuscitative methods, including fluid administration and surgical intervention, may not be sufficient or timely. As such, Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) has emerged as an important temporizing measure, providing proximal control of hemorrhage and maintaining perfusion to vital organs during the critical period before definitive hemostasis.

METHODS

Search strategy A comprehensive literature search was conducted using the following electronic databases:
Embase
Scopus
Ovid

Medical Subject Headings (MeSH) and free-text terms were used in various combinations, including:
“REBOA” OR “resuscitative endovascular balloon occlusion of the aorta”
“partial REBOA” OR “pREBOA”
“complete REBOA” OR “cREBOA”.

Participant or population Articipants included are adult trauma patients experiencing severe hemorrhage or hemorrhagic shock requiring Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA). All included patients must have undergone either complete REBOA (cREBOA), involving total aortic occlusion, or partial REBOA (pREBOA), involving partial occlusion allowing limited distal perfusion. The review includes participants irrespective of injury mechanism, gender, or geographic location. Studies involving pediatric populations, animal studies, or non-traumatic indications are excluded.

Intervention Patients receiving partial REBOA (pREBOA).

Comparator Patients receiving complete REBOA (cREBOA).

Study designs to be included Comparative observational studies, including:Retrospective cohort studies, Prospective cohort studies, Registry-based analyses These designs must directly compare outcomes between patients receiving partial REBOA (pREBOA) and those receiving complete REBOA (cREBOA) in the setting of traumatic hemorrhagic shock.

Eligibility criteria Inclusion Criteria
– Population: Adult trauma patients (≥16 years) receiving REBOA.
– Intervention: Partial REBOA (pREBOA).
– Comparison: Complete REBOA (cREBOA).
– Outcomes: At least one of the following:
In-hospital mortality
24-hour mortality
Acute kidney injury (AKI)
Multiple organ dysfunction syndrome (MODS)
Distal emboli or limb ischemia
ICU length of stay (ICU LOS)
– Study Design: Comparative observational studies (retrospective/prospective cohorts, registry studies).
– Language: Published in English.

Exclusion Criteria
– Case reports or small case series
– Studies without a comparison between pREBOA and cREBOA.
– non-REBOA interventions.
– Pediatric studies
– Animal, cadaveric, or simulation studies.
– Conference abstracts without sufficient data.

Information sources Electronic Databases
– A systematic search will be conducted using the following databases:

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Ovid
Embase
Scopus.

Manual Reference Searching

Main outcome(s)
24-hour mortality
In-hospital mortality.

Additional outcome(s)
Acute kidney injury (AKI)
Multiple organ dysfunction syndrome (MODS)
Distal emboli or limb ischemia
ICU length of stay (ICU LOS).

Quality assessment / Risk of bias analysis To evaluate whether the included observational studies were designed and conducted in a way that provides trustworthy, unbiased results. We plan to use the Newcastle–Ottawa Scale (NOS) — a validated tool designed specifically for non-randomized studies.

Strategy of data synthesis For dichotomous outcomes (e.g., in-hospital mortality, 24-hour mortality, AKI, MODS, distal emboli/limb ischemia), the odds ratio (OR) and corresponding 95% confidence intervals (CIs) will be calculated.
For continuous outcomes (e.g., ICU length of stay), mean differences (MD) or standardized mean differences (SMD) with 95% CIs will be used.

Subgroup analysis If data permit, subgroup analyses will be conducted based on: REBOA zone (e.g., zone 1 vs. zone 3)
Mechanism of injury (blunt vs. penetrating)
Study design (prospective vs. retrospective).

Sensitivity analysis If data permit, subgroup analyses will be conducted based on: REBOA zone (e.g., zone 1 vs. zone 3)
Mechanism of injury (blunt vs. penetrating)
Study design (prospective vs. retrospective).

Country(ies) involved This systematic review and meta-analysis is being conducted in Thailand.

Keywords REBOA, Partial REBOA, Complete REBOA, Resuscitative Endovascular Balloon Occlusion of the Aorta.

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