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Management of non-compressible torso hemorrhage of the abdomen in civilian and military austere/remote environments: protocol for a scoping review

Donald Adams ,[1] Paige L McDonald,[2] Elaine Sullo,[3] Alexander B Merkle,[4] Timothy Nunez,[5] Babak Sarani ,[6] Stacy A Shackelford,[7] Mark W Bowyer,[8] Philip van der Wees[9]

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For numbered affiliations see end of article.

Correspondence to
Dr Donald Adams; Dadams89@GWU.edu

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SUMMARY

The management of non-compressible torso hemorrhage in military austere/remote environments is a leading cause of potentially preventable death in the prehospital/battlefield environment that has not shown a decrease in mortality in 26 years. Numerous conceptual innovations to manage non-compressible torso hemorrhage have been developed without proven effectiveness in this setting. This scoping review aims to assess the current literature to define non-compressible torso hemorrhage in civilian and military austere/remote environments, assess current innovations and the effectiveness of these innovations, assess the current knowledge gaps and potential future innovations in the management of non-compressible torso hemorrhage in civilian and military austere/remote environments, and assess the translational health science perspective of the current literature and its potential effect on public health.

The Joanna Briggs Institute for evidence synthesis will guide this scoping review to completion. A nine-step development process, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist, will be used to enhance the methodological and reporting quality of this scoping review. The Participant, Concept, Context framework will broaden this scoping review's reach in developing a comprehensive search strategy. Thirty years will be explored to assess all relevant literature to ensure a thorough search. Two researchers will explore all the discovered literature and develop consensus on the selected literature included in this scoping review. The article will undergo review and data extraction for data analysis. The knowledge to action framework will guide the knowledge synthesis and creation of this scoping review. A narrative synthesis will systematically review and synthesize the collected literature to produce and explain a broad conclusion of the selected literature. Lastly, a consultation exercise in the form of qualitative interviews will be conducted to assess the thematic analysis results and validate the result of this scoping review. This scoping review will require Institutional Review Board approval for the expert consultation in the form of qualitative interviews. Consultants' identifying information will remain confidential. The collected and analyzed data from this scoping review will identify gaps in the literature to create an evidence-informed protocol for the management of non-compressible torso hemorrhage of the abdomen in civilian and military austere/remote environments. The results of this scoping review will be distributed in peer-reviewed journals and educational, medical presentations. Scoping Review Protocol, Level IV.

INTRODUCTION

The challenge of management of non-compressible torso hemorrhage (NCTH) in civilian and military austere/remote environments has gone unanswered during the past 26 years.[1–3] The inability to control bleeding from a severed femoral vein/artery in Mogadishu, Somalia in 1993[4] was one of many events that ignited the discussion regarding the management of NCTH in the austere and remote environment.[5–7] NCTH is a leading cause of potentially preventable death in the prehospital/battlefield environment.[2 8 9] NCTH of the abdomen is defined as hemorrhage that cannot be immediately controlled by direct pressure of an artery or vein that has been disrupted.[7]

Management of NCTH has undergone multiple evaluations, and three interventions have been developed to manage this issue externally and internally. The current adjuncts to facilitate control of hemorrhage in the abdomen in an austere/remote environment include the abdominal aortic junctional tourniquet (AAJT), the ResQFoam, and resuscitative endovascular balloon occlusion of the aorta (REBOA).[2] The purpose of these devices is to potentially control hemorrhage as rapidly as possible to prevent exsanguination. Two of these interventions, the AAJT and the ResQFoam, have shown great promise in efficacy trials,[2 10–12] yet these interventions' effectiveness is still in question. The REBOA catheter has shown efficacy and effectiveness in the management of NCTH.[13–15] Unfortunately, all these interventions have a limited period of utility, making them potentially ineffective in austere/remote environments where definitive surgical care is greater than 30 min to 60 min from the point of injury.

The present scoping review aims to assess the current literature to define NCTH in civilian and military austere/remote environments. This scoping review looks to assess what other innovations are available and the effectiveness of these innovations in managing NCTH of the abdomen in civilian and military austere/remote environments. This scoping review will also address the existing knowledge gaps and potential future innovations in managing

NCTH of the abdomen in civilian and military austere/remote environments. Lastly, this scoping review will assess the translational health science perspective of the current literature and assess its potential effect on public health. Translational health science is a multidisciplinary non-linear spectrum of science that incorporates basic research to public health.[16 17] This scoping review will address what some have historically called the translational chasm #3, often noted as implementing and adopting new knowledge[18] only.

Research questions

- What is the effectiveness of current innovations for managing non-compressible hemorrhage in the abdomen in civilian and military austere/remote environments?
- What are the existing knowledge gaps in the literature regarding management of NCTH of the abdomen in civilian and military austere/remote environments?
- What are potential future innovations that may improve management of non-compressible hemorrhage of the abdomen in civilian and military austere/remote environments?
- Why is non-compressible hemorrhage of the abdomen in civilian and military austere/remote environments a translational health science problem?

METHODOLOGY

A scoping review will be used to assess the status of the current literature regarding the concept of the management of NCTH in civilian and military austere/remote environments. Synthesis of the data will be performed to assess the rigor of the selected literature to inform the development of an evidence-based protocol for truncal hemorrhage control and to inform future research needs in this study area.

Protocol

The current scoping review will follow the scoping review protocol format in the Peters *et al*[19] Joanna Briggs Institute (JBI) for evidence synthesis. Additionally, to improve the methodological and reporting quality, this scoping review will include the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews checklist.[20] This protocol will follow the nine-step development process using subtitles, Title, Development of Title and Research Questions, Introduction, Inclusion Criteria, Search Strategy, Source of Evidence Selection, Data, Extractions, Analysis of the Evidence, and Presentation of results.

A preliminary search for scoping reviews and systematic reviews to identify current knowledge for managing NCTH was conducted on December 20, 2020. A review was conducted in PubMed, Scopus, Cochrane Library, JBI Evidence Synthesis, and Grey Literature, such as Google Scholar (2010–December 2020). The results of the preliminary search produced five articles: two scoping reviews[21 22] and three systematic reviews.[13 23 24] Bekdache *et al*[25] and Roberts *et al*[26] in previous scoping reviews assessed the literature to evaluate the indications, population, and complexities when using the REBOA catheter in American College of Surgeons-approved level 1 trauma centers.[25 26] However, the indications for damage control surgery in civilian and military austere/remote environments are different from those explored in these previous reviews. It is therefore important to inform stakeholders of austere/remote operational planning of the existing gaps in data regarding managing NCTH of the abdomen to provide appropriate hemorrhage control in civilian and military austere/remote environments.

Inclusion criteria

This scoping review will use the Participant, Concept, Context (PCC) framework to broaden its scope as recommended by the JBI manual for evidence synthesis.[19] Using the PCC framework will ensure less restrictive inclusion criteria[19] in comparison with using a more precise and restrictive framework such as the Population, Intervention, Comparator, and Outcome framework.[27 28] Specifying the PCC framework will assist in developing a thorough search strategy.

The PCC framework helps identify the main concepts from our aims. The population will identify the specific circumstances or groups within the research question's context for inclusion in the search strategy. Population for this scoping review will include human participants only, ages 18 years of age and older, and male or female with NCTH in civilian and military austere/remote environments. Defining the population for this scoping review will allow the search criteria to be specific and only focus on the population selected.

Concept is a rather abstract term used to guide the literature search's latitude and complexity.[19] The concept of this research study will focus on the management of NCTH of the abdomen. The concept will explore the current intervention, trends, and mortality in managing NCTH. Additionally, this study will explore the different disciplines that will potentially need to collaborate on this concept.

Context is defined as the external factors that will influence the concept and the study population.[19] The context for this scoping review will focus on a specific setting, that is, civilian and military austere/remote environments. Civilian and military austere/remote environments are low-resource settings that are not consistent with the prehospital and or hospital framework associated with healthcare in major cities within the USA or similar countries with equivalent care levels.[29] The context of austere/remote environment in this scoping review will be applied to managing NCTH of the abdomen.

Type of evidence sources

All available study designs will be reviewed for inclusion in this scoping review. Only English-language journals will be included. All literature from established peer-reviewed journals will be reviewed for inclusion in this scoping review. During the initial review, any article or publication not containing the concept of NCTH of the abdomen in civilian and military austere/remote environments will be excluded. Cadaveric studies and animal studies will be excluded from this scoping review.

Search strategy

This scoping review will use a health science research librarian from George Washington University to assist in performing a systematic search of the literature (see search string in online supplemental appendix 1). The systematic search strategy will be used to search selected databases via the Himmelfarb Health Sciences Library. Grey literature will also be reviewed. A search of all relevant databases will be conducted to identify literature that discusses NCTH in civilian and military austere/remote environments. The databases will be searched within 30 years to date to account for the time of one of the significant incidents[4] that brought about discussion of the management of NCTH in civilian and military austere/remote

environments. The time frame will be from December 1990 through December 2020, and only English-language literature will be included.

The search will be conducted using PubMed, Scopus, and Cochrane Central Register of Controlled Trials. Additional literature will be sought from citations in the selected literature and experts in the field of trauma surgery.

Additionally, articles and literature will be sought referencing previous and current trauma surgery conferences from January 2010 to December 2020. Specifically, referencing organizations such as the American Association for the Surgery of Trauma (AAST), Eastern Association for the Surgery of Trauma (EAST), Society of Critical Care Medicine, and the Western Trauma Associations for titles and abstracts referencing NCTH.

To ensure completeness of the literature search, a review of gray literature will be sought from internet queries such as Google Scholar and Science.gov. Other websites of interest are the AAST, American College of Surgeons, American Trauma Society, EAST, National Trauma Research Institute, The Society for Critical Care Medicine, the International Association of Trauma and Surgical Intensive Care, and European Society of Trauma and Emergency Surgery.

Selection of sources of evidence

Two reviewers (DA and ABM) will independently screen all initial articles' titles and abstracts for suitability for inclusion in this scoping review. Ideally, both reviewers will use EndNote[30] to manage and collect literature for the scoping review. The initial selections will be reviewed for duplication, and all duplicates will be excluded. The remaining articles will be subject to full-text review and excluded if the concept of NCTH of the abdomen in civilian and military austere/remote environments is not embodied. Two reviewers will independently review the full-text articles for inclusion in this scoping review. While reviewing the full-text articles, if additional articles are identified relevant to the scoping review, they will be extracted and reviewed for inclusion. During the review process, if there are disputes between the reviewers, a third reviewer (PvdW) will review the article for inclusion or exclusion. This process will be presented using the PRISMA diagram.[31] All articles selected after the final review will be assessed for methodological quality.[32 33]

Data charting process

One reviewer (DA) will review and extract data from the selected articles for this scoping review and will organize the extracted data on a prearranged Excel spreadsheet[34] (see online supplemental appendix 2). The data extracted will align with the research questions for this scoping review. The extracted data will undergo pilot testing as discussed by Peters *et al*,[19] assessing relevant data from 10 selected articles by an independent verifier. Pilot testing will continue iteratively until the data collected are consistent among the reviewers and an independent verifier.[35]

The following data will be extracted to analyze the literature: (1) the authors; (2) the year of publication; (3) the time span of the research; (4) the country of origin; (5) the aim of the research; (6) the specific population by age and sex; (7) civilian versus military setting; (8) sample size; (9) the type of study/methodology conducted; (10) main outcomes; (11) how the study outcomes answer the scoping review questions; (12) context of civilian and military austere/remote environments; (13) management of NCTH; (14) healthcare disciplines involved.[36]

Analysis of the data

The knowledge to action framework will guide this scoping review's knowledge creation.[37] The knowledge to action framework is an iterative framework that allows this scoping review to serve as a mechanism to synthesize the existing knowledge and to identify knowledge gaps. The framework will also guide the review of articles for data extraction related to contextualizing that knowledge to overcome barriers and facilitators to the use of existing knowledge and to the generation of future knowledge to address specific knowledge gaps.

The collected literature will undergo a narrative synthesis. A narrative synthesis is the first step in systematically reviewing and analyzing the collected literature from the selected articles.[38] The sum of the narrative summary will produce a comprehensive conclusion of the selected literature's collected findings.[19] More specifically, this scoping review will use a modified approach to summarizing and developing a conclusion based on the strengths of textual narrative synthesis and thematic narrative synthesis.

Textual narrative synthesis has been used to evaluate both quantitative and qualitative data. A textual narrative synthesis will illustrate the categorization of different study characteristics, context, quality, and conclusions. Synthesizing the selected literature using textual narrative synthesis will enable the reviewers of this scoping review to identify the gaps in the literature by displaying where data were non-existent and assessing the quality of the evidence in variable categories.[36 39]

Thematic narrative synthesis is used for synthesizing the results of qualitative literature for systematic reviews. Thematic narratives evaluate the selected literature by assessing codes in a line-by-line analysis of the literature, using the identified codes to develop descriptive themes, and finally developing an analytical theme.[40 41] Combining the strengths of both types of narrative summaries will increase this scoping review conclusion's trustworthiness[40] by providing a detailed description of the literature accepted for this scoping review.[39]

The collected literature will be separated based on the specific methodology (quantitative, qualitative, and mixed methods) used in the study. The studies will be explored for heterogeneity of their results, comparing the results, and highlighting any similarities, differences, and patterns in the collected findings.[38]

All the collected data will be placed categorically in an Excel spreadsheet[34] (see online supplemental appendix 2) and will undergo data analysis. This scoping review will analyze the separate data categories as listed above under Data Charting Process. Once categorized, each column will undergo analysis to assess the quantitative frequency counts. The quantitative frequency counts will assess the frequency in the current literature of those items that align with the aims' research questions.

Consultation of the data

The data collected and analyzed for this scoping review will undergo consultation[42 43] in the form of qualitative interviews. The qualitative interviews will be done by three senior trauma surgeons and three senior general surgery physician assistants who can provide perspectives and validation on the results of this scoping review. The author (DA) of the scoping review will provide the consultants with the preliminary findings from the qualitative thematic analysis of the scoping review to query their perspectives about the qualitative analysis. Additionally, the consultants will be queried about the results of the qualitative thematic analysis to validate the findings.

The qualitative data will be collected after written consent has been obtained. The interviews will be conducted via Zoom[44]

voice recordings only and transcribed via the REV.com[45] transcription service. The data will then be uploaded into NVivo,[46] a qualitative data analysis system for coding and developing themes. The consultant data will be reported in the scoping review under the title 'Consultation'. Additionally, the data collected from the consultants will be integrated into the final discussion of the scoping review. Including expert consultation in this scoping review will enhance the results, making the results more applicable to stakeholders interested in this research discussion.

DISCUSSION

This scoping review protocol will be the first to develop a path forward to assess the literature of the past 30 years discussing the management of NCTH of the abdomen in civilian and military austere/remote environments. The knowledge to action framework will guide knowledge creation to synthesize the current evidence from multiple sources and identify gaps in the literature, and will direct the analysis of articles for data extraction and contextualizing the data to overcome barriers and facilitators for current and future knowledge to address specific knowledge gaps.[37] The assessment of the current literature and identification of gaps in current knowledge in this scoping review will provide the basis for next steps in using the knowledge to action framework: develop new knowledge from knowledge creation, adapt knowledge to the current subject of discussion, assess the barriers and facilitators of the knowledge, implement the new knowledge, monitor the new knowledge after implementation, evaluate the outcomes of the knowledge and sustain the knowledge. The use of the knowledge to action framework will potentially assist in the discovery of new knowledge that will ultimately lead to innovations including the development of an evidence-informed protocol toward the management of NCTH to eliminate these potentially preventable causes of death due to injury.[47]

Author affiliations
[1]Translational Health Science, George Washington University School of Medicine and Health Sciences, Washington, District of Columbia, USA
[2]Clinical Research and Leadership Department, George Washington University School of Medicine and Health Sciences, Washington, District of Columbia, USA
[3]Department of Surgery, George Washington University School of Medicine and Health Sciences, Washington, District of Columbia, USA
[4]Department of Surgery, Sutter Capital Pavilion, Sutter Health, Sacramento, California, USA
[5]Trauma and Acute Care Surgery, San Antonio Military Medical Center, San Antonio, Texas, USA
[6]Trauma and Acute Care Surgery, George Washington University School of Medicine and Health Sciences, Washington, District of Columbia, USA
[7]Joint Trauma System, Defense Center of Excellence for Trauma, San Antonio, Texas, USA
[8]The Norman M Rich Department of Surgery, Uniformed Services University of the Health Sciences and Walter Reed National Military Medical Center, Bethesda, Maryland, USA
[9]Department of Clinical Research and Leadership, PhD program in Translational Health Sciences, George Washington University School of Medicine and Health Sciences, Washington, District of Columbia, USA

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Patient consent for publication Not required.

Ethics approval This scoping review will require Institutional Review Board approval for the expert consultation in the form of qualitative interviews. The Institutional Review Board approval will be obtained from the George Washington University Office of Human Research. Consultants' identifying information will remain confidential. All excerpts taken from the consultants will be credited as from the consented consultant and referred to as 'Participant number (#)'. The privacy and confidentiality of the consulting participants of this scoping review will be maintained to ensure good research practices.

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ORCID iDs
Donald Adams http://orcid.org/0000-0001-5394-1734
Babak Sarani http://orcid.org/0000-0001-6247-3004

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