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# Preoperative hyperbaric oxygen therapy for abdominal and gastrointestinal surgeries: a systematic review protocol

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**Systematic Review**

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# Abstract

**Background**: Major abdominal and gastrointestinal surgeries are frequently associated with significant postoperative complications, notably anastomotic leakage and mortality. Preoperative hyperbaric oxygen therapy (HBOT) has been proposed as an adjunctive intervention to optimize tissue oxygenation and improve surgical outcomes.

**Objective**: To evaluate the clinical effects of preoperative HBOT on postoperative outcomes in adult patients undergoing abdominal or gastrointestinal surgery.

**Methods**: This systematic review will include randomized controlled trials (RCTs) and observational studies (such as cohort and case-control studies). We will search MEDLINE (via PubMed), Embase, and LILACS for studies comparing preoperative HBOT to standard surgical care without HBOT. The primary outcomes will be postoperative mortality and the incidence of anastomotic leakage. Secondary outcomes include postoperative pain and length of hospital stay. Two independent reviewers will screen studies, extract data, and assess the risk of bias. If applicable, a meta-analysis will be performed.

**PROSPERO Registration:** CRD420261339389


# 1. Introduction

# 1.1 Rationale

Major abdominal and gastrointestinal surgeries are frequently associated with significant postoperative complications, notably anastomotic leakage and mortality [1, 2].

Despite advancements in surgical techniques and standard perioperative care, inadequate tissue oxygenation and local ischemia at the surgical site remain critical factors that impair wound healing and increase morbidity. These complications not only prolong the length of hospital stays and inflate healthcare costs but also severely impact patient recovery and overall survival.

Preoperative hyperbaric oxygen therapy (HBOT) has emerged as a promising adjunctive intervention to optimize patients prior to surgery. By delivering 100% oxygen under increased atmospheric pressure, HBOT significantly enhances systemic and local tissue oxygen tension, promotes angiogenesis, reduces edema, and exhibits antimicrobial properties. Consequently, administering HBOT in the preoperative period may precondition vulnerable tissues, mitigate the risk of ischemic complications such as anastomotic leaks, and ultimately improve postoperative outcomes, including reduced pain, shorter hospitalizations, and lower mortality rates.

# 1.2 Objectives

The primary objective of this systematic review is to evaluate the clinical impact of preoperative hyperbaric oxygen therapy (HBOT) on patients undergoing abdominal or gastrointestinal surgeries.

Specifically, this study aims to assess the correlation between preoperative HBOT and postoperative mortality rates, determine its efficacy in reducing the incidence of anastomotic leakage. Secondary outcomes include postoperative pain (assessed by validated scales), postoperative nausea and vomiting (PONV), incidence of postoperative ileus (POI), and length of hospital stay.

# 2. Methods

This protocol is reported in accordance with the Preferred Reporting Items for Systematic review and Meta-Analysis Protocols (PRISMA-P) guidelines [3].

2.1 Eligibility Criteria

- Population: Adult patients (aged 18 years or older) scheduled for abdominal or gastrointestinal surgeries.
- Intervention: Administration of Hyperbaric Oxygen Therapy (HBOT) in the preoperative period.
- Comparator: Adult patients undergoing abdominal or gastrointestinal surgery who did not receive preoperative HBOT, receiving standard perioperative care only (or sham HBOT).
- Outcomes: Primary outcomes include postoperative mortality and anastomotic leakage. Secondary outcomes include postoperative pain (assessed by validated scales) and length of hospital stay.
- Study Design: Randomized controlled trials (RCTs) and observational studies (including cohort and case-control studies).
- Exclusion Criteria: Pediatric population (children and adolescents < 18 years of age); studies focusing exclusively on postoperative HBOT administration; surgical procedures involving areas other than the gastrointestinal tract or the abdominal wall; case reports, editorials, and animal studies.

# 2.2 Information Sources and Search Strategy

A comprehensive literature search will be conducted in the following electronic databases: MEDLINE (via PubMed), Embase, and LILACS. The search will be performed without restrictions regarding publication date or language.

The search strategy was developed using a combination of controlled vocabulary (e.g., Medical Subject Headings - MeSH, and Emtree) and free-text words related to hyperbaric oxygenation and gastrointestinal/abdominal surgeries. The base search strategy optimized for MEDLINE (via PubMed) is as follows:

("Hyperbaric Oxygenation"[Mesh] OR "Hyperbaric Oxygen Therapy" OR "HBOT" OR "Hyperbaric Oxygen") AND ("Digestive System Surgical Procedures"[Mesh] OR "Bariatric Surgery"[Mesh] OR "Anastomosis, Surgical"[Mesh] OR "Gastrointestinal Surgery" OR "Abdominal Surgery")

This strategy will be adapted to meet the specific syntax requirements of the other electronic databases. For Embase, equivalent Emtree terms will be utilized, and for LILACS, the equivalent Health Sciences Descriptors (DeCS) will be applied. In addition to the database searches, the reference lists of all included studies and relevant review articles will be manually screened to identify any additional eligible studies.

## 2.3 Study Selection and Data Extraction

Retrieved records will be exported to a reference manager, and duplicates will be removed. Two independent reviewers will screen titles and abstracts. Full-text articles of potentially relevant studies will be assessed for eligibility. Any disagreements will be resolved through discussion or consultation with a third reviewer. Data extraction will be performed using a standardized form, capturing study characteristics, patient demographics, intervention details, and outcome data.

## 2.4 Risk of Bias Assessment

The methodological quality and risk of bias of the included studies will be assessed independently by two reviewers. For randomized controlled trials, the Cochrane Risk of Bias 2 (RoB 2) tool will be used [4]. For observational studies, the Risk Of Bias In Non-randomized Studies - of Exposure (ROBINS-E) tool will be applied [5].

## 2.5 Data Synthesis

If sufficient homogenous data are available, a quantitative synthesis (meta-analysis) will be conducted using appropriate statistical software (e.g., Review Manager or R). Treatment effects will be expressed as Risk Ratios (RR) or Odds Ratios (OR) for dichotomous data, and Mean Differences (MD) for continuous data, with 95% Confidence Intervals (CI). Heterogeneity will be assessed using the I2 statistic. If a meta-analysis is not feasible due to clinical or methodological heterogeneity, a narrative synthesis of the findings will be provided in accordance with the Synthesis Without Meta-analysis (SWiM) reporting guideline [6]. Finally, the overall certainty of the evidence will be assessed using the GRADE approach [7].

# 3. Discussion

This systematic review will comprehensively synthesize the available evidence regarding the efficacy and safety of preoperative hyperbaric oxygen therapy (HBOT) in abdominal and gastrointestinal surgeries. By strictly adhering to the PRISMA guidelines, this study aims to provide robust data that could potentially influence future perioperative care protocols, minimizing the risk of severe complications such as anastomotic leakage, postoperative ileus, and mortality. A potential limitation of this planned review is the anticipated clinical and methodological heterogeneity among the included studies, particularly concerning variations in surgical techniques and specific HBOT regimens (e.g., pressure levels and number of sessions). Nevertheless, mapping the current state of the evidence and identifying these gaps will be crucial for guiding future high-quality randomized controlled trials in this field.

# Declarations

Ethics approval and consent to participate

Not applicable. This study is a systematic review protocol, which involves the synthesis of data from previously published literature. It does not involve human participants, data, or tissue; therefore, ethical approval and consent to participate are not required.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable. This is a systematic review protocol, and no primary data have been collected or analyzed yet. Data sharing is not applicable to this article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

LR and RCAJ conceptualized the study, formulated the research question, and designed the protocol. LR and RCAJ developed the literature search strategy, defined the eligibility criteria, and drafted the initial manuscript. All the authors critically reviewed the methodology, refined the risk of bias assessment strategy, and provided significant intellectual input. All authors actively participated in reviewing and editing the manuscript. All authors read and approved the final manuscript.

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## Supplementary Files

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