



# Reducing Surgical Blood Loss and Transfusion Reactions: A Systematic Review of Outcomes of Acute Normovolemic Hemodilution Versus Blood Transfusion

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## Objectives

To examine current evidence and assess the outcomes of acute normovolemic hemodilution versus blood transfusions as it relates to surgical blood loss and transfusion reactions. After reviewing current research, education was provided based on evidence-based practice and a quality improvement project was created using pre and posttests to evaluate learning.

## Introduction

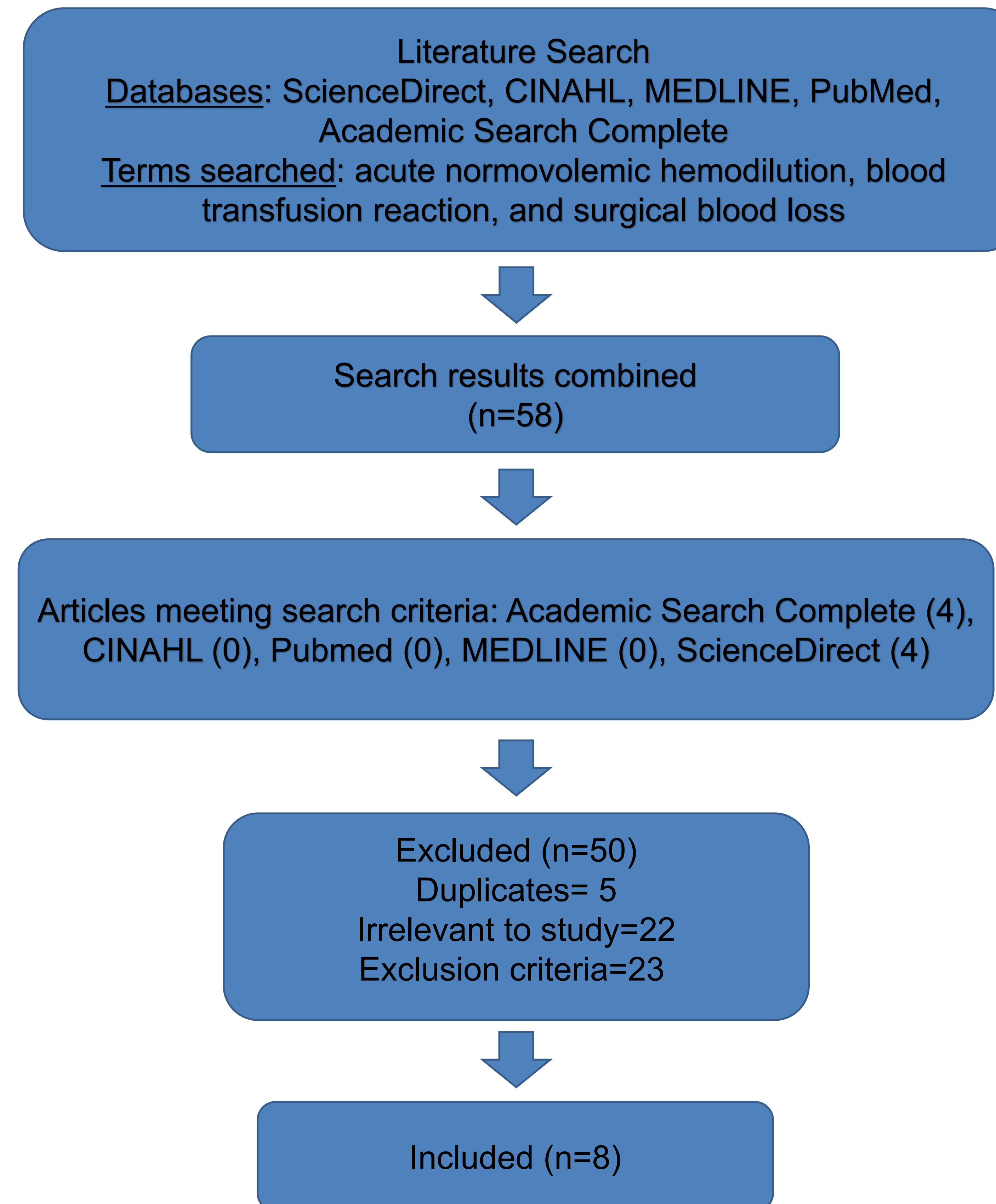
As anesthesia providers, perioperative blood transfusions are a routine treatment in the presence of active bleeding, anemia, and hypovolemia. There is no absolute guideline that exists on when to transfuse a patient, and there is often a discrepancy between clinician to clinician. This leads to the over prescribing of packed red blood cells which leads to a vast array of potential complications. Potential complications of allogenic blood transfusions include possible ABO incompatibility, sepsis, febrile and hemolytic reactions, immunosuppression, cancer cell metastasis, and viral transmission (Shorbagy & Salah, 2016). However, perioperatively, blood transfusions are typically given at the discretion of the anesthetist when the hemoglobin is less than 7 g/dl and the patient is displaying clinical indicators that a blood transfusion is needed (Chekol et al., 2020).

Acute normovolemic hemodilution (ANH), although used sparingly, is a technique that is thought to decrease the likelihood of perioperative blood transfusions. ANH was first developed in the 1970s, and was initially only used in cardiac surgery, however it is now being used in neurologic, orthopedic, and general surgeries (Shander et al., 2020). ANH must be utilized by anesthetists that are familiar with the hemodynamic responses accompanied by the hemodilution of ANH therapy. Especially in cardiac surgery, the use of ANH has proven advantageous in decreasing the transfusion requirements of packed red blood cells (PRBCs) by providing a hemodiluted hemoglobin concentration, thus reducing the amount of RBCs lost throughout a surgical procedure (Shander et al., 2020).

## Study Characteristics

The articles chosen for this review include systematic reviews, meta-analysis', case studies, literature reviews, prospective randomized control studies, and practice guidelines. A large reoccurring theme within these articles expressed the need for further research to be done on ANH to determine if it was efficacious enough to become a standard of practice. Due to the lack of resources that fit the inclusion criteria, this topic is broadly discussed in the review.

## Review of Literature



## Presentation of Findings

(Pre-Test) Exposed	(Pre-Test) Unexposed
18.18%	81.82%

Prior to providing the study population with education regarding ANH, only 18.18% of participants had prior clinical exposure to this practice. The remaining 81.82% of participants had never been exposed to ANH in the clinical setting. Post ANH education, 100% of participants stated an increased understanding of ANH. A statistical analysis was performed using a Chi square method to compare individual responses on the use of ANH in the operating room. Using the p value approach and a hypothesized proportion of 0.5 (50%) of participants having clinical experience using ANH, a p value of 0.007526315 was obtained. **Therefore, the null hypothesis is rejected as the p value is less than  $\alpha$  (0.05).**

## Implementation of Research

A pre-test was administered to a group of senior Student Registered Nurse Anesthetists to establish their baseline knowledge of ANH. After obtaining results from the pre-test assessment, a presentation was given on the overview of ANH. The presentation included the potential risks, benefits, and concerns of the utilization of ANH. Also, during the presentation, ANH was compared to allogenic PRBC administration in terms of advantages, disadvantages, and efficacy. After the presentation concluded, the senior Student Registered Nurse Anesthetists were then instructed to take a post-test to evaluate learning.

## Data Collection Process

Data was acquired from each article by one investigator. The objective stated in the abstract of this systematic review was continually referenced while examining each of the articles. The types of surgeries, blood management techniques, and specific outcomes were compiled to compare and contrast between ANH and allogenic blood transfusions among the articles. Once all of the articles were critiqued, my extracted information was used to address this systemic review's objective of reviewing outcomes of reducing blood loss and blood transfusion reactions between ANH and allogenic blood transfusions.

## Conclusion

The articles meeting the study criteria all provided insight to the effective use of ANH as well as its proof of improved patient outcomes. However, the main consensus drawn from the articles was that more research needs to be done on the true safety and efficacy of the use of ANH. More research is needed in order to make ANH a standard of care, replacing that of allogenic packed red blood cell transfusion. The use of ANH showed clear benefits of reduced surgical blood loss and reduced incidences of allogenic blood transfusions. On the other hand, the use of ANH was specific to a select population meeting criterion such as a goal hemoglobin and hematocrit level, excluding many patients from using this method of perioperative blood salvaging. Also, the use of vasopressor support was much higher in the patients undergoing ANH to provide adequate hemodynamic parameters for surgery. Further studies will have to be conducted in order to determine if the use of ANH is as safe and efficacious as described in the provided articles.

