# Autologous Blood Transfusion: Overview

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## Abstract

Autologous blood transfusion (ABT) has been gradually attracting more attention due to the increasingly prominent problem of blood transfusion safety and blood shortage in recent years. With the rapid development of blood conservation techniques, blood component separation technology, blood transfusion medicine and a constant increase in clinical needs, ABT technology has been expanded and innovated to a large degree.Due to the steadily growing issue of blood transfusion safety and blood scarcity in recent years, autologous blood transfusion (ABT) has been gradually gaining greater attention. ABT technology has greatly extended and innovated as a result of the quick advancement of blood preservation methods, blood component separation technology, blood transfusion medicine, and an ongoing rise in clinical needs. This article reviews and analyses current issues as they relate to the development of preoperative autologous blood donation (PABD), acute normovolemic hemodilution (ANH), intraoperative and postoperative autotransfusion, among other novel technologies and theories. The discussion of challenges and applications also serves as a resource for peers.

**Keywords: Autologous blood transfusion, Preoperative autologous blood donation, Acute normovolemic and Intraoperative and postoperative auto transfusion**

## Introduction

Autologous blood transfusion (ABT) has gained greater attention recently because to the advancement of medical technology and the widening gap between blood supply and demand. Its effectiveness and safety have also gradually drawn notice. Although the safety and preservation of blood have substantially improved due to a shortage, there are still certain hazards associated with blood transfusions. [1] Both positive and negative effects can result from blood transfusions; they can both save lives and result in death. In addition to causing unfavourable reactions that could spread a number of infectious diseases, allogeneic blood transfusions can put a greater financial and emotional strain on patients and their families. ABT can lessen the burden on patients while avoiding the major risks associated with allogeneic blood transfusion, reducing blood shortages, and conserving blood supplies. As a result, ABT has drawn increased attention, is frequently requested in therapeutic settings, and is increasingly utilised in practise.

Allogeneic blood transfusion, like allogeneic organ transplantation, is a potentially risky treatment. It may have an effect on immunisation in the long run, resulting in microthrombosis, blood coagulation, and hemolytic reactions. Since 1980, ABT has received widespread recognition from clinical professionals and has been used extensively in the treatment of anaemia and surgical bleeding because to its benefits, which include the avoidance of the transmission of illnesses, less adverse responses, saving blood resources, high safety, and efficiency. [2] ABT has steadily gained acceptance in recent years as a result of improved awareness among medical staff, blood management specialists, patients, and patients' families. Concurrently, the volume of autologous blood stored in hospitals has been constantly increasing. ABT can assist to prevent the spread of blood-borne illnesses and immunosuppression, and it can sometimes be the sole source of blood when the required type of blood is difficult to get. Preoperative autologous blood donation (PABD), acute normovolemic hemodilution (ANH), and intraoperative and postoperative autotransfusion are the three alternatives for ABT. [3]

**PABD stands for preoperative autologous blood donation.**

The phrase "PABD" refers to a procedure in which a patient's blood is drawn, held for a short period of time prior to therapy, and then reinfused. . and reduce the risk of infection caused by an immune system reaction to an allogeneic blood transfusion.These are the distinct benefits of PABD over other approaches.As a result, it has seen extensive use in the fields of clinical care and surgery, with outstanding outcomes. [4] However, there are several restrictions on autologous blood preservation before surgery in clinical practise. Predeposited autotransfusion, for instance, is typically used on young patients rather than on elderly patients. Applications for it include surgical hematorrhea in expectant mothers, lumbar disc herniation, scoliosis, hip

surgery, and hip replacement. Additionally, it helps to improve aberrant blood rheology, maintain normal blood indices, lessen blood supply shortages, and reduce unpleasant reactions to blood transfusions.

Preoperative ABT has advanced in addition to conventional transfusion patterns in the following ways:

1) The patient receives therapies that are reasonably basic given their unique circumstances in order to effectively prepare their bodies for blood donation;

2) A proper volume of Before and after blood donation, crystalloid liquid is transfused into the body to gently dilute the blood and lower blood viscosity, promote microcirculation, and. cut down on blood damage and actual blood loss during surgery. While accepting appropriate autologous blood collection, minor hemodilution There was no substantial detrimental influence on blood's oxygen-carrying capacity, blood coagulation, or the heart, brain, and kidneys.

3) When a lot of blood needs to be drawn, erythropoietin and iron are given to the patient to help with erythrocyte production and maturation, preventing preoperative anaemia.

According to studies, erythropoietin and iron can be used together to quickly increase hematopoiesis. Erythropoietin can be given to patients prior to surgery to boost their haemoglobin levels, lessen the need for allogeneic and autologous blood transfusions, and speed up their recovery. Thus, the enhanced ABT has a number of benefits, including mild blood dilution, decreased blood viscosity, better microcirculation, and avoidance of hypoxia brought on by anaemia following blood donation. For patients who are planned to undergo elective heart surgery, This enhanced PABD (physical condition adjustment by basic treatment, crystalloid liquid supplementation, and intraoperative injection of erythropoietin) preoperative blood preparation plan is a safe and dependable approach. [5] The method is effective if no unfavourable reactions to the blood transfusion procedure occur and haemoglobin and haematocrit levels are within normal ranges before and after autologous blood donation, before and after transfusion, and before discharge. As a result, the occurrence of postoperative problems, the amount of time spent in the ICU, postoperative hospitalisation, and overall hospitalisation after heart surgery all reduce significantly.

**Acute normovolaemic haemodilution (ANH)**

Multiple units of blood are collected into traditional blood donation packs in ANH prior to surgery (frequently in the operating theatre), and the patient's blood volume is maintained by the concurrent infusion of crystalloid or colloid fluids. When the procedure is over, or if there is significant bleeding, the blood is stored at room temperature in the operating room and reinfused. ANH is most frequently utilised during cardiac bypass surgery because it is advantageous to immediately postoperatively administer "fresh whole blood" containing platelets and clotting components. ANH has been associated with risks such myocardial ischemia, fluid overload, and erroneous blood patient errors. [6, 7] ANH is most successful as a blood-conservation measure in surgeries with significant blood loss.The safety of ANH is yet uncertain, and systematic reviews of published trials have found no discernible reduction in donor transfusion exposure when compared to standard care or alternative blood conservation strategies.

**Intraoperative cell salvage (ICS)**

This procedure involves the collection and reinfusion of surgically lost blood. Commercially available, mostly automated ICS devices are now often used in hospitals for serious traumatic or obstetric haemorrhage management, as well as elective and emergency surgery involving significant blood loss. Personnel who have acquired the relevant training must always use and maintain the equipment in accordance with the manufacturer's instructions. [8]

Blood is first filtered to remove contaminants before being aspirated into a collection reservoir and treated with heparin or citrate to avoid clotting. If enough blood is collected and the patient needs a transfusion, the stored blood can be centrifuged and cleaned in a closed, automated system. Red blood cells suspended in sterile saline solution are formed within four hours of processing, and the patient must receive them via transfusion. [9, 10] In the operating room, the reinfusion bag should be labelled with the fewest patient identifiers possible, which can be

deduced from the patient's ID band. With the exception of circumstances where a leucodepletion filter is recommended, the red cells are transfused through a 200 m screen filter, as in a typical blood administration set. Similar to any other transfusion, the patient should be observed, the transfusion ordered, and the documentation completed. After receiving all necessary information, patients having elective operations that may involve the use of ICS should provide their informed permission. Indications for ICS in adults and children are as follows:

- Surgical procedures where the patient is expected to lose more than 20% of their projected blood volume.
- Elective or urgent surgery for individuals who have a history of bleeding (such as a Caesarean section at high risk) or have a low preoperative Hb concentration.
- Significant haemorrhage.
- Patients who may have trouble receiving donor blood because they have numerous blood group antibodies or rare blood groupings.
- Patients who are willing to receive and consent to ICS but who refuse blood transfusions from donors.

When intestinal waste contaminates the surgical site, ICS should not be employed, and surgical fields with bacterial contamination should not be used to aspirate blood. [11,12]. Manufacturers do not advocate ICS in patients undergoing surgery for malignant disease due to worries of cancer cell reinfusion and dissemination. Although utilising a leucodepletion filter to reinfuse red blood cells is recommended, significant clinical experience demonstrates that this is not a major concern. Many focused and national guideline organisations support for the widespread use of ICS in women at high risk of postpartum haemorrhage during Caesarean section, as well as in the therapy of significant obstetric haemorrhage. Although severe fluid contamination should be aspirated prior to blood collection and harvested red cells reinfused using a leucodepletion filter, theoretical concerns about amniotic fluid embolism have not been substantiated in practise. [13,14]

**Postoperative cell salvage (PCS)**

PCS is most commonly used in orthopaedic procedures, especially after knee or hip replacement and for scoliosis correction. Blood from wound drains is collected and either filtered or cleansed in an automated system before being reinfused into the patient.When blood losses are expected to be between 500 and 1000 mL, basic filtering devices for reinfusion of unwashed red cells are commonly used. Concerns concerning negative effects on blood coagulation have not been substantiated in everyday practise with these infusion volumes. To utilise the device, accurately record the collection, and label the pack at the bedside, clinical staff must get training and have their proficiency evaluated. [15] Salvaged blood must be collected in the allotted amount of time (often six hours) by the manufacturer, and the reinfusion must be monitored and recorded in the same manner as donor transfusions.

Most Jehovah's Witnesses are in favour of PCS since it is reasonably affordable, has the potential to lessen exposure to donor blood, and can be used. It is still unknown whether it considerably enhances a comprehensive blood conservation strategy that already includes rigorous postoperative transfusion thresholds, haemostatic/antifibrinolytic interventions during surgery, and preoperative Hb optimisation.

**Advantages**

Predeposit autologous transfusion removes virtually all risks of viral transmission and immunologically caused hemolytic, febrile, or allergic responses. These negative consequences can occur as frequently as one in 100,000 times (HIV) or as infrequently as 5% of the time (febrile reactions). Furthermore, when blood products-induced immunomodulation is avoided, it may reduce the risk of postoperative infection and cancer recurrence. Immunomodulation refers to demonstrated decreases in cellular immune activity after allogeneic, but not autologous, transfusions. [16]

**Disadvantages**

Given that more blood must be taken than is generally required to avoid afterwards allogeneic transfusions, up to 50% of the collected blood may be rejected. Leftover blood is rarely used for further patients since most autologous donors do not meet the high health requirements for allogeneic blood donation. [17] Because of blood waste and administrative expenses involved with autologous initiatives, the costs of collecting blood are higher than those for allogeneic transfusion.Additional dangers include volume overload, microbiological contamination, and ABO hemolytic reactions to the transfusion brought on by administrative or clerical mistakes.

**Patients' suitability**

Only elective surgery makes predeposit autologous donation a realistic option. Prior to their procedure, patients must be willing and able to travel to a donation centre, which can be inconvenient, stressful, and possibly reduce their productivity at work. Blood volume, venous access, packed cell volume, and haemodynamic stability are crucial factors in determining who is an acceptable candidate for the treatment because preoperative donation causes perioperative anaemia (which may not be completely corrected before surgery).[18] The majority of the time, children under the weight of 30 to 40 kg are not acceptable, while adult patients are only prohibited from giving blood if they suffer from significant hemodynamic issues, current systemic infections, or a history of severe reactions to donation (such as seizures). Patients who have diarrheal disorders in the days or weeks before donation should refrain from doing so since their blood may be more likely to become contaminated with bacteria. Although autologous donors are more likely to develop mild reactions than voluntary donors are (perhaps because they are less experienced and less young and fit), these reactions are rarely serious.

**Cost of autologous blood transfusion**

The majority of studies on cost effectiveness to far have compared allogeneic with autologous blood transfusion; comparative cost statistics on autologous blood transfusion techniques are somewhat subjective and contradictory. The majority of these studies concluded that allogeneic blood transfusions are less expensive than autologous ones. The additional labour required to deviate from typical large-scale allogeneic collection practises, as well as over-collection and wasteful use, all contribute to the higher cost of underutilised autologous collection. [19] The resources needed for donor recruiting, infectious disease testing, phlebotomy, cross-matching, administrative and inventory management, as well as overhead costs, were often computed to estimate direct cost. Our assessment clearly shows that autologous blood transfusion procedures are superior to allogeneic blood transfusions per unit of transfusion.

**Conclusion**

A plan for autologous blood transfusions must be dependable, efficient, and safe for both patients and professionals. A hospital that wants to start an autologous blood transfusion programme needs everyone involved to fully commit. Motivation and communication are essential to success, and all important stakeholders are involved in the planning process. Many of our patients are likely to recognise the advantages of autologous transfusion. The establishment of an autologous blood transfusion service to address this need can only be advantageous, notwithstanding the significant organisational challenges that must be overcome and the requirement for a strong sense of commitment. To spread the idea that using one's own blood is the safest option, our coworkers will need to be informed. It will prevent donor blood from being wasted and enable more efficient use of the blood supply. Only in addition to the established blood transfusion programme should an autologous blood transfusion programme be used. Even within our centres, we can make this work. Appreciate the idea first, conduct additional research into the cost-benefit ratio, push for the formation of a transfusion committee, then policy, and support your case with data.

**References**

1. Parker-Williams EJ. Autologous blood transfusion. Postgraduate Doctor 1989; 11: 52-56
2. Sloand E, Kumar P, Klein HG, Merritt S, Sacher R. Transfusion of blood components to persons infected with human immunodeficiency virus type 1: relationship to opportunistic infection. Transfusion 1994; 34: 48-53.

3. Kirkley SA. Proposed mechanisms of transfusion-induced immunomodulation. Clin Diagn Lab Immunol 1999; 6: 652-657.
4. Kirkley SA, Cowles J, Pellegrini VD, et al. Increased T helper 2 (Th2) type cytokine secretion in surgical patients receiving allogeneic transfusions. Transfus Med 1998; 8: 195-204.
5. Ekblom BT, Berglund B. Effect of erythropoietin administration on maximal aerobic power. Scand J Med Sci Sport. 1991;1:88–93
6. McKenna, J.E. Autologous blood transfusion in trauma: a literature review. Scand J Trauma Resusc Emerg Med 23 (Suppl 2), A7 (2015). https://doi.org/10.1186/1757-7241-23-S2-A7
7. Oppitz PP, Stefani MA. Acute normovolemic hemodilution is safe in neurosurgery. World Neurosurg. 2013;79:719–724. doi: 10.1016/j.wneu.2012.02.041. [PubMed] [CrossRef] [Google Scholar]
8. Autologous blood transfusion (collection and reinfusion of the patient's own red blood cells)
9. http://www.transfusionguidelines.org/transfusion-handbook/6-alternatives-and-adjuncts-to-blood-transfusion/6-1-autologousblood-transfusion-collection-and-reinfusion-of-the-patient-s-own-red-blood-cells
10. Singbartl G. Pre-operative autologous blood donation: clinical parameters and efficacy. Blood Transfus. 2011;9:10–
11. Krieger KH, Isom OW. Blood conservation in cardiac surgery. Eds. New York, NY: Springer Science & Business Media; 2012.
12. Furuta, Y.; Nakamura, Y.; Tokida, M.; Ichikawa, K.; Ohsawa, T.; Ohkubo, M.; Ohsaka, A. Pre-operative autologous blood donation and transfusion-related adverse reactions: A 14-year experience at a university hospital. Transfus. Apher. Sci. 2018, 57, 651–655. [Google Scholar] [CrossRef]
13. Furuta, Y.; Nakamura, Y.; Tokida, M.; Ichikawa, K.; Ohsawa, T.; Ohkubo, M.; Ohsaka, A. Pre-operative autologous blood donation and transfusion-related adverse reactions: A 14-year experience at a university hospital. Transfus. Apher. Sci. 2018, 57, 651–655. [Google Scholar] [CrossRef]
14. Furuta, Y.; Nakamura, Y.; Tokida, M.; Ichikawa, K.; Ohsawa, T.; Ohkubo, M.; Ohsaka, A. Pre-operative autologous blood donation and transfusion-related adverse reactions: A 14-year experience at a university hospital. Transfus. Apher. Sci. 2018, 57, 651–655. [Google Scholar] [CrossRef]

15. Turner DL, Hoppeler H, Noti C, Gurtner HP, Gerber H, Schena F, et al. Limitations to VO2max in humans after blood retransfusion. Respir Physiol. 1993;92:329–41.
16. Luten M, Roerdinkholder-Stoelwinder B, Schaap NPM, De Grip WJ, Bos HJ, Bosman GJCGM. Survival of red blood cells after transfusion: a comparison between red cells concentrates of different storage periods. Transfusion. 2008;48:1478–85.
17. Committee AAT . Guidelines for blood recovery and reinfusion in surgery and trauma. Bethesda: American Association of Blood Banks; 1997. [Google Scholar]
18. . Esper SA, Waters JH. Intra-operative cell salvage: a fresh look at the indications and contraindications. Blood Transfus. 2011;9:139–147. [PMC free article] [PubMed] [Google Scholar]
19. Chalfin HJ, Frank SM, Feng Z, Trock BJ, Drake CG, Partin AW, et al. Allogeneic versus autologous blood transfusion and survival after radical prostatectomy. Transfusion. 2014;54:2168–2174. doi: 10.1111/trf.12611. [PMC free article] [PubMed] [CrossRef] [Google Scholar]