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### Original Research Article

## Complications of Autologous Blood Transfusion by ANH Method in Cardiac Surgery Patients in Shahid Madani Hospital of Tabriz

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### ABSTRACT

**Introduction:** ANH is most commonly used in surgeries that involve the loss of large amounts of blood, most commonly in heart surgeries with or without extracorporeal circulation, aneurysm surgery, orthopedic surgery (thigh and knee), vascular surgery, and Thoracic surgery, urological surgery and general surgery are used. The rate of bleeding is more than 10% to 15% of the patient's intravascular volume. **Material and Methods:** This study is a retrospective study that was conducted during 2019 with the participation of patients candidates for cardiovascular surgery at Tabriz University of Medical Sciences who needed blood transfusions. Blood transfusion method was evaluated by ANH method and the results were reported. **Results:** In 86.4% patients had coronary artery bypass graft, in 6.6% patients had a heart valve replacement including aorta and mitral. In 0.9% patients, mitral and aortic valve replacement was performed simultaneously (MVR+AVR) and in 3.2% patients, coronary artery transplantation was observed with mitral and aortic valve replacement. In 2.3% patients with congenital heart abnormalities and in 0.6% patients with Bentall surgery in ascending aortic aneurysm (aortic valve replacement, Aortic root, ascending aorta, and repositioning of coronary arteries into grafts) were performed. **Conclusion:** According to the present study, none of the patients showed cardiac arrhythmia or hemodynamic instability during blood sampling and up to half an hour after it, so autologous ANH transfusion for cardiac surgery patients (coronary artery bypass graft and valve replacement) in this Research was a safe way.

**Keywords:** autologous blood transfusion, cardiac surgery, ANH method

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## Introduction

One of the autologous or autologous blood transfusion methods is Acute Normovolemic Hemodilution (ANH), in which blood is collected shortly before surgery with hemodilution (blood thinning) and is a useful and cost-effective strategy. Preserves blood and blood products in patients who lose more than one liter of blood during surgery. This method reduces the need for allogeneic blood transfusions and the complications of the transfusion [1]. ANH is less expensive than preoperative autologous blood donation (PABD). Shortly after induction of anesthesia and before the onset of bleeding and surgery, the patient's own blood is drawn by ANH and a replacement fluid (crystalloid) is injected to maintain intravascular volume. Autologous blood can be returned to the patient whenever the patient needs it clinically or his or her hematocrit drops[2]. One of the potential benefits of ANH is the improvement in tissue oxygenation due to reduced blood viscosity and reduced contact with allogeneic (other) blood antigens and pathogens, and complications of blood transfusion. In addition, whole blood drawn from the patient contains coagulation factors and fresh platelets that are made available to the patient for re-injection. Since taking blood from a patient undergoing surgery can make him anemic, in this method the autologist must maintain the patient's hemodynamics (cardiovascular condition) and normalize his blood pressure with a replacement fluid [3]. (Normovolemic) and paid attention to his hemoglobin level. Preoperative blood sampling reduces blood loss during surgery [4]. ANH is most commonly used in surgeries that involve the loss of large amounts of blood, most commonly in heart surgeries with or without extracorporeal circulation, aneurysm surgery, orthopedic surgery (thigh and knee), vascular surgery, and Thoracic surgery (removal of one or all of the right or left lung), urological surgery (prostatectomy, cystectomy, and nephrectomy) and general surgery (limited bowel surgery and limited tumor resection) are used [5,6]. The rate of bleeding is more than 10% to 15% of the patient's intravascular volume. It should be examined.

## Material and Methods

**Study design:** In a retrospective study, a three-day retraining course was held for cardiac surgery staff (specialist physicians and operating room nurses) at Shahid Madani Hospital (Tabriz University of Medical Sciences) and used various autologous blood transfusion methods,

including dilution method. Acute blood pressure with normal pressure or ANH received special attention.

**Inclusion and exclusion criteria:** Inclusion criteria included: Inclusion criteria included cardiovascular islet candidates, autologous blood transfusion and consent to participate in the study, and exclusion criteria also included blood transfusion during a recent month, history of allergies. Previous to blood, blood samples were homologous.

**Methodology:** Then the information of cardiac surgery patients (including age, sex, weight, type of surgery, hemoglobin, hematocrit, autologous blood sampling rate after anesthesia, blood sampling site, complications during blood sampling and up to half an hour after, stability and instability of hemodynamic status and Using a pump balloon) was sent to the autologous blood transfusion unit in Tehran province. This study was performed retrospectively on Tabriz blood transfusion. All data of cardiac surgery patients for whom autologous blood transfusion was performed by ANH method in the operating room were analyzed. Inclusion criteria included hemoglobin above 12, elective surgery, cardiac output of more than 45%, absence of any infection or kidney and lung disease, seizures, bleeding disorders, hematologic disorders and liver cirrhosis. In this study, adult patients underwent cardiac surgery after anesthesia and complete cardiovascular monitoring, a unit of autologous blood (450 ml) and blood weighing 5-8 kg mL/kg were taken and blood was taken for each ml. The patient was injected with 3 ml of crystalloid (Ringer). Their complications, including arrhythmias such as atrial fibrillation rhythm, abnormal ventricular rate, and unstable hemodynamics, were then assessed and recorded during blood sampling and up to half an hour later and was injected after surgery.

**Data analysis:** Then the information sent to these cardiac surgery patients to the autologous blood transfusion ward in Tabriz in 2019 was analyzed with 18 SPSS. Frequency tables, central indices and dispersion indices were used to analyze the data. This study was performed to evaluate the possibility of performing one of the autologous methods (acute dilution of blood with normal pressure) in different patients with heart surgery and its complications in these patients.

**Ethical considerations:** This study was conducted after approval by the ethics committee of Tabriz University of Medical Sciences (NO: IR.TBZMED.REC.1399.957). Then the informed consent was completed by the participants and their information was used.

## Results

Complications during autologous ANH blood sampling (collecting the patient's own blood shortly after anesthesia and replacement with crystalloid and hemodilution) were evaluated in 308 heart surgery patients in 2019. Results were reported as mean  $\pm$  standard deviation. These patients had a minimum of 14 and a maximum of 81 years with a mean age of  $54.34 \pm 10.91$  years. Among all patients, 296 (96.1%) were male and 12 (3.9%) were female. Their weight was reported to be between 42 and 102 kg with an average weight of  $72.58 \pm 10.82$  kg. The hemoglobin of these patients was between 13-21 g/dL ( $15.07 \pm 1.25$ ) and their hematocrit was between 39-66 ( $46.18 \pm 3.75$ ). In 278 (90.3%) patients, radial artery was used for blood collection and in 30 (9.7%) patients, venous blood was collected. The type of operation of these patients was heart surgery from which an autologous blood sample was taken. In 266 (86.4%) patients had coronary artery bypass graft, in 20 (6.6%) patients had a heart valve replacement including aorta and mitral. In 3 (0.9%) patients, mitral and aortic valve replacement was performed simultaneously (MVR+AVR) and in 10 (3.2%) patients, coronary artery transplantation was observed with mitral and aortic valve replacement. In 7 (2.3%) patients with congenital heart abnormalities (including tetralogy repair, fallopian tube defect, duodenal defect) and in 2 (0.6%) patients with Bentall surgery in ascending aortic aneurysm (aortic valve replacement, Aortic root, ascending aorta, and repositioning of coronary arteries into grafts) were performed. None of the patients reported cardiac arrhythmias or hemodynamic instability during blood sampling and up to half an hour after.

## Discussion

This study showed that autologous (ANH) method can be used in different heart surgeries and patients tolerated this method well and in different heart surgeries such as replacement of one valve such as mitral or aorta, simultaneous replacement of two mitral valves and Aorta, simultaneous replacement of mitral and tricuspid valves, coronary artery bypass graft and

simultaneous aortic valve replacement by coronary artery graft, simultaneous mitral valve and coronary artery bypass graft replacement, and even aortic valve replacement and ascending aortic root and coronary artery bypass grafting [7] The autologous ANH method was used and the patients tolerated this method well and no arrhythmias such as atrial fibrillation rhythm and abnormal ventricular beat and unstable hemodynamics were seen in them and the patients did not suffer from acute complications [8, 13]. ANH is a proven method of reducing the need for blood transfusions in heart surgery. Although the extent to which ANH reduces the use of blood products and its consequences are not yet generally agreed upon by physicians, in a study, researchers stated that less blood products when using the method [9, 14-16]. ANH autologous is consumed. In this autologous procedure, some red blood cell mass is taken and replaced with colloid or crystalloid or a combination of both, and less blood is lost due to the patient's blood being diluted on the surgical site. This method is fully approved by the Association of Anesthesiologists. Autologous ANH blood can be used to prevent the transmission of infectious diseases and hemolytic reactions. Cardiac surgery is responsible for approximately 20% of allogeneic blood transfusions. However, with the understanding of transfusion physiology and the reduction of blood transfusion threshold and the use of antifibrinolytics and autologous blood transfusion in heart surgery, a reduction in this rate has been observed [10, 17-19]. In a study at a very large hospital in the United States, this autologous procedure was performed on patients with coronary artery bypass graft surgery, and blood consumption was lower in this group than in the control group [11, 20-23]. In a study, researchers found that heart valve patients were less tolerant of other autologous procedures than other patients, but patients tolerated the autologous ANH method well by changing the mitral valve (with hemoglobin  $10.3 \pm 4.3$  g/dl). Some studies have reported this autologous method as contraindication in aortic valve stenosis due to decreased cardiovascular reserve with myocardial hypertrophy. However, researchers have shown that this autologous procedure can also be performed safely in aortic stenosis if the heart is functioning properly [12, 24-26]. In a postoperative ANH study on CABG patients, their hemodynamic status was assessed. Within five minutes, the heart rate did not increase, but twenty minutes later, it decreased. In both groups, five patients needed an intra-aortic pump balloon for hemodynamic support, but in the present study, there was no report of an intra-aortic pump balloon requirement [13, 27-30].

## Conclusion

According to the present study, none of the patients showed cardiac arrhythmia or hemodynamic instability during blood sampling and up to half an hour after it, so autologous ANH transfusion for cardiac surgery patients (coronary artery bypass graft and valve replacement) in this Research was a safe way. Therefore, it is suggested that in future studies, considering the control group, the complications and the amount of allogeneic blood consumption in the two groups be compared.

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