Evaluation of Blood Transfusion Complications in Patients Undergoing Surgery

Hamidreza Azizi Farsani1, Amin Mokhtari2*, Masih Ebrahimi Dehkordi1, Ali Mokhtari1, Maryam Mardanshahi1, Donya Sheibani Tehrani1

1Department of Anesthesiology, Shohadaye Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
2Shahid Beheshti University of Medical Sciences, Tehran, Iran
3Department of Neurosurgery, Isfahan University of Medical Sciences, Isfahan, Iran
4Department of IT, Shahid Beheshti University, Tehran, Iran

*Correspondence to
Amin Mokhtari, MD, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Tel: +989104971330; Email: aminmokhtari111273@gmail.com

Abstract

Introduction: Patients undergoing surgery may need transfusion of blood products for a variety of reasons. Therefore, this study aimed to determine the incidence of blood transfusion complications in patients undergoing surgery.

Methods: The present study was performed as a cross-sectional study in 2020 at Shohadaye Tajrish Hospital in Tehran, Iran. A total of 1132 patients who had complications during surgery upon transfusion of blood and blood products from 2015 to 2020 were included in the census. To collect information, a checklist, including patients’ information, the type of product, and types of complications was used. SPSS software version 21 was used for data analysis.

Results: In this study, 99.7% of the complications were acute, and in 91.1% of the cases, the severity of complications was mild. Of the confirmed complications, 46.4% were allergic reactions, and 43.8% were reported as non-hemolytic febrile reactions. A total of 91.1% of patients completely recovered after the onset of the complication, 6.2% had a partial disability, 0.4% had severe disability, and 0.3% died.

Conclusion: The results showed that most patients had acute complications in terms of the type of complication and mild in terms of the severity, thus a completely regular program is recommended to control side effects related to blood and blood products transfusion.

Keywords: Blood transfusion, Transfusion reaction, Complications, Patients, Surgery

Introduction

Blood transfusion is an acute medical intervention that is usually a quick and short-term treatment in the face of life-threatening conditions of patients or stabilization of dangerous health conditions.1,2 In recent decades, the development of technology in the science of blood transfusion has been a continuous and growing trend to be able to initially increase the safety of blood transfusion for recipients.3 However, blood transfusion may still cause some complications and dangerous conditions.4 Many of these risk complications are associated with the presence of alloageneic white blood cells in injected blood products.5 Although over years little attention has been paid to the presence of leukocytes in blood products, today access to appropriate techniques for the removal and reduction of white blood cells in blood products, along with improvement of the effectiveness have significantly reduced some common complications of blood transfusion.6 These improvements include a reduction in the frequency and severity of transient blood transfusion reactions, a significant reduction in the risk of transmitting the cytomegalovirus infection, and the possibility of some other diseases transmitted by donor leukocytes such as Creutzfeldt-Jakob disease, a decrease in the prevalence of alloimmune platelet resistance, as well as in the risk of mortality or organ dysfunction in recipients,
especially in patients who are candidates for cardiac surgery. Studies have shown that septicemia, an acute complication, and respiratory injury due to blood transfusion, which are acute complications, are the causes of 4%-42% of 189 deaths due to blood transfusions. Any sign and symptom that is observed during or shortly after blood transfusion should be considered as a complication of the injection unless proven otherwise. The severity of a blood transfusion reaction may not be appreciable due to the patient's clinical symptoms. For example, acute hemolytic reaction may be from life-threatening to a mild symptomatic complication. Therefore, any symptom following blood or blood products transfusion should be considered potentially threatening and be timely identified health professionals. Blood transfusion reactions may be acute or delayed. Acute reactions occur during or within the first 24 hours of injection, but delayed reactions occur days, weeks, and even years later. Acute blood complications include allergy, acute hemolytic complication, septicemia, tracheal, anaphylactic shock, and acute pulmonary edema. Due to the fact that acute complications of blood transfusion are more common and fatal than blood-borne viral infections, much attention is paid to this issue today.

Due to the high prevalence of blood transfusion complications and related mortality and morbidity, this study was performed to determine the complications of blood transfusion in patients undergoing surgery at Shohadaye Tajrish Hospital in Tehran, Iran.

Materials and Methods
This was a cross-sectional retrospective study conducted in Shohadaye Tajrish hospital affiliated to Shahid Beheshti University of Medical Sciences in Tehran, Iran, in 2020. The records of all patients who underwent blood and blood product transfusions during surgery and also had transfusion complications. Overall, 1132 records were included in the study by census from 2015 to 2020. Inclusion criteria include undergoing surgery and the need for blood transfusions and blood products during surgery. Exclusion criteria include not having transfusion complications and incomplete archived data.

Data was collected using a checklist to record the patient's demographic information, disease history, types of products leading to the complication and complete information of products, body temperature, heart rate, respiration rate, blood pressure, crossmatch status, direct antiglobulin test (DAT) result, and antibody screening, and complications, and finally the patient's fate.

Qualitative variables were expressed by frequency and percentage and quantitative variables by mean and standard deviation. After checking and confirming the normality of the distribution of quantitative data, paired sample t test and McNemar test were employed to evaluate the difference between quantitative and qualitative variables before and after transfusion. Frequency tables and statistical tests were performed in SPSS software version 21. The significance level of statistical tests was considered P < 0.05.

Results
In this study, the files of 1132 patients were examined. Regarding gender, 37.8% of patients in this study were men, and 62.2% were women. Seventy percent of the cases had over 40 years old, and only 3.5% were under the age of 10 years. The mean age of the patients was 51.9 ±21.23 years in the age range of 1 to 96 years.

Overall, 44.8% of patients had a history of antibiotic use, 22.1% had a history of hypertension, 20.4% had a history of heart diseases, and 49.5% had a history of transfusion in less than three months. Forty-five point three percent of women had experienced a history of pregnancy more than three months ago (Table 1).

The results of this study showed that 72% of the complications were caused by RBC (packed cell) product, 9% by fresh frozen plasma (FFP), 6.9% by random donor platelet (RDP) and 5.7% by Leuko-reduced RBCs. Eighty-point six percent of the product type had a complication related to RBC, and in 64.5% of cases, the injection of the product after observing the complication was stopped. The patient's condition in 97.6% of cases was under no anesthesia. The average age of the injected product was 39.32 days, which is in the age range of 0 to 716 days. The average time interval between the beginning of the injection and the onset of the complication was 99.03 minutes in the time range of 1 to 720 minutes. The average volume of injection of the product until the occurrence of the complication was 146.96 mL in the volume range of 1 to 500 mL (Table 2).

The results of this study show that body temperature, heart rate, and respiration rate before injection and after the complication were significantly different (P < 0.05). Mean body temperature, heart rate, and respiration rate

| Table 1. Patients’ records |
|---------------------------|
|                      | Number | Percent |
| Pregnancy history       |        |         |
| Yes, less than 3 months ago | 45   | 6.5    |
| Yes, more than 3 months ago | 319 | 45.3   |
| History of high blood pressure           | 201 | 22.1   |
| History of heart disease                | 231 | 20.4   |
| History of lung disease                 | 80  | 7.1    |
| History of immunodeficiency             | 90  | 8      |
| History of kidney disease               | 93  | 8.2    |
| History of allergies                   | 88  | 7.8    |
| History of liver disease                | 44  | 3.9    |
| History of blood transfusion            |      |        |
| Yes, less than three months             | 558 | 49.5   |
| Yes, more than three months             | 119 | 10.5   |
| History of antibiotic use               | 618 | 54.6   |

International Journal of Basic Science in Medicine. Volume 5, Issue 4, 2020 | 137
Complications reported in this study show that 99.7% of complications were acute and 91.1% were mild (grade 1), and regarding the types of complications, 55.2% and 30.5% of the cases were allergic and non-febrile reactions, respectively. Of the confirmed complications of blood transfusion, 46.4% reported allergic reactions and 43.8% reported non-hemolytic febrile reactions. Ninety-three-point one percent of patients fully recovered after the onset of the complication, 6.2% had a partial disability, 0.4% had severe disability, and only 0.3% died (Table 4).

Transfusion side effects in patients included 40.5% chills, 30.6% fever, 25.3% urticaria, 21.3% pruritus, 20.6% skin redness, 18.6% restlessness, and 16% tachycardia (Table 5).

**Discussion**

Blood transfusion is an acute medical intervention and a rapid treatment in the face of life-threatening conditions and stabilization of dangerous health conditions. However, blood transfusions may still cause some dangerous complications. According to studies, more than 20% of injections lead to various complications in the recipient of blood and its products.\(^{15,16}\) Reactions that occur within the first 24 hours after a blood transfusion are considered premature reactions and occur in 1% to 3% of transfusions.\(^{17}\) The findings of the present study showed that on average, 99.7% of the recipients had acute complications 99 minutes after blood transfusion. RBC (packed cell) product with 72% triggered the most acute complications 99 minutes after blood transfusion. However, blood transfusions may still cause some reactions was confirmed in 98% of cases.

Allergic reactions are common transfusion complications and often occur mildly in 1 to 3% of cases after injection and are usually accompanied by skin manifestations such as itching, skin rash, and flushing.\(^{19}\) Allergies usually occur following the injection of plasma products. Allergy, which is one of the most common and acute complications following blood transfusion occurred in 46.4% of our patients, which is higher compared to the statistics reported by other researchers like Pandey and Vyas\(^{20}\) (1%-5%), and Teimuri et al\(^{12}\) (0.3%). In general, research results indicate that red blood cells are generally responsible for allergic reactions in patients.\(^{19,21}\)

One of the most common early reactions to blood transfusion is the non-hemolytic complication of fever.\(^{22}\) Non-hemolytic fever typically occurs following the injection of cellular products such as packed red blood cells, whole blood, and platelets, and rarely occurs with plasma products.\(^{22-24}\) According to studies, the highest rate of non-hemolytic fever is due to platelet injection (30%).

### Table 2. Summary of Products’ Information Leading to Complications

| The type of the product leading to complications | Number | Percent |
|-------------------------------------------------|--------|---------|
| Whole blood                                     | 3      | 0.3     |
| RBC (packed cell)                               | 815    | 72      |
| Leuko-reduced RBC                               | 64     | 5.7     |
| Washed RBC                                      | 11     | 1       |
| Washed leuko-reduced RBC                        | 11     | 1       |
| RDP                                             | 78     | 6.9     |
| SDP                                             | 18     | 1.6     |
| Pooled Platelet                                 | 2      | 0.2     |
| Irradiated Platelet                             | 12     | 1.1     |
| Children’s blood bag                            | 1      | 0.1     |
| Irradiated RBC                                  | 8      | 0.7     |
| FFP                                             | 104    | 9       |
| Cryoprecipitate                                 | 5      | 0.4     |

### Table 3

| Products’ types | Number | Percent |
|-----------------|--------|---------|
| RBC             | 912    | 80.6    |
| Platelet        | 110    | 9.7     |
| FFP             | 109    | 9.6     |
| Whole Blood     | 1      | 0.1     |

| Products’ ABO and Rh blood groups                | Number | Percent |
|-------------------------------------------------|--------|---------|
| A+                                              | 353    | 31.2    |
| A-                                              | 25     | 2.2     |
| B+                                              | 245    | 21.6    |
| B-                                              | 27     | 2.4     |
| O+                                              | 369    | 32.6    |
| O-                                              | 33     | 2.9     |
| AB+                                             | 74     | 6.5     |
| AB-                                             | 6      | 0.6     |

| Was product injection stopped after complication occurrence? | Number | Percent |
|--------------------------------------------------------------|--------|---------|
| Yes                                                          | 729    | 64.5    |
| No                                                           | 402    | 35.5    |

| The patient’s condition during transfusion                   | Number | Percent |
|--------------------------------------------------------------|--------|---------|
| Under general anesthesia                                     | 23     | 2       |
| Local anesthesia                                             | 4      | 0.4     |
| None                                                          | 1105   | 97.6    |

| Product age (days)                                          | Mean   | SD     | Min-Max |
|-------------------------------------------------------------|--------|--------|---------|
| Interval from the start of transfusion to the occurrence of complication (min) | 99.03  | 91.42  | 1-720   |
| Approximate volume of the injected product until the onset of complication (ml) | 146.96 | 90.57 | 1-500   |

RDP, random donor platelet; SDP, single-donor platelet; FFP, ffresh frozen plasma; RBC, Red blood cell.
Azizi Farsani et al compared to other blood products, while packed red blood cells, which are the most used blood product, have the lowest rate of non-hemolytic fever (0.5%-6%).

In this study, the prevalence of non-hemolytic fever was 43.8%, which is higher than other reports. On the other hand, most cases of non-hemolytic fever occurred following the injection of packed red blood cells. This result is inconsistent with other studies in which most of these complications are related to the injection of platelet units.

In the present study, the most common side effects in patients included chills (40.5%), fever (30.6%), urticaria (25.3%), and pruritus (21.3%). In their descriptive study, Bodaghkhan et al evaluated 57,902 hospitalized patients undergoing transfusion over two years for acute complications of transfusion and stated that 0.08% of patients had acute transfusion complications. Out of 52 patients, 25 had a fever, 15 had itching and redness of the skin, 15 had a skin rash, 9 had back pain, 5 had hypotension, 5 had shortness of breath, 1 had chest pain, 1 had hematuria, and 1 patient had cold sweating. The most common acute complication observed after blood transfusion was fever, and its prevalence was reported to be 0.04%, which was in line with our study and lower compared to international statistics.

Najafi Ghezeljeh and Kalhor in their review on 15 articles found that survival during the first 30 days and also during the first year after heart surgery among

### Table 3. Summary of clinical and laboratory indicators before injection and after complication

| Indicator                        | Before injecting the product | After the onset of the complication | Mean | SD | P Value* |
|----------------------------------|------------------------------|------------------------------------|------|----|----------|
| Body temperature                 |                              |                                    | 36.96| 0.42| 0.001    |
| Heart rate                       |                              |                                    | 37.55| 1.28|          |
| Systolic blood pressure          |                              |                                    | 113.48| 34.56| 0.125    |
| Diastolic blood pressure         |                              |                                    | 70.46| 30.37| 0.081    |
| Number of breaths                |                              |                                    | 19.34| 10.12| 0.001    |

### Table 4. Types of complications and patients’ outcomes

| Type of complication confirmed (blood transition) | Number | Percent |
|--------------------------------------------------|--------|---------|
| Acute                                            | 1129   | 99.7    |
| Chronic                                          | 3      | 0.3     |
| Mild (Grade 1)                                   | 1031   | 91.1    |
| Severe (Grade 2)                                 | 94     | 8.3     |
| Life-threatening (Grade 3 like shock)             | 7      | 0.6     |
| FNHTR                                            | 496    | 43.8    |
| Allergic reaction                                | 525    | 46.4    |
| TAD                                              | 9      | 0.8     |
| TRAL                                             | 2      | 0.2     |
| TACO                                             | 4      | 0.4     |
| Hypotension related to transfusion delayed HTR    | 3      | 0.3     |
| nonimmune hemolysis (ARO)                        | 42     | 3.7     |
| immune hemolysis (alloantibody)                  | 7      | 0.6     |
| immune hemolysis (alloantibody)                  | 38     | 3.4     |
| other reaction                                   | 4      | 0.4     |

### Table 5. Types of complications and patients’ outcomes

| Type of complication | Number | Percent |
|----------------------|--------|---------|
| FNHTR                | 496    | 43.8    |
| Allergic reaction    | 525    | 46.4    |
| TAD                  | 9      | 0.8     |
| TRAL                 | 2      | 0.2     |
| TACO                 | 4      | 0.4     |
| Hypotension related to transfusion delayed HTR    | 3      | 0.3     |
| nonimmune hemolysis (ARO)                        | 42     | 3.7     |
| immune hemolysis (alloantibody)                  | 7      | 0.6     |
| immune hemolysis (alloantibody)                  | 38     | 3.4     |
| other reaction                                   | 4      | 0.4     |
| Complete improvement                                | 1053   | 93.1    |
| Minor or brief disability                          | 70     | 6.2     |
| Severe disability or permanent disability         | 5      | 0.4     |
| Death                                             | 3      | 0.3     |
patients who had blood transfusion was significantly lower than patients without blood transfusion. The incidence of death in short- and long-term after surgery was significantly higher among patients with blood transfusion than patients without blood transfusion. Complications such as atrial fibrillation, infection, pneumonia, and stroke were also significantly higher in patients with blood transfusion. Meanwhile, Salimi et al. examined 1261 patients who received 3880 units of blood products stated that the most common complaints were cold (22.5%), pruritus (20.1%), and chills (18.1%). Acute hemolytic reactions, fever reactions, and allergic reactions were 0.52, 6.2, and 1.11 per 1000 injections, respectively. They concluded that despite improved blood purification techniques, acute transfusion reactions could lead to significant mortality, which was consistent with the results of this study.

### Table 5. Side effects caused by transfusion

| Side effects                           | Number | Percent |
|----------------------------------------|--------|---------|
| Fever                                  | 417    | 36.8    |
| Chills                                 | 458    | 40.5    |
| Back pain                              | 46     | 4.1     |
| Headache                               | 48     | 4.2     |
| Chest pain                             | 58     | 5.1     |
| Stomach ache                           | 35     | 3.1     |
| Urinary incontinence                   | 3      | 0.3     |
| Decreased urination                    | 8      | 0.7     |
| Discoloration of urine                 | 50     | 4.4     |
| Restlessness                           | 211    | 18.6    |
| Feeling sick                           | 113    | 10      |
| Hot flashes                            | 114    | 10.1    |
| Itching                                | 241    | 21.3    |
| Wheals                                 | 286    | 25.3    |
| Redness of the skin                    | 233    | 20.6    |
| Stridor                                | 3      | 0.3     |
| Wheeze                                 | 13     | 1.1     |
| Tachypnea                              | 81     | 7.2     |
| Bleeding                               | 14     | 1.2     |
| Rhonchus                               | 13     | 1.1     |
| Nausea                                 | 86     | 7.6     |
| Vomit                                  | 47     | 4.2     |
| Lower blood pressure                   | 29     | 2.6     |
| Increased blood pressure               | 98     | 8.7     |
| Bradycardia                            | 7      | 0.6     |
| Tachycardia                            | 181    | 16      |

### Conclusion

Careful attention should be paid by physicians, nurses, and midwives to the early signs and symptoms of an acute reaction to blood and its products transfusion. This can be important in preventing more adverse consequences following transfusion. Hospitals can also manage complications by creating a regular schedule for blood and blood product transfusions.

### Ethical Approval

This study was approved by Shahid Beheshti University of Medical Sciences Ethics Committee with the code of IR.SBMU.REC.1398.863. All patients’ records remained confidential to the researcher.

### Conflict of Interest Disclosure

The authors declare there is no conflict of interests.

### Authors’ Contributions

All authors contributed equally to this study.

### References

1. Bhaskar B, Dulhunty J, Mullany DV, Fraser JF. Impact of blood product transfusion on short and long-term survival after cardiac surgery: more evidence. Ann Thorac Surg. 2012;94(2):460-467. doi:10.1016/j.athoracsur.2012.04.005
2. Borhany M, Anwar N, Tariq H, et al. Acute blood transfusion reactions in a tertiary care hospital in Pakistan-an initiative towards haemovigilance. Transfus Med. 2019;29(4):275-278. doi:10.1111/tme.12541
3. Carson JL, Noveck H, Berlin JA, Gould SA. Mortality and morbidity in patients with very low postoperative Hb levels who decline blood transfusion. Transfusion. 2002;42(7):812-818. doi:10.1046/j.1537-2995.2002.00123.x
4. Junio J, Gamponia R. Post-operative outcomes of CABG patients given blood transfusion based on Society of Thoracic Surgeons Guidelines on blood transfusion. Phil Heart Center J. 2012;16:47-54.
5. Paone G, Likosky DS, Brewer R, et al. Transfusion of 1 and 2 units of red blood cells is associated with increased morbidity and mortality. Ann Thorac Surg. 2014;97(1):87-94. doi:10.1016/j.athoracsur.2013.07.020
6. Loor G, Li L, Sabik JF 3rd, Rajeswaran J, Blackstone EH, Koch CG. Nadir hematocrit during cardiopulmonary bypass: end-organ dysfunction and mortality. J Thorac Cardiovasc Surg. 2012;144(3):654-662.e654. doi:10.1016/j.jtcvs.2012.03.058
7. Kleinman S. Transfusion-transmitted infection risk from blood components and plasma derivatives. In: Simon TL, Dzik WH, Snyder EL, Stowell CP, Strauss RG, eds. Rossi’s Principles of Transfusion Medicine. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2002:706-707.
8. McCullough J. Transfusion Medicine Paper: John Wiley & Sons; 2016.
9. Sazama K. Reports of 355 transfusion-associated deaths: 1976 through 1985. Transfusion. 1990;30(7):583-590. doi:10.1046/j.1537-2995.1990.30790385515.x
10. Azizi S, Tabary SZ, Soleimani A. Prevalence of acute blood transfusion reactions in Mazandaran Heart Center,
11. Bodaghhkhan F, Ramzi M, Vazirian SR, et al. The prevalence of acute blood transfusion reactions in Nemazee hospital. Sci J Iran Blood Transfus Organ. 2014;11(3):247-251. [Persian].

12. Teimuri H, Imani F, Maghsudlu M, Kia Daliri K, Fallah Tafti M. Prevalence of acute blood transfusion reactions in 11 hospitals of Tehran and Mazandaran province. Sci J Iran Blood Transfus Organ. 2007;4(1):19-24. [Persian].

13. Simon TL, McCullough J, Snyder EL, Solheim BG, Strauss RG. Rossi’s Principles of Transfusion Medicine. John Wiley & Sons; 2016.

14. Rudmann SV. Textbook of Blood Banking and Transfusion Medicine. Elsevier Health Sciences; 2005.

15. Beutler E, Williams WJ, Lichtman M, et al. Williams Hematology. McGraw-Hill Professional; 2006.

16. Handin RI, Lux SE, Stossel TP. Blood: Principles and Practice of Hematology. Lippincott Williams & Wilkins; 2003.

17. Hankins J, Lonsway RA, Hedrick C, Perdue M. Infusion Therapy in Clinical Practice: An Evidence-Based Approach. Saunders; 2001:394-395.

18. Asvadi-Kermani I, Evazie Ziaeei J, Nikanfar AR, et al. Blood transfusion acute reactions in patients of Shahid Ghazi hospital. Sci J Iran Blood Transfus Organ. 2006;2(6):215-221. [Persian].

19. Domen RE, Hoeltge GA. Allergic transfusion reactions: an evaluation of 273 consecutive reactions. Arch Pathol Lab Med. 2003;127(3):316-320. doi:10.1043/0003-9985(2003)127<0316:atr>2.0.co;2

20. Pandey S, Vyas GN. Adverse effects of plasma transfusion. Transfusion. 2012;52 Suppl 1:65S-79S. doi:10.1111/j.1537-2995.2012.03663.x

21. Silliman CC, Boshkov LK, Meh dizadehkashi Z, et al. Transfusion-related acute lung injury: epidemiology and a prospective analysis of etiologic factors. Blood. 2003;101(2):454-462. doi:10.1182/blood-2002-03-0958

22. Dy SM. Measuring the quality of palliative care and supportive oncology: principles and practice. J Support Oncol. 2013;11(4):160-164. doi:10.12788/j.suponc.0017

23. Shimada E, Tadokoro K, Watanabe Y, et al. Anaphylactic transfusion reactions in haptoglobin-deficient patients with IgE and IgG haptoglobin antibodies. Transfusion. 2002;42(6):766-773. doi:10.1046/j.1537-2995.2002.00117.x

24. Hoffman R, Benz EJ Jr, Silberstein LE, Heslop H, Anastasi J, Weitz J. Hematology: Basic Principles and Practice. Elsevier Health Sciences; 2013.

25. Goodman C, Chan S, Collins P, Haught R, Chen YJ. Ensuring blood safety and availability in the US: technological advances, costs, and challenges to payment--final report. Transfusion. 2003;43(8 Suppl):3S-46S. doi:10.1046/j.1537-2995.43.8s.2.x

26. Azarkeivan A, Ahmadi MH, Hajibeygi B, Gharebaghian A, Shahbehpour Z, Maghsoudlu M. Evaluation of transfusion reactions in Thalassemic patients referred to the Tehran adult Thalassemia clinic. J Adv Med Biomed Res. 2008;16(62):57-66. [Persian].

27. Najafi Ghezeljeh T, Kalhor L. Clinical outcomes of blood transfusion after coronary artery bypass graft surgery: a review of literature. Iranian Journal of Cardiovascular Nursing. 2015;4(3):64-71. [Persian].

28. Salimi SA, Feizi A, Vanabadi N. Incidence rate of acute reactions in transfusion of blood and its products prepared by Urmia Blood Refinery Center. Advances in Nursing & Midwifery. 2009;19(66):8-13. [Persian].