

BLOOD TRANSFUSION IN EMERGENCY SITUATIONS INCLUDING CONDITIONS OF MASSIVE BLEEDING, URGENT AND MASSIVE TRANSFUSION

Kiril Lazov¹, Maja Spirova²

¹Institute of Transfusion Medicine Skopje, North Macedonia

²PHI University Clinic for Psychiatry, Skopje, North Macedonia

Abstract

In situations involving major blood loss, early diagnosis and effective intervention are essential in preventing the development of hypovolemic shock and its consequences. Rapid provision of blood and blood components may be of vital importance. The key prerequisites include:

Efficient interdisciplinary communication, documentation and investigation of all events associated with massive blood loss, implementation of clinical and laboratory protocols for the management of major hemorrhage, appropriate pretransfusion testing including determination of ABO blood group and RhD antigen, as well as cross matching including the anti-human globulin (AHG) phase.

In emergency situations, the following may be administered: O RhD-negative uncross matched blood; ABO and RhD-specific uncross matched blood; or ABO and RhD-specific blood with incomplete crossmatch.

Keywords: blood grouping and cross matching, emergency treatment, blood group incompatibility, blood component transfusion, haemorrhagic shock

Introduction

In clinical situations involving life-threatening blood loss, early recognition of risk and prompt intervention are essential to prevent hypovolemic shock and its associated complications. The rapid availability of blood and blood components is frequently crucial. Emergency clinical conditions requiring immediate transfusion support include massive obstetric haemorrhage, pediatric trauma, neonatal bleeding, gastrointestinal haemorrhage, hematological emergencies, trauma, and other acute conditions.

Aim

The aim of this paper is to present the most important aspects in the chain of events that ensure the availability of blood and blood components for patients requiring urgent or massive transfusion.

Discussion

On the adequacy of blood transfusion in emergency conditions and massive bleeding conditions influenced by many factors. On Chart 1 the most frequently asked questions are shown investigates the cause of inadequate transfusion in these situations.

Chart 1. Chief issues associated with adequate treatment for patients with urgent/massive transfusion needs

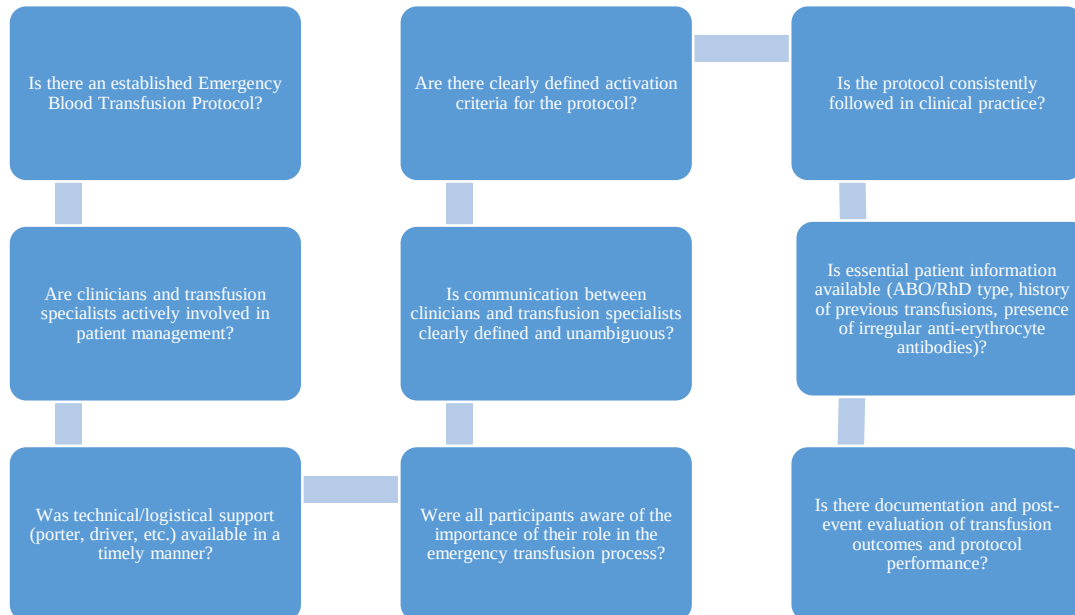
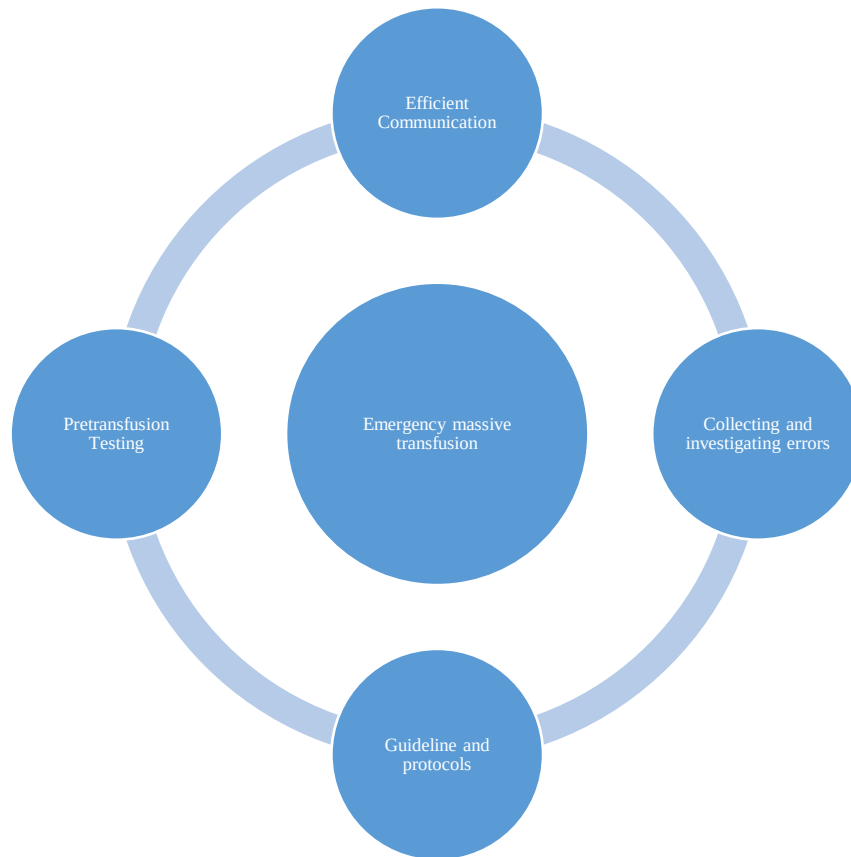


Chart 2. The most important aspects of providing blood transfusion for patients in urgent conditions, including the state of massive blood loss



Efficient Communication

The human factor plays a significant role in the effectiveness of transfusion therapy. In addition to rapid and appropriate clinical response, efficient communication among all members involved in the management process is crucial. These include emergency physicians, surgeons, anesthesiologists, transfusion medicine specialists, hematologists, nursing staff and technical support personnel. Prompt notification of the transfusion service and involvement of a hematologist is necessary in order to anticipate requirements for fresh frozen plasma, cryoprecipitate, platelets, and management of potential coagulopathy.

Collecting and investigating errors

Every event associated with massive blood loss must be documented. Any difficulties encountered in the provision of blood, as well as clinical outcomes such as mortality, morbidity or adverse incidents, should be recorded and analyzed. This enables evaluation and improvement of transfusion strategies in emergency situations. Potential problems may occur at any stage of the transfusion process and may arise from errors in clinical assessment, decision-making, or communication.

Guideline and protocols

One of the difficulties in emergency scenarios or conditions where there is significant patient bleeding is striking a balance between the need for blood and minimizing the needless usage of blood components. Protocols for handling severe bleeding or transfusions provide the best and safest recommendations for using blood products, improving patient safety. They are required in every hospital and are updated annually. They cover clinical and laboratory care in situations involving significant blood loss. Protocols must be understood by employees at all levels. Staff members must comprehend their function and significance in the patient care process during theoretical and practical instruction. The collection, critical evaluation, and reporting of post-transfusion responses and transfusion procedure errors are crucial for the development and enhancement of guidelines. Transfusion facilities need to have protocols in place for quickly supplying fresh frozen plasma, platelet concentrates, and erythrocytes to patients with severe bleeding or urgent conditions.

Pretransfusion testing

Pre-transfusion testing is necessary for whole blood/erythrocyte transfusions and includes:

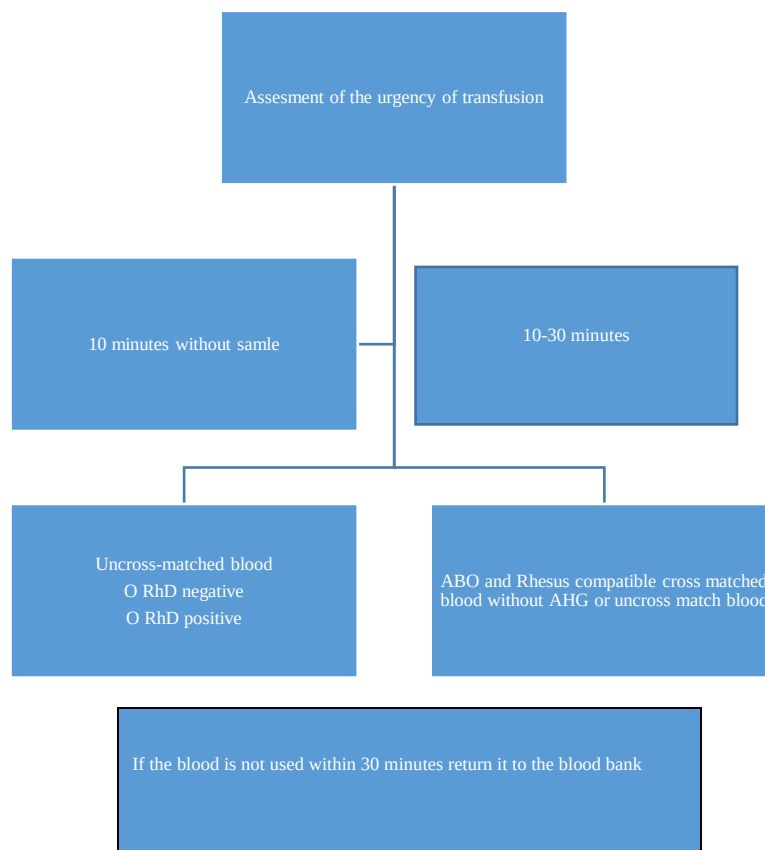
- 1) Determining the patient's RhD antigens and ABO blood group;
- 2) Cross-reaction (compatibility) between patient plasma and donor erythrocytes (serological crossmatch that includes anti-globulin phase).

The process can take anything from 45 minutes to an hour. In some circumstances, a transfusion might be required. Whenever possible, ABO and RhD isogroup RBCs should be utilized. To utilize blood without cross matching, the clinician must sign a request. If a patient has irregular alloantibodies and has a blood transfusion without a crossmatch, they may experience a haemolytic response.

Urgent transfusions carry a minimal and acceptable risk.

Chart 3 displays the pre-transfusion testing volume based on the clinical doctor's estimate of the transfusion's urgency.

Chart 3. Level of pretransfusion testing in relation to the degree of urgency of erythrocyte concentrate transfusion



The following apply:

- a) O RhD-negative blood, no crossmatch
- b) ABO and RhD specific blood, no crossmatch

a) A specific quantity of erythrocyte units—both RhD-negative and Kell-negative—are kept in storage by transfusion facilities for use in emergency scenarios. Within 10 minutes of receiving the blood request, patients may receive urgent transfusions of ORhD-negative deplassmatized erythrocytes without crossmatch if there is no patient blood sample or time for testing (i.e., blood group and crossmatch determination). Due to the restricted supply of RhD-negative blood, patients who are bleeding should only utilize a minimal amount of it [16]. Transfusions of ORhD-positive erythrocytes can be employed in the absence of ORhD-negative deplassmatized erythrocytes in patients who are at risk for death, particularly men and women who are not of reproductive age. The result of RhD-positive erythrocytes is RhD-negative D vaccination. ABO and RhD-specific units are thereafter given to the sick when they have a certain blood group.

b) Within 10-30 minutes of obtaining the sample in the laboratory, patients can issue ABO/RhD typed blood without cross matching or ABO/RhD typed blood with cross matching but no AHG phase. Cross matching without the AHG phase is not fully safe as it only detects unexpected antibodies, such as those in blood corpuscle systems MN, P, and Lewis, which are typically not clinically important. Patients who have previously received blood transfusions or are pregnant are more likely to experience a haemolytic transfusion reaction due to exposure to foreign erythrocyte antigens and the development of antibodies. Cross matching without the AHG phase involves spinning tubes containing plasma from both the patient and the donor, resulting in macroscopic agglutination. If the test results are negative, the patient will receive blood transfusion.

Meanwhile, testing continues with cross matching using anti-human globulin reagent (AHG) gel technique or the conventional approach in a test tube. A positive test result may necessitate a transfusion, which can lead to termination. Forward information to clinical physicians to evaluate the risks and benefits of emergency transfusions.

There are several reasons why this step can be avoided in an emergency. The first explanation is the prevalence of antibodies, which can range from 0.004% in individuals who have never received a transfusion or been pregnant to over 0.3% in transfused individuals and pregnant women, and as high as 5–30% in individuals who have received repeated transfusions. The fact that not all of them are IgG class antibodies with clinical significance is another factor. Additionally, the majority of antibodies do not bind complement, which results in extravascular hemolysis, which is less life-threatening than intravascular hemolysis. Among the causes include post transfusion responses brought on by decreased antibody concentrations as a result of blood loss or fluid replacements, even when antigen-positive erythrocytes are administered to individuals with clinically substantial antibodies, can be mild or delayed. Every unfinished pretransfusion test needs to be finished backward. This suggests that every blood unit type applied is based on the antigen that triggers the immune response in order to increase the risk of a postponed hemolysis reaction.

In emergency scenarios, patient samples must be securely identified. Laboratories offer blood units based on new blood samples, rather than archival records. Once the patient's identity is determined, notify the transfusion facility and review previous records.

For high-volume transfusions, blood units should be warmed at room temperature for 15-30 minutes, in a water bath, or in dedicated machines that provide dry, warm air at 37°C. Inadequate heating or prolonged exposure to room temperature might cause erythrocyte hemolysis and bacterial growth. If blood is not utilized within 30 minutes, it should be returned to the transfusion facility. Refrigerators in hospital rooms and clinics are not permitted to store unused units of blood or components.

When a patient requires a transfusion, the clinician must assess the urgency of the situation, seek support from appropriate institutions, and collect a sample for testing. Contacting a haematologist can help clinicians prioritize laboratory tests, estimate the need for additional blood units, and provide advice on managing coagulopathy. After determining the patient's ABO blood group and RhD antigen, fresh frozen plasma and cryoprecipitate (after 30 minutes of defrosting) can be used, along with platelets if available.

Conclusion

Ensuring the safe and timely provision of blood and blood products in emergency situations, particularly in cases of major hemorrhage, requires a well-structured and consistently implemented Emergency Blood Transfusion Protocol. Effective management depends on close collaboration between clinical teams and transfusion services, clearly defined roles and responsibilities, and unambiguous communication pathways.

The availability of accurate patient data (including ABO/RhD typing, transfusion history, and antibody screening results), together with rapid logistical and technical support, plays a critical role in minimizing delays and preventing transfusion-related complications. Standardized activation criteria and adherence to established guidelines for the prompt release of erythrocytes, plasma, and platelets are essential to ensure both patient safety and optimal clinical outcomes.

Furthermore, continuous monitoring, documentation, and post-event evaluation of protocol performance are necessary to identify potential gaps and improve future practice. A systematic, multidisciplinary approach strengthens institutional preparedness, enhances response efficiency, and ultimately contributes to reduced morbidity and mortality associated with severe bleeding and transfusion emergencies.

References

1. Allard S and Bolton-Maggs PHB. Haematological aspects of bleeding emergencies – a brief overview. *Vox Sanguinis* 2017; 12:73–79.
2. Bujandrić N, Grujić J i Krga Milanović M. Transfuziološko zbrinjavanje bolesnika sa eritrocitnim antitelima. *Med Pregl* 2013; LXVI (11-12):491-96.
3. Callum JL, Nascimento B and Alam A. Massive haemorrhage protocol: what's the best protocol? *Vox Sanguinis*. 2016; 11(S1):297–306.
4. Charbit J, Lakhal K, Deras P, Dehon A, Latry P, Boissier E, Schved JF and Capdevila X. Influence of surgical bleeding on the relationship between admission coagulopathy and risk of massive transfusion: lesson from 704 severe trauma patients. *Vox Sanguinis*. 2016; 111(2):151–160.
5. O'Brien KL and Uhl L. How do we manage blood product support in the massively hemorrhaging obstetric patient? *Transfusion*. 2016; 56(9): 2165–71.
6. Stanković B and Stojanović G. Chemotherapy analysis in massive transfusion syndrome. *Med Pregl*. 2016; LXIX (1-2):37-43.