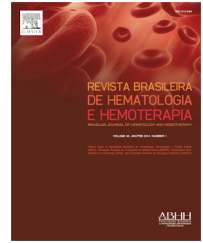




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Special article

Teaching transfusion medicine: current situation and proposals for proper medical training



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ABSTRACT

The current curricula in medical schools and hospital residence worldwide lack exposure to blood transfusion medicine, and require the reformulation of academic programs. In many countries, training in blood transfusion is not currently offered to medical students or during residency. Clinical evidence indicates that blood transfusions occur more frequently than recommended, contributing to increased risk due to this procedure. Therefore, the rational use of blood and its components is essential, due to the frequent undesirable reactions, to the increasing demand of blood products and the cost of the process. Significant improvements in knowledge of and skills in transfusion medicine are needed by both students and residents. Improvements are needed in both background knowledge and the practical application of this knowledge to improve safety. Studies prove that hemovigilance has an impact on transfusion safety and helps to prevent the occurrence of transfusion-related adverse effects. To ensure that all these aspects of blood transfusion are being properly addressed, many countries have instituted hospital transfusion committees. From this perspective, the interventions performed during the formation of medical students and residents, even the simplest, have proven effective in the acquisition of knowledge and medical training, thereby leading to a reduction in inappropriate use of blood. Therefore, we would like to emphasize the importance of the exposure of medical students and residents to blood services and transfusion medicine in order for them to acquire adequate medical training, as well as to discuss some changes in the current medical curricula regarding transfusion medicine that we judge critical.

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Introduction

The inadequacy of the current medical curricula in blood transfusion in Brazil makes it necessary to recast the academic

programs of medical graduation and residence. In the majority of countries, training in blood transfusion is not currently offered to medical students or residents, and thus curriculum teaching is poor in this area.¹ The optimal clinical use of blood and blood products requires profound theoretical

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and practical knowledge of transfusion medicine. While the importance of a continuous knowledge transfer in transfusion medicine is well recognized, less is known about the character and scope of education provided to medical students and residents.² Despite major advances in different medical disciplines and the application of modern specialized therapeutic methods, transfusion medicine is still traditionally practiced by non-specialized medical practitioners, who are unaware of the numerous advances in transfusion medicine.¹

The lack of knowledge in blood transfusion can reduce transfusion safety and cause significant harm to the patient. Thus, competent performance becomes an essential requirement in transfusion medicine, preventing possible complications and transfusion reactions.³ Transfusions are becoming increasingly important in medical treatments nowadays. The awareness that these procedures have an inherent risk, makes it necessary to keep a watchful eye on the quality of transfused blood. This is directly linked to the standards of quality of the blood provider, which starts with the recruitment of blood donor candidates, a fact that many physicians are unaware. Of utmost importance is a full understanding of the correct indications of blood components, which is the initial step in increasing transfusion safety. "Muse before you transfuse" is a rule that all potential transfusers should utilize (J.P. Isbster, personal communication).

Considering that a large number of medical students and residents will be involved in the course of their practice, whether be it medical or surgical, with health services where the prescription of blood components and derivatives is necessary, it is mandatory to have appropriate and solid knowledge through theoretical and practical training. This training must aim to enable a correct prescription and use of blood products. However, at present a considerable number of young physicians are unaware of the importance of blood use, and lack the knowledge on the indications and hazards of the use of blood products, despite medical education programs that are increasingly looking to train general professionals, who should be able to aptly prescribe blood components.

The prescription of blood components mobilizes a complex structure through a cyclical process that starts with the awareness of the population regarding blood donation, which comprises the selection of adequate candidates to donate and ends with the processing and adequate storage of the blood component.

This precious and expensive product will ideally later be made available to the patient in need of a blood transfusion through a precise indication and with adequate support during the procedure. For this to be accomplished, it is necessary to invest in the medical training of both the general practitioner and the specialist who, in Brazil today, do not receive training in their graduation and residence programs.

We would like to discuss some changes in the current medical curriculum regarding transfusion medicine that we judge critical and analyze some information on the educational practice in transfusion medicine throughout the world, with particular emphasis on the education and training of medical students and residents.

Educational practice in transfusion medicine in the world

In Australia, medical student education is primarily the responsibility of universities and their associated teaching hospitals. Different structures exist at various universities, with some offering undergraduate and others postgraduate medical school programs. The content, amount and timing of transfusion teaching vary greatly between medical schools. Some programs include transfusion content from the first year of training, while others only include it at later stages. The education mainly consists of lectures and tutorials with great diversity between institutions with regard to practical vs. didactic teaching methods. Medical resident teaching is provided largely by the academic teaching hospitals. There is again considerable variation between institutions as to the timing, content and emphasis placed on teaching transfusion medicine. Most will include transfusion as part of the intern education program; however, the extent and content of teaching in this area varies greatly. There is currently no national, standardized curriculum in transfusion for all medical students or residents. University teaching hospitals set their own curricula, and the relevant staff at individual training hospitals determines the content of local transfusion teaching to junior resident staff. Some Australian states require completion of a transfusion module before or during internship or residency in their public hospitals. Completion of these courses, however, is not required for medical school graduation or medical registration.²

In Brazil we have a common hematology and transfusion medicine (called *hemotherapy*) residence program in the country; the latter accounts for approximately 30% of a minimum 2-year program. Some private hospitals maintain a residence program and then the blood transfusion service is responsible to provide adequate training and education on the clinical aspects concerning patient blood management for all residents during their training. The educational program may include lectures and practical activities covering the basic blood cycle (recruitment, collection, processing of blood components, storage, pre-transfusional tests, prescription of blood components and transfusional reaction management), therapeutic aphaeresis; platelet refractoriness management (clinical and laboratory), blood transfusion in intensive care unit; maximum blood surgery ordering schedule (MBSOS); autologous blood transfusion (mainly intra-operative salvage); infectious marker donor counseling, etc. In addition, residents follow the permanent blood transfusion service medical staff in their daily activities, which allows them to see the medical problems that occur in hospitals.²

In France, blood transfusion is not a full university discipline. Some French medical schools have university professors specialized in transfusion, who provide their courses to medical students. In other medical schools, hematologists teach transfusion, but the number of hours is often low. Residents specializing in transfusion can do internships in blood banks, but there are very few of them. The curriculum varies in each Hospital-University Center for both medical students and residents, but the French Society of Blood Transfusion (SFTS) regularly updates a standard curriculum. The organization

of the teaching of transfusion depends on each Hospital-University Center (they work independently from each other). The same is also true for the distribution of lecture time vs. practical training. The time devoted to practical training is variable, sometimes very reduced, if existent. Courses are obligatory for medical students, and optional for residents. Most often the subject of the blood transfusion is included in hematology for medical students. Successful passing of the hematology transfusion examination is necessary to go into the following year. For the residents, transfusion medicine is fully optional and depends on the specialty chosen.²

In virtually all these countries, medical students receive some education in transfusion medicine. The extent and form of this education does not only vary considerably from country to country, but also between universities/medical schools within most of the countries. Education in transfusion medicine for residents also varies and depends on the specialization involved.²

Evidence-based blood transfusion

When a good blood product is available, prepared in a blood center that has good manufacturing processes and quality assurance, then one needs to use it properly, i.e., to prescribe it according to accepted and updated protocols of blood utilization.

To devise these protocols, blood transfusion physicians and researchers utilize studies that highlight which blood product is the best for the patient, which will give less morbidity and better survival.

Clinical evidence indicates that transfusions occur worldwide more often than recommended,⁴ contributing to the increased risk of the procedure which is also directly proportional to the amount of blood transfused. Among the known risks, one is the triggering of an inflammatory response in the recipient.⁵

In this way, it is necessary to better assess the real benefits of blood transfusion, since recent studies have demonstrated for example that a reduction in the reference thresholds for transfusion in critically ill patients may be of benefit.^{5,6} Thus, the individualized assessment of each case, the evaluation of the risks and benefits associated with blood transfusion, as well as always revising existing protocols, are actions that must be considered mandatory before prescribing transfusion.

Thus, the best way to reduce the adverse effects of blood transfusion is to reduce the number of unnecessary and inappropriate transfusions. Moreover, the rational use of blood and its components is necessary, due to the increasing demand of blood products and the cost of production.⁷

Given this reality, many national and international guidelines have been created, aiming to optimize and standardize transfusion practices. For this, several studies were conducted to evaluate the effectiveness of the protocols, individually or combined with other interventions, such as the distribution of educational materials and practical training of clinical staff.⁶

Despite the interventions performed, the factors that influence prescribing a transfusion in the clinical practice are not yet fully known.^{4,8} Current studies still fail to clearly define the rationality of transfusion practice and the effectiveness of

performed interventions. Therefore, it is still necessary to seek a better understanding of these factors in order to reduce the unnecessary use of blood products.⁸

As a starting point, in the development of such interventions, it is suggested that investment be made in medical training by exposing both the general practitioner and the specialist to blood services and transfusion medicine teaching.

Transfusion medicine in medical training

Significant improvements in knowledge of and skills in transfusion medicine are needed for both students and residents. However, the minimal lecturing schedules needed at both undergraduate and postgraduate levels are difficult to determine. Ongoing monitoring of clinical practice outcomes, such as through hemovigilance programs and in-hospital audits, is needed to continually evaluate the effectiveness of education and training programs, with further effort tailored to the results of these assessments.²

Improvement is needed in both background knowledge and practical application (general and institution-specific) of this knowledge to further the safe practice of transfusion medicine. Any additional teaching in this area could be adapted and implemented at different stages of training, with possibly more emphasis on knowledge of the theoretical background during medical school and highlighting the practical aspects at the start of residency.^{2,6,7}

Formal assessments, whether by examination or other means, or requirement of completion of a training program should ideally be incorporated into the various teaching structures to enhance alignment of students' and residents' knowledge and skills with the relevant educational activities. A national approach to the training of residents could ensure that all medical practitioners have at least a basic exposure to the fundamentals of transfusion medicine. Additional training of medical students and residents could be of substantial benefit. Medical education in transfusion could be further enhanced at the start of residency, reinforcing important concepts and promoting compliance with basic safe transfusion practices. Attention should be paid to critical practical applications such as patient identification, appropriate clinical decision-making, prescription of blood, monitoring of patients and investigation of adverse reactions covering both general principles and institution-specific requirements.^{2,7}

The knowledge of interns and residents could also be improved through a multidisciplinary team approach, incorporating input from senior transfusion scientists and specialist transfusion nurses into the delivery of education and training. If every resident could be exposed to this rotation at some point during their residency, the greater awareness of transfusion issues would be anticipated and translated into improved practice.^{2,6}

Blood safety and hemovigilance

Hemovigilance is a relatively new system in the world, first implemented in France in 1993 and then in the United Kingdom. In Brazil, the hemovigilance process, first defined

through Resolution RDC 153 of the Brazilian sanitary agency ANVISA, started in 1999.⁹

Hemovigilance is defined as an evaluation and alert system, organized with the objective of collecting and evaluating information about adverse and/or unexpected effects of the use of blood products to prevent the occurrence or recurrence of these effects.^{10,11} Hemovigilance deals with the safety of the blood transfusion chain and can be summarized in one phrase: "the security of vein to vein."¹² This information is used to identify risk, improve quality of products and processes and increase the safety of the donor and the patient, preventing the occurrence or recurrence of such events. It is important, for example, in situations of seroconversion of donors to Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) that are associated with infection in the recipient. Proper monitoring of these cases are only accomplished through the existence of an active system of hemovigilance in the hospital and blood center, a fact that demonstrates the unique importance of this tool in transfusion safety.¹⁰

Moreover, despite advances in serological methods, the risk attached to the immunological window period is still present and therefore the development of diagnostic methods with greater sensitivity, such as NAT, and with a lower negative predictive value, but without the loss of specificity are required to reduce the risk of transmission of infectious diseases through blood transfusions. These data demonstrate the need to educate the medical and lay community and publicize that donation is an act of citizenship that aims to save lives and not to transmit diseases.⁹

Perhaps due to its recent implementation, hemovigilance has not yet been included in medical graduation or residency programs, as would be desirable.

Hospital blood transfusion committees

In order to ensure the appropriateness of blood transfusion, "Hospital Transfusion Committees" (HTCs) have been created in different countries to oversee all aspects of the transfusion of blood products. HTCs are local committees with a multidisciplinary approach for the promotion and monitoring of correctness of blood product usage.¹³

The approaches used to achieve this goal have varied both historically and between nations. The principles of these methods are common, and the use of a HTC or Blood Utilization Committee has been promoted worldwide at one time or another. The role of the HTC can be described as the promotion of best transfusion practice through the enhancement of awareness and education, facilitation of policy development, and monitoring and reviewing the use of blood and blood products and adverse incidents involving these products.¹³

The main functions of a HTC include: (a) developing systems for the implementation of the national guidelines within the hospital; (b) liaison with the blood transfusion service to ensure the availability of required blood and blood products at all times; (c) liaison with the relevant department to ensure a reliable supply of intravenous replacement fluids and other alternatives to transfusion at all times; (d) developing a hospital blood ordering schedule; (e) developing hospital

standard operating procedures for all steps in the transfusion process; (f) training all hospital staff involved in transfusion; (g) monitoring the usage of blood and blood products within the hospital; (h) the investigation and monitoring of severe adverse effects or errors associated with transfusion, taking any corrective and preventive actions required and reporting through the hemovigilance system to national committees on the clinical use of blood.¹³

Generally speaking, clinicians receive little or no formal training on the clinical indications for blood transfusion therapies during their time at medical school.^{2,5} HTCs can promote best practice by providing continuing professional education and monitoring performance by clinical audit and peer reviewing. Regularly notifying clinicians on their performance is an additional strategy that may improve transfusion practice.¹³

Final considerations

Over the past decades, the fields of activity and knowledge in transfusion medicine have evolved into an array of diverse areas and sub-specialties including immunohematology, blood component production, hemapheresis, pathogen detection, methods of cell and tissue collection and manipulation, cell conservation and banking, transplant immunology and hemostaseology. In the majority of the clinical disciplines, clinicians are required a basic or more advanced knowledge in these fields to meet the requirements of modern medicine. Specialist physicians in transfusion medicine are valuable and competent partners for these related disciplines when it comes to safe, effective and tailored blood transfusion. Transfusion medicine is thus an important qualification at the interfaces of analytical laboratory medicine, pharmaceutical production and clinical disciplines such as internal medicine, anesthesiology and surgery. Although transfusion specialists have focused considerable efforts on identifying mechanisms to reduce transfusions, there has been little analysis to identify the best means to change transfusion practice among physicians.¹⁴

Behavioral interventions to modify transfusion practices have proven effective, and it is important to be able to change transfusion practices among physicians, given the potential risks associated with transfusions and the challenges facing the blood transfusion system.¹ One of the methods to reduce blood use is to do on site interventions and monitoring, as well as providing training to physicians.¹⁴ Previous studies have shown that the knowledge of medical doctors needs to be improved, as it has an important role in the optimal use of blood products. Moreover, this awareness influences their approach toward blood transfusion of patients in need of blood and blood components. As physicians are the ones ordering blood, they play a major role in determining the amount of blood and blood components to be used.

Appropriate prescription of blood components and blood transfusion is negatively correlated with the number of years in practice, calling for change and development of continuous in-service training programs.¹

In Brazil, medical students in their general medicine and residency courses are currently not provided with formal academic training; despite vast developments in different

specialized medical disciplines related to blood transfusion and application of modern specialized methods, transfusion medicine is still practiced traditionally by practitioners and they are largely unaware of these new developments in transfusion medicine.

Finally, while many choices of blood products have complicated the physician's decision-making process, they have also made hemotherapy more specific and effective. Therefore, educational programs and preparation of curricula according to the most recent advances in transfusion medicine are needed in order to enhance the knowledge of medical students, residents and physicians.

Conflicts of interest

The authors declare no conflicts of interest.

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