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Original article

Blood transfusion in children at a university hospital in a middle-income country: The need to reinforce adherence to current guidelines



Transfusion sanguine chez les enfants dans un hôpital universitaire d'un pays à revenu intermédiaire : nécessité de renforcer le respect des lignes directrices actuelles

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ARTICLE INFO

Article history:

Available online 18 March 2020

Keywords:

Blood Bank
Pediatrics
Transfusion medicine

Mots clés :

Banque de sang
Médecine transfusionnelle
Pédiatrie

ABSTRACT

Objectives. – Blood component transfusion is a common procedure used during hospital admissions; however, it is not risk-free. The evaluation of correct use of blood products (BP) is of vast importance considering the risks and costs implied in their use. Our principal objective was to evaluate the adherence to national guidelines for blood transfusion in pediatric patients at a third level university hospital.

Material and methods. – A prospective and retrospective descriptive analytical study was conducted to report the incidence of incorrect use of BP in pediatric patients (1 month to 16 years of age). In a timeline period of 4 years, 579 medical records were randomly selected from a total of 6575 transfusions realized to create a statistically significant sample. The variables studied were volume, infusion time, and transfusion criteria. Indications were evaluated in patient's medical records according to national guidelines.

Results. – Of the transfusions analyzed, 54% were classified as incorrect mainly due to lack of transfusion criteria fulfillment. Blood transfusion indications in pediatric patients adhered poorly to national guidelines.

Conclusion. – The implementation of effective programs for education and information on the use of BP are needed to increase compliance with current guidelines.

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R É S U M É

But ou objectif. – La transfusion des composants sanguins est une procédure courante utilisée lors des admissions à l'hôpital ; cependant, elle n'est pas sans risque. L'évaluation de l'utilisation correcte des produits sanguins (PS) est d'une grande importance compte tenu des risques et des coûts impliqués dans leur utilisation. Notre objectif principal était d'évaluer l'adhésion aux directives nationales pour la transfusion sanguine chez les patients pédiatriques dans un hôpital universitaire de troisième niveau.

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Matériels et méthodes. – Une étude analytique descriptive prospective et rétrospective a été menée pour signaler l'incidence d'une mauvaise utilisation des PS chez les patients pédiatriques (âgés de 1 mois à 16 ans). Sur une période de 4 ans, 579 dossiers médicaux ont été sélectionnés au hasard sur un total de 6575 transfusions réalisées pour créer un échantillon statistiquement significatif. Les variables étudiées étaient le volume, le temps de perfusion et les critères de transfusion. Les indications ont été évaluées dans les dossiers médicaux des patients conformément aux directives nationales.

Résultats. – Parmi les transfusions analysées, 54 % ont été classées comme incorrectes principalement en raison du manque de respect des critères de transfusion. Les indications de transfusion sanguine chez les patients pédiatriques respectaient mal les directives nationales.

Conclusion. – La mise en œuvre de programmes efficaces d'éducation et d'information sur l'utilisation des PS est nécessaire pour accroître le respect des directives actuelles.

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1. Introduction

Blood transfusion is one of the most common procedures performed in medical practice during in-hospital attention [1,2]. It is widely used in many pediatric medical conditions such as anemia, thrombocytopenia, coagulation disorders, or hemorrhage due to trauma or surgery. The selection of the correct procedure is important to diminish complications and adverse effects. Despite improvement on safety measures, risks associated to blood transfusion remain [3,4]; thus transfusions should be given only when benefits are greater than the potentially associated side effects [5–7]. This principle has helped to standardize blood transfusion indications and decide who is a candidate for such procedure and who is not. The next step of this process is to translate the information into a widely adopted and consistent practice through the development of clinical practice guidelines [5].

Research has been conducted throughout decades to establish guidelines for blood transfusion [8–10], and the proper collection, evaluation of the donor, preservation and application of the BP [11–15].

Protocol and guidelines have been established for the safe and correct use of BP. It is important that personnel that operate BP understand and verify the adherence to their normative around the world [16–18], in order to implement actions that permit optimal clinical improvement and reduce the number of adverse effects related to blood transfusion. In our country the “Guideline for the clinical use of blood from the Secretary of Health” [19] indicates the specifications for BP transfusions, in both adult and pediatric patients. This guideline follows the requirements and recommendations from international institutions such as the World Health Organization (WHO) and the AABB. However, there is a lack of specifications in numerous clinical scenarios regarding the neonatal and pediatric population.

The present study was carried out in a University Hospital in northeast Mexico, focusing on prescribing practices of pediatrics residents, as they are who mainly prescribe the use of blood components. Adherence to national guidelines in daily practice reflects their level of knowledge and comprehension, and analysis of current practices allows to determine specific education needs based on the results.

The main objective of the present report was to evaluate the use of blood products in pediatric patients and to determine if transfusion of BP was accurately indicated. Other objectives were to determine which clinical departments have the highest levels of non-adherence to guidelines for the clinical use of blood, and which are the blood products with the highest rate of non-compliance with guidelines.

2. Material and methods

2.1. General strategy

This is a bidirectional, descriptive and analytic study to document the prevalence of correct and incorrect use of blood components in pediatric patients. The study was approved by the Institution's Ethics and Research Committee.

Blood bank's transfusion records from the University Hospital Dr. José E. González were analyzed and correlated with the patient's medical file in order to evaluate indications in patients from 30 days old to 16 years during a period of 4 years. From a total of 6575 transfusions a statistically significant sample for a finite population with a 95% confidence interval was estimated in 579 transfusion episodes. A total of 172 medical files (recipients) were studied for correlation.

Indications, including product type, volume and infusion time, and justifications were evaluated directly in the patient's medical records as correct or incorrect according to their adherence to National Guidelines. Information was organized according to the clinical departments responsible for the transfusions.

The statistical analysis was performed using the SPSS software version 21.0; frequency and percentages were calculated; variables were evaluated with the Kolmogorov-Smirnov test and for qualitative variables chi-square was used.

Patients with lack of relevant perinatal background, congenital pathologies and records with insufficient data were excluded.

3. Results

Physicians analyzed a total of 579 transfusions and correlated with 179 medical files (recipients) from each pediatric ward. We found that 311 (53.7%) of the transfusions were classified as incorrectly indicated. Numbers of different blood products were 252 (43.5%) for erythrocyte, 226 (39.0%) for platelet and 8 (1.4%) for leuko-reduced platelet concentrate, 85 (14.7%) for fresh frozen plasma and 8 (1.4%) for cryoprecipitate (Fig. 1). Blood products incorrectly indicated included 153 (60.7%) of erythrocyte concentrates; 91 (38.9%) of platelet concentrates; 64 (75.3%) of fresh frozen plasma and 6 (75%) of cryoprecipitates (Fig. 2). Indication errors were classified as incorrect volume, inappropriate transfusion rate, lack of transfusion criteria or more than one error (Table 1).

From all the transfusions 201 (34.7%) were performed in Infant and Preschooler guards 187 (32.3%) in the Pediatric Intensive Care Unit, 165 (28.5%) in the emergency department, 15 (2.6%) in the operating room, 9 (1.5%) in surgery recovery rooms, and 2 (0.34%) in other departments, including Orthopedic and Plastic Surgery services.

TRANSFUSIONS

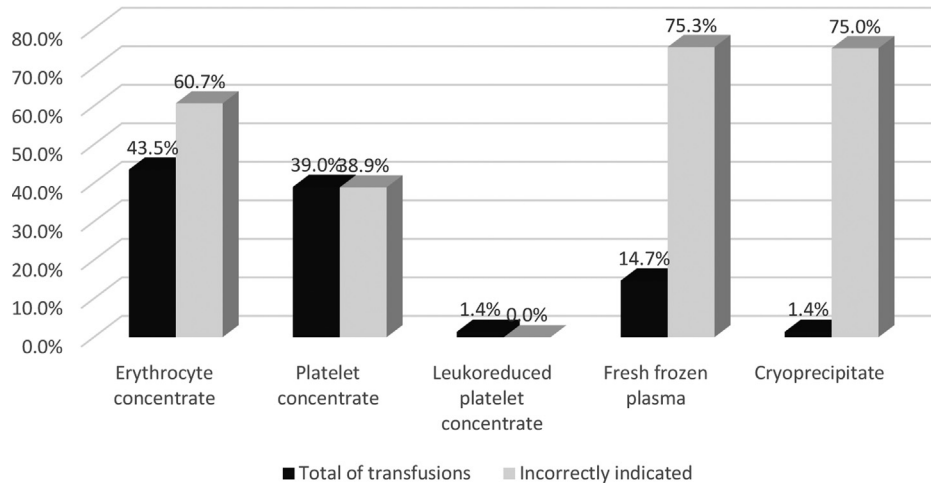


Fig. 1. Evaluation of correct and incorrect indication by type of blood product.

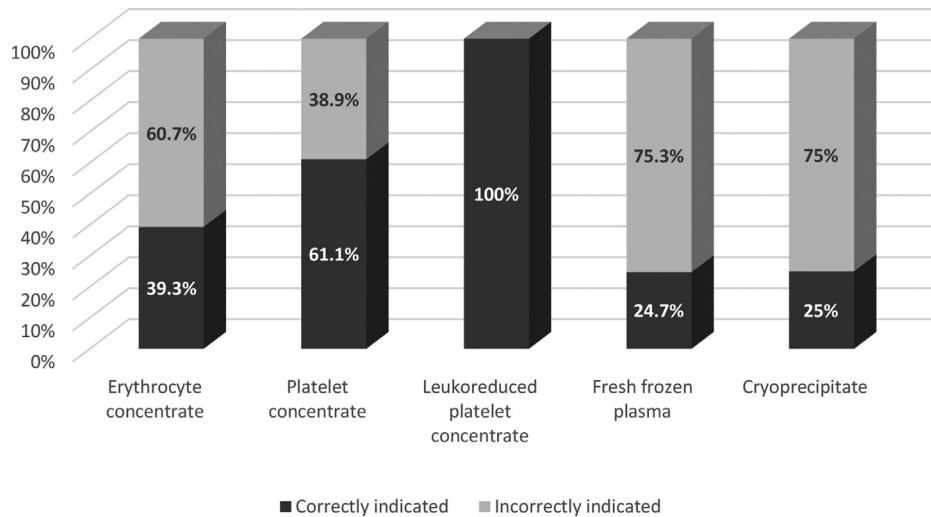


Fig. 2. Percentage of the patients that require a transfusion by pathology.

Table 1

Types of inappropriate blood transfusion indication in pediatric patients at a university hospital.

Error type	n (%)
Volume	76 (24.4%)
Infusion Time	26 (8.4%)
Lack of transfusion criteria	152 (48.9%)
Volume and Infusion Time	4 (1.3%)
Volume and lack of transfusion criteria	33 (10.6%)
Infusion time and lack of transfusion criteria	19 (6.1%)
Volume, Infusion time and lack of transfusion criteria	1 (0.3%)
Total	n = 311 (100%)

(1) volume; (2) infusion time (3); lack of transfusion criteria (4); volume and infusion time; (5) volume and lack of transfusion criteria; (6) infusion time and lack of transfusion criteria; (7) volume, infusion time and lack of transfusion criteria.

The majority 348 (60.1%) of transfusions were indicated for hemato-oncologic diseases, 61 (10.5%) for traumatologic conditions, 56 (9.7%) for infectious, 31 (5.4%) for cardiovascular, 29 (5.0%) for gastrointestinal, 26 (4.5%) for respiratory and 28 (4.8%) for other pathologies (Fig. 3).

4. Discussion

Blood products are commonly used in pediatric patients. Indications for their correct use are found in widely available clinical guidelines written to establish specific conducts, to guarantee a high benefit/risk ratio and to avoid adverse effects. Previous studies found a high percentage of inappropriate use, from 15 to 39% of BP's indicated [20]. However, these reports analyzed smaller samples in a shorter period. We documented that the incorrect use of BP's is up to 3.6 times than in previous studies. Parameters and indications for BP transfusion require a thorough review, emphasizing the most frequent errors in order to significantly improve current blood ordering practices in the study's academic institution. Therapy with BP is an instrument with undebatable potential to save lives in critical situations, improve patient's symptoms and overall condition. It is considered an efficient therapy, however, like many other therapeutic interventions, this procedure is not innocuous [21–24]. Unlike other developing countries [25,26], the proper rules on how and when to correctly indicate BP's exist in Mexico and they are regularly reviewed and modified based on scientific evidence [19]. However, as previously mentioned, this guidelines lack of different clinical scenarios and indications for both adult

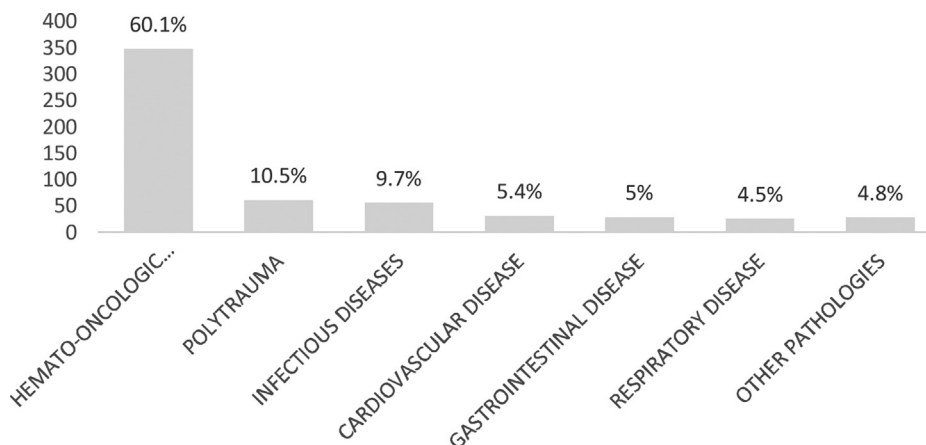


Fig. 3. Transfusions realized organized by type of blood product and error percentage.

and pediatric patients are homologated in some pathologies. Other Latin American countries, such as Argentina, have exclusive guidelines for neonatal and pediatric patients, which reveals the urgency to develop a guide of our own based on the American and European models [27]. The findings in this report demonstrate that there is poor adherence to currently available guidelines, and the need to considerably improve blood use education in the academic setting with close senior staff supervision and strong emphasis in continuing education.

In studies performed in other third-level academic hospitals to evaluate the use of BP's in pediatric populations results vary widely, from 5 to 39% of BP's have been reported as incorrectly indicated [20,26]. We found a higher incidence of incorrect indications (54%) in our center, which differs from international reports that found an adherence to guidelines ranging from 25% to 5%, both in low and high-income countries [16,28–30], in part this could be related to the larger sample size and the extended period of time evaluated in this study.

There are several factors we consider could explain the high rate of inadequate transfusions. Fundamentally, the problem emerges from the absence of an adequate national guideline for neonatal and pediatric patients. Additionally, some of the medical practitioners have little experience in certain pathologies that require transfusions, and many of them are not aware of the national transfusion guidelines.

Our institution is responsible for the training of general practitioners and specialists. Based on the recommendations and experiences from other institutions [14,26,28,31,32], it has been determined that rigorous education and supervision should be established to ensure compliance with guidelines worldwide. As a result of the findings in this report the hospital transfusion committee has instituted an on-line procedure for reviewing, approving or rejecting the BP requests made by residents based on national guidelines, with the purpose of both, educate the physicians in training on the correct use of blood products and assure the highest quality and safety of the medical care provided to patients requiring blood transfusion.

As for the blood products, only 1.4% of platelet concentrates were leuko-depleted and none of the erythrocyte concentrates were leuko-depleted. This was due to economic issues.

There are some limitations, including that it is a retrospective study, thus analyzing the exact clinical scenario of the patient at the time was difficult. Also, the number of recipients is small, therefore, further studies with bigger number of patients must be made in order to evaluate the real impact of the incorrect transfusions in our institution.

5. Conclusion

Strict adherence to transfusion guidelines in pediatric patients at the study's center was poor and significant improvement to current blood ordering practices is required. Education in contemporary blood transfusion strategies must be provided to physicians in training to reduce inappropriate BP use and prevent adverse events. Likewise, the development of transfusion guidelines, focused exclusively on pediatric patients would help prevent future errors. These guidelines must be available for the training practitioners in every pediatric area. Additionally, coordination between the blood bank and every clinical department that requests BP's is important. Stored and organized records help analyze the transfusions previously indicated and identify mistakes. Furthermore, communication between physicians and trained blood bank staff may prevent errors before transfusions. Unfortunately, many institutions in low and middle-income countries do not have sufficient resources to develop an adequate data registry. Finally, this study shows the importance of developing transfusion guidelines exclusively for pediatric patients, along with proper supervision of doctors in training.

Disclosure of interest

The authors declare that they have no competing interest.

Acknowledgments

All authors contributed substantially to the collection of information and elaboration of this article.

References

- Fortin S, Cardona LG, Latreille M, Tucci M, Lacroix J. Blood transfusion in acute and chronic pediatric settings: beliefs and practices. *Transfusion* 2016;56:130–8.
- Guarnaccia C, Giannone F, Falgares G, Caligaris AO, Sales-Wuillemin E. Differences in social representation of blood donation between donors and non-donors: an empirical study. *Blood Transfus* 2016;14:487–9.
- McGuire AR, DeJoseph ME, Gill JR. An approach to iatrogenic deaths. *Forensic Science, Medicine, and Pathology*, Vol. 12. Humana Press Inc.; 2016. p. 68–80.
- Negi G, Gaur DS, Kaur R. Blood transfusion safety: a study of adverse reactions at the blood bank of a tertiary care center. *Adv Biomed Res* 2015;4:237.
- Szczepiorkowski ZM, Dunbar NM. Transfusion guidelines: when to transfuse. *Hematology/the Education Program of the American Society of Hematology*, Vol. 2013. American Society of Hematology. Education Program; 2013. p. 638–44.
- Carson JL, Strair R. Transfusion strategies in hematologic and nonhematologic disease. *Hematol Am Soc Hematol Educ Progr* 2014;2014:548–52.

- [7] Hopewell S, Omar O, Hyde C, Yu L-M, Doree C, Murphy MF. A systematic review of the effect of red blood cell transfusion on mortality: evidence from large-scale observational studies published between 2006 and 2010. *BMJ Open* 2013;3, <http://dx.doi.org/10.1136/bmjopen-2012-002154>, e002154.
- [8] Shah A, Stanworth SJ, McKechnie S. Evidence and triggers for the transfusion of blood and blood products. *Anaesthesia* 2015;70:10–9 [e3–e5].
- [9] Carson JL, Sieber F, Cook DR, Hoover DR, Noveck H, Chaitman BR, et al. Liberal versus restrictive blood transfusion strategy: 3-year survival and cause of death results from the FOCUS randomised controlled trial. *Lancet* 2015;385:1183–9.
- [10] Carson JL, Grossman BJ, Kleinman S, Tinmouth AT, Marques MB, Fung MK, et al. Red blood cell transfusion: a clinical practice guideline from the AABB. *Annals of Internal Medicine*, Vol. 157. American College of Physicians; 2012. p. 49–58.
- [11] Harris AM, Lead B, Atterbury C, Chaffe B, Elliott C, Hawkins T, et al. Guideline on the Administration of Blood Components British Committee for Standards in Haematology Date for guideline review; 2012.
- [12] British Committee for Standards in Haematology, Milkins C, Berryman J, Cantwell C, Elliott C, Haggas R, et al. Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories. *Transfus Med* 2013;23:3–35.
- [13] Jones J, Ashford P, Asher D, Barker J, Lodge L, Rowley M, et al. Guidelines for the specification, implementation and management of information technology systems in hospital transfusion laboratories. *Transfus Med* 2014;24:341–71.
- [14] Butler CE, Noel S, Hibbs SP, Miles D, Staves J, Mohaghegh P, et al. Implementation of a clinical decision support system improves compliance with restrictive transfusion policies in hematology patients. *Transfusion* 2015;55:1964–71.
- [15] Hurrell K. Safe administration of blood components. *Nurs Times* 2015;110:16–9.
- [16] Haspel RL, Lin Y, Mallick R, Tinmouth A, Cid J, Eichler H, et al. Internal medicine resident knowledge of transfusion medicine: results from the BEST-TEST international education needs assessment. *Transfusion* 2015;55:1355–61.
- [17] Surial B, Burkhart A, Terliesner N, Morgenthaler M, Bachli E. Adherence to transfusion guidelines: are we prepared for the smarter medicine or choosing wisely® initiative? *Swiss Med Wkly* 2015;14:145.
- [18] Collins RA, Wisniewski MK, Waters JH, Triulzi DJ, Alarcon LH, Yazer MH. Excessive quantities of red blood cells are issued to the operating room. *Transfus Med* 2015;25:374–9.
- [19] Malagon A, Berges A, Bonifaz R, Amalia B. "Guía para el uso clínico de la sangre". *Asoc Mex Med Transfusional* 2007;1:175.
- [20] Saldaña-Casas OF, De la Torre-Fernández A, Guzmán-García M. Blood component transfusions in a privatized hospital for children. *Rev Mex Pediatr* 2005;72:65–9.
- [21] Pandey S, Vyas GN. Adverse effects of plasma transfusion. *Transfusion* 2012;52, <http://dx.doi.org/10.1111/j.1537-2995.2012.03663.x>, 65S–79S.
- [22] Dasararaju R, Marques MB. Adverse Effects of Transfusion. *Cancer Control* 2015;22:16–25.
- [23] Benson AB. Pulmonary Complications of Transfused Blood Components. *Critical Care Nursing Clinics of North America*, Vol. 24; 2012. p. 403–18.
- [24] Rogers TS, Fung MK, Harm SK. Recent Advances in Preventing Adverse Reactions to Transfusion. *F1000Research*, Vol. 4. Faculty of 1000 Ltd; 2015.
- [25] Natukunda B, Schonewille H, Smit Sibinga CT. Assessment of the clinical transfusion practice at a regional referral hospital in Uganda. *Transfus Med* 2010;20:134–9.
- [26] Meléndez HJ, Zambrano M, Martínez X. Evaluación de adecuada indicación transfusional en un hospital universitario. *Rev Col Anest* 2007;35:195–201.
- [27] Del Pozo A, Kuperman S, Demirdjian G, et al. Guías de atención pediátrica. Uso de transfusiones en pediatría. Hospital de pediatría "Juan P. Garrahan" 2011;1:23–55, http://www.garrahan.gov.ar/PDFS/gap_historico/GAP2011-USO-DE-TRANSFUSIONES-VERSION-IMPRESA.pdf.
- [28] Díaz MQ, Borobia AM, García Erce JA, Maroun-Eid C, Fabra S, Carcas A, et al. Appropriate use of red blood cell transfusion in emergency departments: a study in five emergency departments. *Blood Transfus* 2017;15:199–206.
- [29] Alcorn K, Ramsey G, Souers R, Lehman CM. Appropriateness of Plasma Transfusion: a College of American Pathologists Q-Probes Study of Guidelines, Waste, and Serious Adverse Events. *Arch Pathol Lab Med* 2017;141:396–401.
- [30] Reis VN Dos, Paixão IB, Perrone ACA de S, Monteiro MI, Santos KB Dos. Transfusion monitoring: care practice analysis in a public teaching hospital. *Einstein (Sao Paulo)* 2016;14:41–6.
- [31] Plumb JOM, Taylor MG, Clissold E, Grocott MPW, Gill R. South Coast Perioperative Audit and Research Collaboration (SPARC). Transfusion in critical care – a UK regional audit of current practice. *Anaesthesia* 2017;72:633–40.
- [32] Garraud O, Filho LA, Laperche S, Tayou-Tagny C, Pozzetto B. The infectious risks in blood transfusion as of today – A no black and white situation. *Presse Médicale*, Vol. 45. Elsevier Masson SAS; 2016, e303–11.