An audit of appropriate use of blood products in adult patients in a Venezuelan general university hospital

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Abstract

Objective. To audit appropriate use of blood products in adult patients.

Design. A cross-sectional study with pre-set criteria.


Study participants. We studied 700 adult patients from the Medicine, Surgery, Emergency and Obstetrics departments.

Main outcome measure. Appropriate use of blood products.

Results. Seven hundred patients who had an average of 2.45 transfusions (95% confidence interval = 2.28–2.62) were studied. Prevalence of appropriate use was 51.3% for all departments. Prevalence by department was: 72% for Medicine, 36% for Surgery, 56% for Emergency, and 47% for Obstetrics. The average number of transfusions per subject in each department was: Medicine, 3.41; Surgery, 1.75; Obstetrics, 2.09; and Emergency: 2.81 (F-test: \( P = 0.005 \)). Using the department of Medicine as the reference group, it was found that the departments of Surgery, Emergency and Obstetrics had a higher ‘risk’ of inappropriate use of transfusions, showing odds ratios of 4.4, 1.38 and 2.79 respectively.

Conclusion. The main conclusions of this study are: (i) the prevalence of the appropriate use of blood products was 51%; (ii) packed red cells and fresh frozen plasma were the blood products with the lowest prevalence of appropriate use; and (iii) none of the departments showed rates of appropriate use of transfusions greater than 80%, implying a higher cost in health care and putting patients at a higher risk for acquiring a transfusion-transmitted disease.

Keywords: audit, haemotherapy, odds, risk, transfusion

The inappropriate use of medical technology is a major factor in increased health care expenses; inappropriate use of blood is costly. These elevated expenses are caused by the need to guarantee safety of the transfusion [1–3] and to avoid high health risk [4–8]. In a study about factors affecting the cost of transfusion of blood products, Koistinen pointed out four items: the costs of collection, laboratory costs, handling costs, and blood administration costs [3]. Furthermore, there is a risk of transfusion-transmitted disease, mainly those associated with retroviruses and hepatitis viruses [4]; however, in South America there is the additional risk of transfusion-associated transmission of trypanosomes and malaria. Therefore, inappropriate use of transfusion may cause additional costs for treatment of these diseases.

There is a need for continuous audit of the use of blood products as therapy, mainly in hospitals where there is no transfusion committee, as in the Ciudad Hospitalaria ‘Dr. Enrique Tejera’. This paper reports the results of a cross-sectional study designed to determine the rate of appropriate use of transfusions in different departments of this health care facility. Of course, these results may provide a good opportunity for improvements and to find strategies for such improvements.

Materials and methods

This study was conducted at the ‘Ciudad Hospitalaria Dr. Enrique Tejera’ in Valencia, Venezuela, a hospital of 900 beds and
centre of reference for a population of 3 million in the North Central Region of Venezuela. The study included patients aged 12 years or older from the Surgery, Medicine, Emergency and Obstetrics departments. We analysed 700 consecutive requests for transfusions in a 6-month period starting in February 1997. A total of 1700 transfusions were evaluated in these 700 patients (1 unit of blood product was considered as one transfusion).

A review of the patient’s medical history was done on each request for a blood product. This review was carefully carried out by two of the authors (GC and GP). Even though all reviewers were using the same methods and criteria, if any discrepancy occurred, one of us (AM, the haematologist) made the final decision. The patient records were analysed for the following factors: age, sex, current diagnosis, department, type and amount of blood products, and the reasons or stated indication for the transfusion of a blood product. When information was not available or was unclear, the patient was not included in the study. When the reasons for the transfusion were not clear, we considered the transfusion inappropriate. Since only information available on the medical charts was reviewed to determine the appropriateness of the transfusion, we did not attempt to evaluate the efficacy of the transfusion therapy.

Appropriate use of blood products was assessed by using the criteria established by Audet and Goodnough for packed red cells (PRC) [9], by the British Committee for Standards in Haematology for fresh frozen plasma (FFP) [10], by the NIH Consensus Conference for platelets [11] and by the College of American Pathologists for cryoprecipitate [12].

Inappropriate use of a blood product for a particular subject was considered as a violation of the established criteria shown above.

Given a wide variety of definitions of what is an appropriate rate for the use of blood products, in this paper we define a ‘good’ rate as any rate ≥ 80%.

Analysis of data

All data were assembled into a database. Mean rates of appropriate use ± SD were calculated. A $\chi^2$ test was used to test associations between categorical variables as appropriate. For continuous variables, the t-test statistic was used to test the difference between two group means, and ANOVA was used to compare groups for differences in the means of the transfusion by department. A logistic regression method was used to analyse the association of inappropriate transfusion with related factors. The ‘appropriate transfusion’ was considered as the dependent variable, and the independent variables were age, sex and department. $P$ values and confidence intervals (CI) are reported.

Results

Transfusions were evaluated in 700 (54% female), mean age 39.51 ± 18.58 years (95% CI = 38.13–40.89). These patients received 1700 transfusions (2.45 ± 2.29 transfusions per patient); 59% received two transfusions, 24% received one, and 17% received three or more transfusions. Of the patients, 165 were from Medicine, 218 from Surgery, 144 from Emergency and 173 from Obstetrics.

The overall prevalence of appropriate use was 51.3.% for all departments. Appropriateness of the use of blood products by department is shown in Table 1. The mean number of transfusions by department was found to be statistically significant (Medicine, 3.41 ± 3.48; Surgery, 1.75 ± 0.94; Emergency, 2.81 ± 2.7; Obstetrics, 2.09 ± 0.85; $P$<0.0000). No associations were found between the inappropriate use rate and either sex or age ($P$<0.26 and $P$<0.40, respectively).

CI for the odds of inappropriate use of blood products by department show statistically significant differences (Emergency, 1.38, 95%CI = 0.81–2.34; Obstetrics, 2.79, 95%CI = 1.73–4.49; Surgery, 4.40, 95%CI = 2.70–7.00). The department of Medicine was used as the reference group. CI for the odds of inappropriate use of each blood product are shown in Table 2.

Discussion

This audit of transfusions determined that use of blood products was appropriate in 51% of cases. Studies similar to this are unknown in Latin America.

Each blood product will be discussed separately given the variety of reasons for transfusing red blood cells, FFP, platelets and cryoprecipitate.

Packed red blood cells

As in Mozes et al. [13] and Schot and Steenssens [14] the blood products with greatest prevalence of inadequate use were PRC and FFP. In an evaluation of red blood cell transfusion practices with the use of pre-set criteria, Ghali et al. [15] found that in 55.3% of cases, PRC was transfused unnecessarily.

In our study, 589 patients were transfused with PRC. Of these patients 27.84% (164/589) were transfused with a single unit of PRC, and of these 164 patients, 61% (100/164) belonged to the group of inappropriate use. Metz et al. [16] also found a high proportion of inappropriate use of single-unit transfusion. Transfusion of a single unit of PRC should not be considered inappropriate by itself; however, its use without an appropriate clinical judgement is not acceptable. Preference for immediate alleviation of symptoms over prevention of later possible complications has been postulated as one of the causes of this phenomenon [13]. Our explanation for such a limited appropriate use of blood component therapy seems to be: (i) absence of a transfusion committee in our hospital and, (ii) use of the laboratory criterion alone. In many instances a low haematocrit count is used to determine a request for a transfusion of PRC; the correct approach is to combine the laboratory criteria with the symptoms of the patient.

Unfortunately, this Venezuelan hospital has no oversight programme for monitoring quality of transfusion practices, which may be one reason for having such a low rate of appropriate use of transfusions. Grindon et al. [17] point out that the presence of a transfusion committee assures consultation...
Audit of appropriate use of blood products

Table 1  Appropriate use by departments and blood products

<table>
<thead>
<tr>
<th>Department</th>
<th>Appropriate</th>
<th>Packed red cells</th>
<th>Fresh frozen plasma</th>
<th>Platelets</th>
<th>Cryoprecipitate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>72%</td>
<td>62%</td>
<td>67%</td>
<td>89%</td>
<td>100%</td>
</tr>
<tr>
<td>Surgery</td>
<td>36%</td>
<td>38%</td>
<td>9%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Emergency</td>
<td>56%</td>
<td>59%</td>
<td>10%</td>
<td>50%</td>
<td>75%</td>
</tr>
<tr>
<td>Obstetrics</td>
<td>47%</td>
<td>49%</td>
<td>25%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Overall</td>
<td>51%</td>
<td>49%</td>
<td>26%</td>
<td>70%</td>
<td>92%</td>
</tr>
</tbody>
</table>

1 All uses inappropriate.  
2 No demand.

Table 2  Odds of inappropriate use of blood products

<table>
<thead>
<tr>
<th>Blood product</th>
<th>Odds ratio</th>
<th>95% confidence interval</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed red cells</td>
<td>0.47</td>
<td>0.30–0.73</td>
<td>0.0009</td>
</tr>
<tr>
<td>Fresh frozen plasma</td>
<td>0.32</td>
<td>0.15–0.69</td>
<td>0.003</td>
</tr>
<tr>
<td>Platelets</td>
<td>2.33</td>
<td>1.22–4.47</td>
<td>0.005</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>11</td>
<td>2.49–68.64</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

in haemotherapy: it evaluates effectiveness of transfusion practices and corrects ineffective practices with blood products.

From a general point of view, a decision to transfuse should always be based on an analysis of risk and benefit, and should consider two factors: (i) evaluation of the physiological needs of the patient; and (ii) transfusing only blood products that satisfy those physiological needs [18]. As in the Metz series [16], we found that many inappropriate transfusions of PRC were carried out on asymptomatic patients in the perioperative period, although there is no evidence that mild or moderate anaemia contributes to perioperative morbidity and mortality [19–20]. In our research, inappropriate transfusion rates were found not to be associated with age. According to the pre-established criteria, transfusions of PRC in our patients with chronic renal failure were appropriate, but from the point of view of the relationship between risk and benefit, erythropoietin should have been used to manage the anaemia in these patients.

**Fresh frozen plasma**

Many authors [13–14,16] also found in their studies a greater prevalence of inadequate use of FFP. In our series, in no case was a prior determination made of a patient’s coagulation deficiency in order to decide on the use of FFP. In addition, despite the fact that there is no evidence to justify the use of FFP as a volume expander, we found this misindication. This reflects little knowledge about the rational use of this blood product, as FFP has risks and there are precise indications for its use [21]. This blood product must be used only as a source of clotting factors or plasma proteins. Drastic reduction in the use of total blood has been reported as the origin of inappropriate use of FFP [22]. A coagulation deficiency determination must be performed before requesting FFP. Once again, as happened with PRC, the same reasons can be given as explanation for the high rate of inappropriate use of this blood product. It is mainly the Surgery, Emergency and Obstetrics departments that are responsible for this phenomenon. Unnecessary transfusion of FFP must be reduced, and we need to encourage development of strategies to achieve this. Barnette et al. [23] conclude that an educational programme may help to reduce the inappropriate use of FFP.

**Platelets**

According to pre-set criteria, this study showed overall a high prevalence of appropriate use of platelets. However, as two departments (Surgery and Obstetrics) showed a very low rate of appropriate use, the odds of transfusing platelets inappropriately is > 1. The main indication for platelet transfusion was to prevent bleeding in patients with narrow failure. There is a hypothesis that, regardless of the weight of the recipient, transfusion of over 2 platelet units would be excessive [24]. When deciding to transfuse platelets, physicians must consider other known factors that increase the risk of bleeding in patients with thrombocytopenia [25] and might suggest reduction in the use of platelets. Recently, Ancliff and Machin [26] reviewed data about the threshold for prophylactic platelet transfusion and pointed out that a threshold of 10 × 10⁹/l is safe in stable patients. However, according to Contreras [27] there is a need to define precise indications for use of platelet transfusion, and this can be achieved by conducting randomized trials and effective and efficient audit. Therefore, we could ask ourselves what is truly an appropriate use of blood products? Until we get a precise definition of this, it will remain controversial.

**Cryoprecipitate**

We found a very high risk of receiving inappropriate transfusion of cryoprecipitate. The possible reasons for this high risk are the same as those described for PRC, FFP and platelets. This blood product is indicated for use only in certain illnesses (see Appendix).

Our results showed that the Surgery, Emergency and Obstetrics departments are associated with a higher risk of inappropriate transfusion than the Medicine department. In contrast, Mozes et al. [13] reported no relationship between inappropriate transfusion and the Surgery, Medicine and Paediatrics departments. It should be pointed out that our study
did not include pediatric patients given that the criteria for the evaluation of transfusion in such patients are different from those used in adult patients [28–29].

Differences in transfusion practices between different departments in our hospital could be explained by the following reasons. First, the difficulty of evaluating appropriate use of blood products in patients with bleeding in different surgical services and, indeed, of whether a transfusion in the intensive care unit is beneficial, is clinically still an unanswered question. Second, the department of Medicine has a postgraduate medical school whereas the others departments do not.

Even when an audit and a chart review are carried out, it is not easy to determine the best rates of appropriate use of blood products. Poses et al. pointed out that it is possible that the patients of hospitals with high rates of blood product use may experience greater benefits despite the fact that high use is more costly and despite the risk of adverse reactions [30].

The high rate of inappropriate use found in this study makes a forceful case for reduction of such use through the strategies of medical audit [31–32] and continuing medical education [33–37]. At the time of writing this paper, we are designing an algorithm as a way of improving rational use of blood products. Oberman [38] has pointed out that responsibility for educational strategies lies mainly on blood bank directors and that this responsibility must be shared by the other physicians. In addition to their economic impact on the blood banks [39], educational programmes to improve appropriate use of blood products may themselves have an impact on the rate of transfusion-transmitted diseases, and therefore also on the costs of treating these diseases.

We believe that this study may have two limitations; interpretation of the results must take these into account. First, defining the rate of appropriate use is controversial for the reasons mentioned above (see Materials and methods). Second, there is a chance of bias in the process of gathering data because a retrospective review was used. However, in our hospital this is the first time that an audit of blood products has been carried out, and thus these results represent the starting point from which the use of this medical technology must be improved. The need to design an educational programme about appropriate use of blood products and to encourage the creation of a transfusion committee are the implications of this study.

In summary, educational efforts addressing appropriate use of blood products should be initiated in our hospital. All efforts to change patterns of use of blood products must be encouraged.

Acknowledgements

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References


Appendix

Audit of blood products: pre-set criteria used to define appropriateness of use

Packed red cells [9]

i  Haemoglobin value <7 g/dl

ii Haemoglobin value between 7 g/dl and 10 g/dl, when any of the following symptoms and/or signs are present: syncope, dyspnoea, postural hypotension, tachycardia, angina, transient ischaemic attack

Fresh frozen plasma [10]

i  Correction of coagulopathy in a bleeding patient
ii  Liver disease: before surgery or other invasive procedure
iii  Correction of coagulopathy in any surgical patient: before an invasive diagnostic procedure or before, during or after a surgical procedure
iv  Reversal of warfarin effect: in cases of life-threatening haemorrhage or before emergency surgery or an invasive procedure

Platelets [11]

i  Prophylactic administration: platelet count \( \leq 20 \times 10^9/\text{l} \) (myelosuppressive therapy, leukaemia, aplastic anaemia)
ii  Therapeutic criterion: Platelet count \( \leq 20 \times 10^9/\text{l} \) in a bleeding patient
iii  Platelet count \( \leq 50 \times 10^9/\text{l} \): before surgery or a diagnostic procedure that carries a risk of significant bleeding

Note: cardiopulmonary bypass surgery is not carried out in our hospital

Cryoprecipitate [12]

i  Hypofibrinogenaemia
ii  Von Willebrand’s disease
iii  Haemophilia A

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