

Retrospective Study of Clinical Outcome in Acute Systemic Infections in Relation to Use of Blood Products

Ramesh Chittam*, TC Rudrappa**, Sindhura***, Badrinath G***, GA Manjunath****

Abstract

Introduction: Blood transfusion has demonstrated its efficacy in saving life in the primary and secondary health care settings in developing countries. There is hence a need to develop policies and strategies to reduce unnecessary blood and component transfusions and ensure the safe and appropriate use of blood and blood products. Towards this there is further need to develop specific guidelines for the transfusion of blood components. *Materials and Methods: Place of Study:* Navodaya Medical College Hospital and Research Centre. *Study Period:* 1 year. *Sample:* All children between the age of 1 to 15 years admitted to PICU. Included those cases with clinical and laboratory evidence of viral hemorrhagic fever had received blood component therapy and clinical and laboratory evidence of sepsis who had received blood component therapy. *Results: Age profile of the study cases:* The difference was statistically significant ($p=0.117$). *Gender distribution of patients:* The differences were again significant ($p=0.075$). *Blood component therapy in Acute Systemic Infections:* Of 38 platelet transfusions, 54% received the transfusion for platelet counts of less than 20000/cumm, while the remainder (46%) received it for platelet counts of >20000/cumm. *Fresh frozen plasma transfusions:* 24 children (40%) received FFP for altered coagulation profile of which 81% were found to be suffering from VHF. *Red Blood Cell Transfusion:* 3 cases received transfusion for hemoglobin of >8gm/dl. *Conclusion:* Regular audit of blood and blood components is an essential part of transfusion services, so that necessary remedial measures can be taken to maximize appropriate and judicious use of each component.

Keywords: PRBC, FFP, PLATLETS, Blood Transfusion.

Introduction

Blood transfusion as a lifesaving intervention which was established to full extent in 20th century. First to transfuse blood from human to human (1818) was James Blundell. Karl Landsteiner discovered ABO blood group systems and thus laid the initial foundations for successful and safe blood transfusion. Landsteiner and Weiner discovered the Rh blood group system, which has significantly improved blood banking practices.

Blood banking is accepted as a separate specialty of Transfusion Medicine. Blood transfusion has

demonstrated its efficacy in saving life in the primary and secondary health care settings in developing countries and is an essential part of modern therapy. If transfusion is used appropriately it can save life and improve health. However owing to its many side effects these should be prescribed only to treat conditions associated with significant morbidity or mortality which cannot be prevented or managed effectively by other means.

The transfusion of blood products, will also lead to risk of down regulating the immune response called as transfusion related immunomodulation (TRIM) besides carrying a risk of serious transfusion reactions, volume overload and the risk of transmission of infections. In all the four situations as mentioned above, it is the WBC and plasma component of blood that has been held responsible. Therefore the present trend is to transfuse component therapy rather than transfusing whole blood. However components themselves, despite recent advances in techniques have minuscule amounts of plasma and contaminants which can pose a serious risk to the patient.

Author Affiliation: *Assistant Professor **Associate Professor ***2nd Year Postgraduate ****Professor, Navodaya Medical college and Research Centre, Raichur - 584101, Karnataka, India.

Corresponding Author: Rudrappa T.C., Associate Professor, Navodaya Medical College and Research Centre, Raichur - 584101, Karnataka, India.

E-mail: rudrappa.navodaya@gmail.com

Received on 03.08.2017, Accepted on 01.09.2017

Blood components, especially plasma, are excellent volume expanders but in patients with cardiac and renal insufficiency it will lead to osmotic loads draw volume into the intravascular space resulting in volume overload. In addition, allogeneic blood transfusion can form large amounts of alloantigen which further can produce a variety of immunological responses including allo-immunisation and down regulation of immune response.

To reduce unnecessary use of blood and components transfusions and to ensure the safe and appropriate use of blood and blood products there is a need to develop policies and strategies. Towards this there is a further need to develop specific guidelines for the transfusion of blood components especially in children and a periodic medical audit to review the current trends in the use of blood components.

Materials and Methods

Source of Data

Place of Study: Navodaya Medical College

Results

Demographic Profile of Sample Cases

Table 1: Age distribution of patients studied

Age in Years	VHF	Septicemia	Others	Total
1-5 YRS	14	3	2	18
5-10 YRS	18	1	1	19
10-15 YRS	20	2	1	22
Total	51	6	3	60

Table 2: Gender distribution of patients studied

Gender	VHF	Septicemia	Others	Total
Male	28	2	1	30
Female	24	4	2	30
Total	52	6	3	60

Table 3: The distribution of appropriate and inappropriate platelet transfusions in the study

Platelet Count	VHF	Septicemia	Others	Total
<20,000	20	1	0	21
>20,000	16	1	0	17
Total	36	2	0	38

Table 4: Indications for transfusion of fresh frozen plasma

Indication	VHF	Septicemia	Others	Total
Hypotension	25	2	1	28
Deranged coagulation profile	20	4	1	24
Low serum albumin	8	2	1	11

Hospital and Research Centre.

Study Period: 1 year

- *Sample:* All children between the age of 1 year to 15 years admitted to PICU at our teaching Hospital over a 12 month period from Oct 2015 to Sept 2016 with acute systemic infections were evaluated. The sample size is 60.
- *Group 1:* Cases with clinical and laboratory evidence of viral hemorrhagic fever who had received blood component therapy
- *Group 2:* Cases with clinical and laboratory evidence of sepsis who had received blood component therapy
- *Group 3:* Systemic infections who had received blood component therapy
- They were further subdivided into different age groups of 1-5yrs, 6-10yrs, 11-15yrs and a detailed analysis was made with regard to type and number of transfusions administered to these patients and their clinical outcome as determined by duration of hospital stay, mortality and significant morbidity.

Table 5: The distribution of the appropriate and inappropriate packed red cell transfusions in the study

Low Hemoglobin	VHF	Septicemia	Others	Total
HB >8gm/dl	3	2	1	5
HB <8gm/dl	1	1	1	3

Table 6: Transfusion reactions in our study

Transfusion Reactions	VHF	Septicemia	Others	Total
FNHR	7	2	1	8
No Reaction	45	5	2	50
TACO	1	0	0	1
Total	52	6	3	60

Table 7: Total duration of hospital stay

Duration of Stay in the Hospital	VHF	Septicemia	Others	Total
<2 DAYS	6	2	2	9
2-5DAYS	7	1	0	8
6-10DAYS	35	2	1	37
11-20DAYS	5	2	1	7
>20DAYS	0	0	0	0
Total	52	6	3	60

Table 8: Distribution of Mortality in the study group

Mortality	VHF	Septicemia	Others	Total
Yes	7	3	2	11
No	45	3	1	49
Total	52	6	3	60

Table 9: Requirement of ventilatory support in the study group

Ventilator Support	VHF	Septicemia	Others	Total
YES	9	4	2	14
NO	43	2	1	46
Total	52	6	3	60

Age Profile of the Study Cases

The age distribution of the entire study series was equally distributed among three subgroups. However, when correlating the age with the various diagnosis in the study, it was found that in VHF cases, a majority of the children were above 5yrs of age, while in the sepsis group a majority of the patients were below the age of 5. The difference was statistically significant (p=0.117)

Gender Distribution of Patients

While observing the gender distribution in the series, the overall distribution of cases was found equal among both the sexes. However when analyzing the study under the various diagnosis, it was found that while males suffered more with VHF, it was female preponderant population who suffered from septicemia. The differences were again significant (p=0.075)

Blood component therapy in Acute Systemic

Infections.

Of the 60 cases in the study, 38 cases received platelet transfusion therapy, of whom an overwhelming majority (95%) were suffering from VHF. Of these 38 platelet transfusions, 54% received the transfusion for platelet counts of less than 20000/cumm (which was considered appropriate), while the remainder (46%) received it for platelet counts of >20000/cumm (Inappropriate).

Fresh Frozen Plasma Transfusions

There were three main indications for FFP transfusion noted in our study, as indicated below:

1. Deranged Coagulation Profile
2. Hypotension
3. Low serum Albumin

28 children (46%) out of 60 children received fresh frozen plasma as a volume expander out of which 91% were found to be suffering from VHF. 11 children

(17.4 %) received FFP for hypoalbuminemia of which majority (77%) were children with VHF. Both of the above indications for FFP transfusions were considered inappropriate. 24 children (40%) received FFP for altered coagulation profile of which 81% were found to be suffering from VHF. This indication was considered appropriate.

Red Blood Cell Transfusion

5 cases received packed red cell transfusion for low hemoglobin <8mg/dl of which 46% of cases had viral hemorrhagic fever and 40% had septicemia. This was considered as an appropriate indication. 3 cases received transfusion for hemoglobin of > 8gm/dl which was considered inappropriate of which 1 case had VHF, 1 case sepsis and 1 case was of acute systemic infection.

Transfusion Reactions

Out of 60 cases which received blood component therapy, 8 cases were noted to have mild febrile non hemolytic reaction and were treated symptomatically. Most of the febrile non hemolytic reactions were noted in the viral hemorrhagic fever group. One case of transfusion associated circulatory overload was also noted. There were no major transfusion reactions seen in our study.

FNHR-febrile non hemolytic reaction

TACO-transfusion associated circulatory overload

End Points of Study

1. Total duration of stay in hospital

Mean duration of stay in hospital was approximately 6-10 days in all three groups studied (P=0.361) i.e viral hemorrhagic fever, septicemia and other acute systemic infections.

2. Mortality

Of the total 60 cases included in the study, mortality was noted at 18.6% (11 patients). In the septicemia group, the mortality rate was higher (52.9%) as compared with the viral hemorrhagic group (13.1%) which was statistically significant (P<0.001).

Ventilatory Support

Of the total of 60 cases, ventilatory support was

required in 14 cases (22.5%) of which a majority (64.7%) cases were in the septicemia group, indicating significant morbidity in this group of patients who required blood component therapy.

Discussion

Blood component therapy implies separation of whole blood into various components like packed red cells, platelet rich plasma, fresh frozen plasma, cryoprecipitate and leucocytes and transfusing them under specific indications. Recent advances in donor screening, blood testing before transfusion, and modifications made to collected components like irradiation etc make blood and components transfusion safer than ever before. Nonetheless blood components should only be transfused when the risks and benefits have been carefully weighed [1].

To maximize the effectiveness, safety and utility of these transfusions, clinicians and intravenous therapists should know about the potential risk of blood component therapy. Therefore the practitioner should keep in mind about the various infectious and non infectious complications before ordering blood and blood components to avoid misuse and unnecessary exposure to recipient [2].

In transfusion medicine blood components are the most valuable and expensive commodities. The demand is increasing and as such proper practice guidelines would be helpful in reducing or avoiding inappropriate transfusion of blood components since the preparation of blood components is a tedious and relatively expensive affair, the judicious request and use of blood components must be practiced. Blood components are given to those with proper indications and in whom the transfusions will have a significant benefit on the management of the patients [3].

If patient is having bleeding manifestations then FFP is indicated [5]. According to American Red Cross it has been shown that frozen plasma may be used to treat multiple coagulation factors (e.g., liver disease) prior to an invasive procedure that would create a risk of bleeding [6].

American Red Cross Practice guidelines for blood transfusion, prophylactic platelet transfusions tells to prevent bleeding at pre-specified low platelet counts. In general, in stable and non-bleeding patients platelet count of >10,000/mm³ is maintained, in unstable and non-bleeding patients >20,000/mm³ is maintained and in patients undergoing invasive procedures or actively bleeding >50,000/mm³ is

maintained [6]. WHO (World Health Organization) blood transfusion safety guidelines proposed that a stable thrombocytopenic patient without evidence of bleeding, platelet count is maintained $>10,000/\text{mm}^3$ because below this spontaneous bleeding is more likely to occur. However, in a patient with fever or infection, maintaining platelet count $>$ of $20,000\text{--}50,000/\text{mm}^3$ may be appropriate [7].

In pediatric critical care patients PRBC transfusion is most commonly used. However, with respect to the threshold hemoglobin concentration for red blood cell transfusion there is a wide variation in transfusion practice patterns among pediatric critical care practitioners [8].

In some study they found frequent adverse neurologic events in restrictive RBC transfusion group suggests that the practice of restrictive transfusion may be harmful to preterm infants [9].

In cases of sickle cell anemia although chronic transfusion is effective in preventing stroke, this therapy carries immediate and cumulative risk with regard to iron loading [10].

Hence, a regular inspection of blood and its component usage is essential to assess the blood utilization pattern and set ideal policies in all of the blood using specialties. In spite of the many blood banking services worldwide; haphazard use of blood components with inappropriate indications continue [4].

The present study was conducted upon 320 episodes of component transfusion over a period from Oct 2015 to Sept 2016 at a tertiary care teaching hospital in children with acute systemic infections predominantly with viral hemorrhagic fever and septicemia.

Of the total of 107 transfusion episodes in 60 patients, 38 episodes were for platelet concentrates, 62 episodes for fresh frozen plasma and 8 episodes for packed red blood cells.

The demographic, clinical, and laboratory parameters of all 60 patients were collected along with the indication for blood component transfusion. Of the total no of cases, 52 patients in the viral hemorrhagic group, 6 in the septicemia group and 3 cases of other acute systemic infections received blood component therapy. These patients were further categorized based on appropriateness for blood component therapy into appropriate and inappropriate groups based on the indication for transfusion. Outcome in these two group of patients were noted in terms of duration of stay, mortality and ventilatory support. The clinical outcomes were compared statistically between these two groups of

patients using appropriate statistical techniques.

Conclusions

- Most of the children of viral hemorrhagic group received blood component therapy than followed by septicemia and other systemic infections. The over view of appropriateness of transfusion of various blood components in our study revealed that of the total transfusion episodes 54% were inappropriate.
- Platelet count >20000 inappropriately transfused was 46%. In them, there was a statistically significant increase in morbidity and an absolute increase in mortality which was however, not statistically significant.
- Our study also showed inappropriate FFP transfusion in 61% (10) of children of where in, the use of Fresh frozen plasma for volume expansion was the most frequent form of FFP misuse followed by hypoalbuminemia. In these children, there was statistically significant increase in morbidity (ventilatory support) and an increase in the mortality which was however not statistically significant.
- Regular checking of blood and blood components is an important part of transfusion services, hence necessary remedial measures can be taken to maximize appropriate and judicious use of each component.

References

1. Abdul Wahid et al. Utility of blood components in paediatric patients. An audit. *Curr Pediatr Res.* 2012; 16(1):61-63.
2. R Jamal et al. A clinical audit on the practice of platelet transfusions at a tertiary paediatric referral centre Department of Paediatrics, Institute of Paediatrics, Kuala Lumpur hospital and Blood Bank, Kuala Lumpur. *Malaysian J Path.* 1998;20(1):35-40.
3. Chng W J, Tan M K, i Kuperan Ponnudura. An Audit of Fresh Frozen Plasma Usage in An Acute General Hospital in Singapore: *Singapore Med J.* 2003;44(11):574-8.
4. John Puetz et al. Use of Fresh Frozen Plasma in US Children's Hospitals Despite Limited Evidence Demonstrating a Beneficial Effect. *J Pediatr* 2012;160:210-5.
5. Aelroth S. Standard terminology for plasma products. *Transfusion.* 2003;43:983.

5. O'Shaughnessy DF, Atterbury C, Bolton Maggs P, Murphy M, Thomas D, Yates S, et al. Guidelines for the use of fresh-frozen plasma, cryoprecipitate and cryosupernatant. *Br J Haematol.* 2004 Jul;126(1): 11-28.
 6. Practical guidelines blood transfusion [Internet]. [cited 2015 Feb 9]. Available from: http://www.sld.cu/galerias/pdf/sitios/anestesiologia/practical_guidelines_blood_transfusion.pdf.
 7. Prelims-a72894.pdf [Internet]. [cited 2015 Feb 10]. Available from: <http://whqlibdoc.who.int/hq/2001/a72894.pdf>.
 8. Laverdière C, Gauvin F, Hébert PC, Infante-Rivard C, Hume H, Toledano BJ, et al. Survey on transfusion practices of pediatric intensivists. *Pediatr Crit Care Med J Soc Crit Care Med World Fed Pediatr Intensive Crit Care Soc.* 2002 Oct;3(4):335-40.
 9. Edward F Bell, Ronald G. Strauss, John A. Widness, Larry T. Mahoney, Donald M Mock, et al. American academy of paediatrics. 2005 June;1:115.
 10. Files B, Brambilla D, Kutlar A, et al. Longitudinal changes in ferritin during chronic transfusion: a report from the Stroke Prevention Trial in Sickle Cell Anemia (STOP). *J Pediatr Hematol Oncol* 2002;24: 284-90.
-