P-ISSN: 2664-3685
E-ISSN: 2664-3693
www.paediatricjournal.com
IJPG 2020; 3(1): 14-19
Received: 10-11-2019
Accepted: 12-12-2019

Dr. Pooja Doddikoppad
Assistant Professor, Department of Pediatrics, MVJMC and RH, Hoskote, Karnataka, India

Dr. ATK Rau
Professor, Department of Pediatrics, MSRMC, Bangalore, Karnataka, India

Dr. Ravichander B
Professor and Head, Department of Pediatrics, MVJMC and RH, Hoskote, Karnataka, India

Corresponding Author:
Dr. Ravichander B
Professor and Head, Department of Pediatrics, MVJMC and RH, Hoskote, Karnataka, India

An audit of the use of blood components in acute systemic infections and its correlation with clinical outcome

Dr. Pooja Doddikoppad, Dr. ATK Rau and Dr. Ravichander B

DOI: https://doi.org/10.33545/26643685.2020.v3.i1a.53

Abstract
Blood components, especially plasma, are excellent volume expanders but increased osmotic loads draw volume into the intravascular space resulting in volume overload, particularly in patients with cardiac and renal insufficiency. In addition, allogeneic blood transfusion exposes the recipient to large amounts of alloantigen which can create a variety of immunological responses including allo-immunisation and down regulation of immune response. All children between the age of 1 year to 15 years admitted to PICU at our teaching Hospital over a 24 month period with acute systemic infections were evaluated.
In our study, of the total of 178 cases, seventy two cases (40%) received fresh frozen plasma for deranged coagulation profile which was considered as an appropriate indication. Eighty two cases (46%) received fresh frozen plasma for hypotension and thirty one cases (17%) for low serum albumin which were both considered as inappropriate indications.
Clinical outcome in these two groups of patients showed that there was no significant difference in duration of hospital stay. There was an increase incidence of mortality in children who received FFP for inappropriate indications, though it was not statistically significant (P=0.375). It was also noted that a statistically significant increase in morbidity in the form of increased requirement of ventilatory support for the inappropriately transfused group (P=0.008) was seen in our study.

Keywords: Blood components, acute systemic infections, clinical outcome

Introduction
The 20th century has seen the establishment of blood transfusion as a lifesaving intervention. James Blundell was the first to transfuse blood from human to human (1818). Karl Landsteiner discovered ABO blood group systems and thus laid the initial foundations for successful and safe blood transfusion. In 1940 Landsteiner and Weiner discovered the Rh blood group system, which further significantly improved blood banking practices [1].
Today blood banking is accepted as a separate speciality of Transfusion Medicine. Blood transfusion being an essential part of modern therapy, it has demonstrated its efficacy in saving life in the primary and secondary health care settings in developing countries. Used appropriately, transfusion 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.
Blood is a scarce human resource and ensuring its safety and clinical effectiveness requires investment-both human and financial. Before prescribing blood or blood products for a patient, it is always essential to weigh the risks of transfusion against the risks of not transfusing. There is abundant data suggesting the association of the liberal use of blood and its components with increased morbidity as a result of fluid overload, increased risk of infection and an unnecessary increase in the duration of hospital stay.
The transfusion of blood products, besides carrying a risk of serious transfusion reactions, volume overload and the risk of transmission of infections, also carries the risk of down regulating the immune response referred to, of late, as transfusion related immunomodulation (TRIM). 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 in transfusion practice is to move as far away as possible from whole blood transfusions and towards component therapy. However components themselves, despite recent advances in techniques have minuscule amounts of plasma and contaminants which can pose a serious risk to the patient. Therefore, before any transfusion it is always worthwhile to ask if the transfusion is really required or not [2].

Blood components, especially plasma, are excellent volume expanders but increased osmotic loads draw volume into the intravascular space resulting in volume overload, particularly in patients with cardiac and renal insufficiency. In addition, allogeneic blood transfusion exposes the recipient to large amounts of alloantigen which can create a variety of immunological responses including allo-immunisation and down regulation of immune response [3, 4]. 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 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.
This study is therefore being undertaken to audit the use of blood components in children with severe systemic infections in a tertiary care hospital PICU and to correlate the use of these components with the morbidity and mortality in these patients.

Methodology
All children between the age of 1 year to 15 years admitted to PICU at our teaching Hospital over a 24 month period with acute systemic infections were evaluated.

Group 1: Included those cases with clinical and laboratory evidence of viral hemorrhagic fever who had received blood component therapy.

Group 2: Included those cases with clinical and laboratory evidence of sepsis who had received blood component therapy.

Group 3: Included other 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. All cases with thrombocytopenia, presenting with features of dengue illness according to WHO criteria 2009 were included in the study if they fulfilled the criteria as mentioned below:-

a) Probable dengue: Fever, nausea and vomiting, rash, aches and pains, tourniquet test positive (narrow pulse pressure <20 mmHg), with warning signs-abdominal pain or tenderness, persistent vomiting, clinical fluid accumulation, mucosal bleeding, lethargy, restlessness, liver enlarged >2 cms.

c) Severe dengue: Severe plasma leakage leading to shock, fluid accumulation with respiratory distress, severe bleeding, severe organ involvement with or without impaired consciousness.
The laboratory features included positive serology, thrombocytopenia (<1,00,000mm), raised liver enzymes, gall bladder wall thickening on USG scan, pleural effusion on X-ray and hypoalbuminemia.
Once included in the study, the following parameters were studied:-

- Haemoglobin
- Total leucocyte count
- Platelet count
- PT, APTT, INR
- Serum albumin
- SGOT, SGPT

Fever, shock, purpura, hypotension and laboratory evidence leukocytosis, leucopenia, CRP positivity, positive blood culture or any positive viral markers.
Further criteria for the diagnosis of septicemia included:
Systemic inflammatory response syndrome and suspected or proven infection with presence of at least 2 of the following 4 criteria**:**

1. Core temperature of >38.5 °C or <36 °C.
2. Tachycardia, defined as a mean heart rate 2 SD above normal for age in the absence of external stimulus, chronic drugs, or painful stimuli or otherwise unexplained persistent elevation over a 0.5-to 4-hr time period or bradycardia, defined as a mean heart rate <10th percentile for age in the absence of external vagal stimulus, beta blocker drugs, or congenital heart disease.
3. Mean respiratory rate 2 SD above normal for age or mechanical ventilation for an acute process not related to underlying neuromuscular disease or general anaesthesia.
4. Leukocyte count elevated or depressed for age (not secondary to chemotherapy induced leukopenia)

Results

Table 1: The distribution of appropriate and inappropriate platelet transfusions in the study

Platelet count	Diagnosis			Total
	VHF	Septicemia	Others	
(<20000)	60	2	0	62(54%)
>20000	48	3	0	51(46%)
Total	108	5	0	113(100%)

Of the 178 cases in the study, 113 cases received platelet transfusion therapy, of whom an overwhelming majority (95%) were suffering from VHF. Of these 113 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).
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

Table 2: Indications for transfusion of fresh frozen plasma

Indication	Diagnosis			Total
	VHF	Septicemia	Others	
Hypotension	75(91%)	5(6%)	2(3%)	82
Deranged coagulation profile	59(81.9%)	10(13%)	3(5.1%)	72
Low serum albumin	24(77%)	5(16%)	2(6%)	31

82 children (46%) out of 178 children received fresh frozen plasma as a volume expander out of which 91% were found to be suffering from VHF. 31 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. 72 children (40%) received FFP for altered coagulation profile of which 81% were found to be suffering from VHF. This indication was considered appropriate.

Table 3: The distribution of the appropriate and inappropriate packed red cell transfusions in the study

Low Hemoglobin	Diagnosis			Total
	VHF	Septicemia	Others	
Hb<8gm/dl	7(46%)	6(40%)	2(13%)	15
Hb>8gm/dl	3(42%)	3(42%)	1(16%)	7

15 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. Seven cases received transfusion for hemoglobin of >8gm/dl which was considered inappropriate of which 3 cases had VHF, 3 cases sepsis and 1 case was of acute systemic infection.

Out of 178 cases which received blood component therapy, 24 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.

Table 4: Transfusion reactions in our study

Transfusion reaction	Diagnosis			Total
	VHF	Septicemia	Others	
1(FNHR)	19(12.3%)	4(23.5%)	1(14.3%)	24(13.8%)
2(No reaction)	134(85.1%)	13(70.6%)	6(85.7%)	149(85.6%)
3(TACO)	1(0.6%)	0(0%)	0(0%)	1(0.6%)
Total	154(98.1%)	17(94.1%)	7(100%)	178(100%)

FNHR: febrile non-hemolytic reaction
TACO: transfusion associated circulatory overload

Table 5: Platelet transfusion corelated with duration of stay

Platelet transfusion	VHF			Septicemia			Others		
	APP (n=60)	INAPP (n=48)	P value	APP (n=2)	INAPP (n=5)	P value	APP (n=0)	INAPP (n=7)	P value
Duration of stay	6.60	6.74	0.773	7.50	6.80	0.870	0.0	4.86	-

Table 6: Platelet transfusion corelated with ventilation and mortality

Platelet count/outcome	VHF			Septicemia			Others		
	APP (n=60)	INAPP (n=48)	P value	APP (n=2)	INAPP (n=5)	P value	APP (n=0)	INAPP (n=7)	P value
Mortality	7(11.7%)	13(27%)	0.808	2(100%)	2(46.7%)	0.471	0	4(57.1%)	-
Ventilation support	8(13.3%)	17(35.4%)	0.0506	2(100%)	3(60%)	0.515	0	4(57.1%)	-

APP: Appropriate if transfusion are given with platelet <20000
INAP-inappropriate if transfusions are given with platelet>20000

In the present study conducted upon 178 cases of acute systemic infections of which 113 cases which received platelet transfusions, the clinical outcome in the children who received platelet transfusion for platelet counts of <20000/cumm (appropriate indication) were compared with children who received platelet transfusion for platelet counts of >20000(inappropriate indication). The clinical outcomes were compared in terms of duration of stay, mortality and morbidity (ventilatory support).

In our study it was found that there was no significant difference between the two groups of children in relation to duration of stay. However it was found that there was a significant increase in the requirement of ventilatory support (P=0.0506) for children who were inappropriately transfused for platelet counts of more than 20000/cumm.

In our study, it was further observed that 46% of transfusions were given for platelet counts of >20000 and in these patients there was a moderate, though statistically insignificant, increase in mortality (P=0.808) in these group of patients

Table 7: Fresh frozen plasma (FFP) transfusion in deranged coagulation profile, hypotension and low serum albumin corelated with duration of stay

FFP transfusion	VHF			Septicemia			Others		
	APP (n=59)	INAPP (n=92)	P value	APP (n=10)	INAPP (n=8)	P value	APP (n=3)	INAPP (n=3)	P value
Mean duration of stay	6.95	6.65	0.395	7.22	6.50	0.794	5.50	4.00	0.728

Table 8: Fresh frozen plasma (FFP) transfusion in deranged coagulation profile, hypotension and low serum albumin corelated with ventilation and mortality

FFP transfusion	VHF			Septicemia			Others		
	APP (n=59)	INAPP (n=92)	P value	APP (n=10)	INAPP (n=8)	P value	APP (n=3)	INAPP (n=3)	P value
Mortality	5(7.3%)	15(16.3%)	0.375	3(33.3%)	6(75.0%)	0.153	1(50.0%)	2(66.7%)	1.000
Ventilation support	4(6.6%)	21(22.8%)	0.008	5(55.6%)	1(12.5%)	0.131	2(50.0%)	2(66.7%)	1.000

APP: Appropriate if indication for transfusion is deranged coagulation profile
INAP: Inappropriate if indication for transfusion is hypotension and low serum albumin

In our study, of the total of 178 cases, seventy two cases (40%) received fresh frozen plasma for deranged coagulation profile which was considered as an appropriate indication. Eighty two cases (46%) received fresh frozen plasma for hypotension and thirty one cases (17%) for low serum albumin which were both considered as inappropriate indications.

Clinical outcome in these two groups of patients showed that there was no significant difference in duration of hospital stay. There was an increase incidence of mortality in children who received FFP for inappropriate indications, though it was not statistically significant (P=0.375). It was also noted that a statistically significant increase in morbidity in the form of increased requirement of ventilatory support for the inappropriately transfused group (P=0.008) was seen in our study.

Table 9: Packed red cell transfusion and corelation with duration of stay

Hemoglobin transfusion	VHF			Septicemia			Others		
	APP (n=7)	INAPP (n=3)	P value	APP (n=6)	INAPP (n=3)	P value	APP (n=2)	INAPP (n=1)	P value
Duration of stay	7.85	6.63	0.297	10.67	4.82	0.658	1.00	6.40	0.218

Table 10: Packed red CEL transfusion and correlation with mortality and ventilation

Hemoglobin transfusion	VHF			Septicemia			Others		
	APP (n=7)	INAPP (n=3)	P value	APP (n=6)	INAPP (n=3)	P value	APP (n=2)	INAPP (n=1)	P value
Mortality	2(28%))	1(32.3%)	0.221	3(50.0%)	2(72.7%)	0.860	2(100.0%)	2(40.0%)	0.429
Ventilation	3(42.9%)	2(65.1%)	0.521	3(50.0%)	2(72.7%)	0.600	2(100.0%)	2(40.0%)	0.429

APP: Appropriate for transfusions with hemoglobin <8 mg/dl. Inappropriate for transfusions with hemoglobin >8mg/dl.

In our study, of the total 178 cases, twenty two cases (12.3%) cases received packed red blood cell transfusion in acute systemic infections of which fifteen cases (68%) received packed red blood cells for haemoglobin <8mg/dl and 7 cases (32%) for hemoglobin >8mg/dl. It was observed that there was no significant difference in terms of duration of stay, ventilation and mortality in children given RBC transfusions either appropriately or inappropriately.

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.

To maximise the effectiveness, safety and utility of these transfusions, clinicians and intravenous therapists should be knowledgeable about the potential risk of blood component therapy. Therefore the clinician should keep in mind the appropriate indication for ordering blood components there by avoiding misuse and unnecessary exposure of the recipient to various infectious and noninfectious complications [5].

Blood components are amongst the most valuable and expensive commodities in transfusion medicine. 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 practised. It is important that 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.

Hence, a regular audit of blood and its component usage is essential to access the blood utilization pattern and set ideal policies in all of the blood using specialities. In spite of

The sophisticated blood banking services worldwide; indiscriminate use of blood components with inappropriate indications continue.

The present study was conducted upon 320 episodes of component transfusion over a period from Oct 2011 to Sept 2013 at a tertiary care teaching hospital in children with acute systemic infections predominantly with viral hemorrhagic fever and septicaemia. Of the total of 320 transfusion episodes in 178 patients, 113 episodes were for platelet concentrates, 185 episodes for fresh frozen plasma and 22 episodes for packed red blood cells.

The demographic, clinical, and laboratory parameters of all 178 patients were collected along with the indication for blood component transfusion. Of the total no of cases, 154 patients in the viral hemorrhagic group, seventeen in the septicemia group and seven 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. Clinical 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.

Thrombocytopenia is a common problem in dengue, which causes a lot of concern not only to the patients but also to the relatives and the attending physicians [6]. In our study, thrombocytopenia (platelet count <20000) was found in 54% of the viral hemorrhagic fever group. No clear guidelines exist for the management of thrombocytopenia. The natural tendency is to transfuse platelets whatever may be the counts. Thrombocytopenia in dengue is primarily immune mediated and platelet transfusion are said to aggravate the thrombocytopenia by an exalted immune response by presenting a strong antigenic stimulus. Besides, the short life span of transfused platelets result only in a transient non- sustained elevation of the platelet count which also evokes hypersensitivity reactions and fluid overload with complications such as pleural effusion, ascitis and pulmonary oedema.

A study by Jayashree *et al.* [7], which covered children below 15 years with serpositive dengue fever (DF) admitted to JSS University Hospital, Mysore found that 36.62% of all platelet transfusions in these children were inappropriate and there was no correlation noted between the platelet counts and severity of symptoms and only three patients out of twenty three with platelet counts below 10,000/cumm had signs of haemorrhage.

Similar studies done by Lye and Krishnamurty found no correlation between the bleeding score and platelet counts. In paediatric dengue shock syndrome, thrombocytopenia did not predict severe bleeding in a univariate analysis, the only two independent predictors of severe bleeding being shock and a low haematocrit [8].

Prophylactic platelet transfusion is defined as platelet transfusion without clinical bleeding, in contrast to therapeutic platelet transfusion given with clinical bleeding. Dengue patients can be categorized into the high, moderate, low and no risk groups based on their platelet count of <20,000, 21-40,000, 41-100,000 and >100,000/cumm, respectively at the time of admission. In our study sixty children had platelet count <20000 (high risk group) in whom prophylactic platelet transfusion were given. However, Lye *et al* have shown that prophylactic platelet transfusion did not improve relevant outcome measures, such as clinical bleeding, platelet increment and platelet recovery among adult dengue patients. Similarly in paediatric DSS, prophylactic transfusions of platelets and fresh frozen plasma did not reduce bleeding or expedite platelet recovery, instead caused fluid overload and prolonged hospitalization.

In our study 108 patients in the viral hemorrhagic group received platelet transfusion. Among these, sixty patients had platelet count <20,000/cumm (high risk group) and forty eight children with platelet counts of >20000/cumm received therapeutic platelet transfusions. Thus, the guidelines for platelet transfusion were ignored, exposing a significant number of patients to the unnecessary hazards of blood transfusion.

Sellahewa states that prophylactic transfusions for dengue are baseless and appear to be an irrational and inappropriate intervention. However, transfer of patients from peripheral hospitals to tertiary care hospitals primarily for platelet transfusions reflect the dilemma confronting clinicians in managing thrombocytopenia in patients with dengue. Makroo *et al.* noted that the prescription for the platelet transfusion is not based on medical rationale, but as a response to an intense social pressure on the treating physicians by the patients and their relatives.

Kumar *et al*. [10] also observed that the demands for platelet transfusion were mostly received as a panic reaction during the epidemic of dengue fever. Observing a fall in platelet count, even with counts above 20×10^9/l, the blood prescribing clinicians had sent requisition for platelet transfusion without any specific indications. This actually led to non-availability of platelet in a centre not geared to meet excessive requirements of platelets. The same chase 'for platelet counts has been mentioned by Ahluwalia. This syndrome of chasing platelet count in dengue patients who are otherwise completely asymptomatic and improving can be labelled as Dengue panic syndrome. This panic syndrome was also quite evident in our study.

The efficacy of prophylactic platelet transfusion and the threshold for transfusion is questionable. Platelet transfusions are hardly ever required even with counts as low as 10,000/cumm because the circulating platelets are haematologically active and sufficient to prevent bleeding by thrombocytopenia per se. In general, platelet transfusion are given only when there are serious haemorrhagic manifestations. Transfusion requirements correlate with the occurrence of bleeding from the gastrointestinal tract but not with the platelet count. Mucosal bleeding may occur in any patients with dengue but, if the patient remains stable with fluid resuscitation/replacement, it should be considered as minor. In patients with profound thrombocytopenia, strict bed rest and protection from trauma to reduce the risk of bleeding is recommended.

According to the guidelines by Ministry of Health, Sri Lanka there is no place for prophylactic platelet even with a count below 10,000/cumm if there is no evidence of bleeding. Considering the various guidelines and several studies done it is clear that platelet count alone does not predict the severity of bleeding. Hence before giving prophylactic platelet transfusion to a high risk group patients with platelet count <20,000, their haemodynamic status and signs of sepsis must be considered.

In our study the clinical outcome in a cohort of children who received platelet transfusion therapy was assessed in terms of appropriateness of blood transfusion. Platelet transfusions in children with platelet <20000 were considered to be appropriate and were compared with children who received platelet transfusion for counts of more than >20000. There was no significant difference in the duration of stay in the hospital. However it was observed that there was significant increase in the need for ventilatory support (P=0.0506) and an increased incidence of mortality in the group of children who received platelet transfusion inappropriately i.e. in those with platelet counts of more than 20000/cumm. This can be explained by the fact that any colloid given to a hemodynamically unstable patient may precipitate fluid overload and result in ARDS syndrome.

In the developing world a considerable heterogeneity exists for platelet transfusion practices between countries and even within countries in hospitals where this precious resource is available. As platelet products are scarce and expensive, there is a need to implement best platelet transfusion practices. A regular medical audit or a blood utilization review is an effective way of increasing the likelihood of improving transfusion practices. Constitution of a hospital transfusion committee, with constant communication, interaction and co-ordination amongst clinicians and transfusion medicine specialist, as well as continuing medical education programmes for prescribing clinicians and blood transfusion personnel would also be helpful in promoting appropriate use of blood.

In our study, seventy two cases of the total 178 cases i.e. (40%) received fresh frozen plasma transfusion for deranged coagulation profile which was considered as an appropriate indication. Although there is no clear evidence for use of fresh frozen plasma as a volume expander or in hypoalbuminemia, fresh frozen plasma was used indiscriminately in our study for these two indications which were considered as inappropriate. Eighty two children (46%) received fresh frozen plasma as a volume expander and in thirty one cases (17%) fresh frozen plasma was used to increase serum albumin.

Inappropriate use of this component not only leads to wastage of limited resources and deprives more needy patients of their use, but also leads to increased health care cost and risk of transfusion related complications which could lead to significant morbidity and mortality. Although guidelines exist since nineteen eighties for the use of FFP in hospital practice, its use has risen by over 20% in the past few years and concerns have been raised about the appropriateness of its clinical use.

In our study, children who received fresh frozen plasma for both appropriate and inappropriate indications were compared in terms of duration of stay, mortality and the need for ventilation. There was no significant difference in the duration of hospital stay in the children of the study. However it is important to note that there was a significant increase in morbidity in the form of need for ventilatory support in children who were inappropriately transfused with fresh frozen plasma (P=0.008). There was also an increased incidence of mortality in these children.

A similar study was carried out in critically ill children. The restrictive transfusion trigger was a hemoglobin level of 7 g per dl, with a target level of 8.5 to 9.5 g per dl (85 to 95 g per L). The liberal transfusion trigger was a hemoglobin level of 9.5 g per dl, with a target level of 11 to 12 g per dl (110 to 120 g per L). Patients in the restrictive group received 44% fewer blood transfusions, with no difference in rates of multiple organ dysfunction syndrome or death. The restrictive transfusion strategy is useful for children who are in a stable condition in the intensive care. It should not be used in preterm neonates or in children with severe hypoxemia, active blood loss, hemodynamic instability, or cyanotic heart disease.

In our study, of the total 178 cases, twenty two cases received packed red blood cell transfusion of which fifteen received packed red blood cell transfusion fora haemoglobin less than 8mg/dl and seven for haemoglobin of >8mg/dl. In these two group of children there was no significant difference in duration of hospital stay, requirement for ventilation and mortality. However, since the sample size was very small it was difficult to arrive at adequate conclusions in this situation.

Thus to conclude, there were significant episodes of inappropriate transfusions of platelet and fresh frozen plasma which lead to increased morbidity in form increased requirement of ventilatory support and increase in incidence of mortality with both components. However no such correlation was noted with either appropriate or inappropriate packed cell transfusion. The study therefore emphasizes the need for development of specific guidelines for transfusion of blood components, constant interaction and co-ordination amongst clinicians and transfusion centre for the implementation of these guidelines and a regular medical audit to review the optimal utilization of blood components

Conclusion

- The over view of appropriateness of transfusion of various blood components in our study revealed that of the total 320 transfusion episodes, 173(54%) were inappropriate.
- It was observed that 46% of children were inappropriately transfused for platelet count >20000. 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% (92) of children of wherein, 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 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.

References

1. Khairallah AA, Haddad SI *et al*. A forgotten chapter in the history of the circulation of blood. Ann Surgery. 1936; 104:1-80.
2. Harvey W. Facsimile reprint of Harvey's manuscript notes for his 1616 Lumleian Lecture.
3. London: Churchill. l886; 236:66-7.
4. Harvey W. Anatomical Exercise on the Motion of the Heart and Blood in Living Beings.
5. Frankfurt. 1628; 1134:5-6.
6. Landsteiner K. The differentiation of a type of human blood by means of normal animal serum. 1961; 1:1132.
7. Moss WL. Studies on isoagglutinins and isohemolysins. Bull Johns Hopkins Hospital. 1910; 21:63-70.
8. Moss WL. A simple method for the indirect transfusion of blood. American Journal Medical Sciences. 1914; 147:698-703.
9. Pallavi CK, Ganesh *et al*. Unfurling the Rationale Use of Platelet Transfusion in Dengue Fever. Indian J Hematol Blood Transfus. 2011; 27(2):70-74.
10. Sellahewa KH Management dilemmas in the treatment of dengue fever. Dengue Bull. 2008; 32:211-21.
11. Makroo RN, Raina V, Kumar P, Kanth RK. Role of platelet transfusion in the management of dengue patients in a tertiary care Hospital. Asian J Transfusion Science. 2007; 1(3):4-7.
12. Verma A, Agarwal P. Platelet utilization in the developing world: strategies to optimize platelet transfusion practices. IJPM. 2009; 41:145-6.