



A PROSPECTIVE STUDY ON RED BLOOD CELL TRANSFUSION PRACTICE IN OBSTETRICS

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ABSTRACT

Background: Optimal blood usage gives better blood inventory and limits transfusion risks. Blood reservations for anticipated blood loss, often results in blood wastage and non-availability for the needy patients. Studying the current Clinical Transfusion Practice in Obstetrics would ensure appropriate blood usage.

Aim: To assess Red cell utilization and appropriateness in Obstetrics Transfusion Practice

Materials & Methods: Blood reservations for Obstetrics in-patients studied during August 2014-July 2015. Collected data on the clinical and blood transfusion particulars were analyzed for the Red Cell usage, its appropriateness assessed by RCOG's Green-top guidelines no.47. Blood utilization indices calculated and compared with the standard cut-off values.

Results: Total Obstetrics in-patients with blood reservation - 1010. 96% of the patients transfused with blood components of various combinations. Anemia is the common indication for transfusion. 86.1% of transfused red cell units were for emergency LSCS. C/T Ratio -1.03, Transfusion Probability -96%. Transfusion Index -1.3, Single unit Transfusion Rate - 61.3%, Whole Blood Transfusion Rate - 6.9%. In appropriately transfused Red Cell units -28.6%.

Conclusion: Blood utilization indices were within normal limits. Inappropriate Red Cell use would get lessened, if transfusion deferred in patients with Hemoglobin of more than 10 gm% and in asymptomatic anemic patients with Hemoglobin of 8-10 gm% in early pregnancy

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INTRODUCTION

The Major Obstetric Hemorrhage (MOH) is the most common cause of maternal mortality worldwide¹ and so the blood transfusion therapy forms the back bone of Obstetric management. As a failsafe element, it rescues patients who are bleeding². World Health Organization (WHO) recognizes blood transfusion as one of the eight essential components of CEmONC (Comprehensive Emergency Obstetric and Neonatal Care) to reduce the Maternal Mortality Rate (MMR). But frequent blood requests are given without proper analysis of the real needs, as a "cushion" for either patients being in labor or the patients undergoing Caesarean section in the event of unexpected hemorrhage.

Also in many hospitals, the standards concerning the usage of blood for surgical reasons have not been changed for many years. "Transfusion styles" result in waste and inappropriate use of this altruistic resource. The average requirement for a particular procedure is usually assessed on the subjective anticipation of blood loss rather than on evidence based

estimates. It also evolves as a wrong perceptual issue on the part of operating room personnel that the Blood Bank will be unable to respond to an emergency situations².

Blood is a scarce human resource but without a substitute². Over ordering of blood with minimal utilization and unnecessary transfusions have serious implications like increased patient morbidity and mortality, expiry of the unused wasted blood kept under reservation, thereby reduced blood bank inventory, blood unavailability in times of the need, technical skills and time wastage, overall workload increase and transfusion cost increase³.

Patient Blood Management (PBM) developed to reduce the Allogenic Blood Transfusion (ABT), as there is evidence of both clinical and economical disadvantage of ABT, in managing peri-operative anemia and it advocates the restrictive use of the same⁴.

In recent times, optimal use of blood products has become an integral part of National Hemovigilance system. Thus minimizing unnecessary transfusions conserves the blood components and reduces the healthcare expenditures⁵.

The audits on clinical transfusion practices have also consistently pointed about the lack in knowledge on prescription, identification or administration of the transfusion

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recipients⁶. One such tool of that system is analyzing the blood requisition forms and blood component utilization⁷ which ensures the appropriateness of blood usage in modern health care services.

Hence, with this background, this study was designed to know the current transfusion practice in Obstetrics field in the Department of Obstetrics and Gynecology, Government Kilpauk Medical College hospital, Chennai and thereby helping to promote good clinical transfusion practice.

Aim

To assess the Red Cell utilization in Obstetrics Transfusion practice.

Objectives

To study the red cell transfusion requirement in the Obstetric in-patients.

To assess how many of the obstetric patients actually received red cell transfusion.

To analyze the indications and appropriateness of the transfused red cell component.

MATERIALS AND METHODS

The descriptive cross-sectional study was done on Obstetrics in-patients for whom blood requests were given in the Department of Transfusion Medicine, The TamilNadu Dr. M.G.R. Medical University, Chennai and Government Kilpauk Medical College Hospital, Chennai in association with the Department of Obstetrics and Gynecology, Government Kilpauk medical college hospital, Chennai. All Obstetrics in-patients for whom blood requests given, were included in the study period August 2014 and July 2015. Obstetrics in-patients who are not willing to participate in study were excluded in the study.

The study protocol was approved by the Ethical Committees of both University and Institute. All the patients were classified according to their diagnosis. Clinical and Blood Transfusion details were obtained from the individual's case record, blood request forms and reservation/issue registers. The received blood requests were processed and cross-matched as per the Hospital Transfusion guidelines.

- The following variables of the study population were recorded: 1) Patient Demographics, 2) Blood Group & Rh Typing, 3) Obstetrics history and Diagnosis, 4) Indication for transfusion, 5) Hemoglobin level, 6) Components requested and issued.
- The following indices were used to know about the efficiency of the blood utilization practice: 1) Cross-match to Transfusion Ratio (C/T ratio)⁸, 2)

Transfusion Probability (%T)⁸, 3) Transfusion Index (TI)⁸

The appropriateness of the Red Cell Transfusion in Obstetrics arrived by using the RCOG guidelines⁹ for blood transfusion in Obstetric patients. Maximum Blood Order Schedule (MSBOS) were also calculated.

Statistical Analysis: The collected data was transformed to Microsoft Excel. Statistical analysis was done with SPSS software, version 17. Ratios and proportions between various groups were used to express the C/T ratio, Transfusion Probability, Transfusion index.

RESULTS

During the study period, there were 3169 Obstetrics admissions with a total 2936 deliveries. The Obstetric in-patients of 1010 for whom blood transfusion requests given comprised the study population which constituted 31.9% of the total admissions. The study population of 95.9% had received the blood/blood components for transfusions.

The results of the study were analyzed under the following sub-headings:

1. Blood utilization vs age groups and Parity.
2. Analysis of the Blood Ordering and Utilization in Obstetrics Transfusions.
3. Blood utilization vs Obstetric conditions
4. Blood Utilization Indices (overall and for specific diagnosis) for Red Cell Transfusion.
5. Appropriateness of Red Cell Transfusion as per RCOG guidelines
6. Single unit Transfusions
7. Whole Blood Transfusions

Blood utilization vs age groups and Parity: The maximum and minimum age of the study population was 40 years and 16 years respectively. The 21-30 year age group constituted the highest percentage among the study population and received the maximum transfusions. The non-transfused population was also high in the 21-30 years group (4.5%). Among the transfused population, >30 years group had the highest transfusion utilization percentage (98.8 %).

Primiparous was 34.6% and Multiparous women were 64.6% among the study population.

The distribution of the blood groups in the study was reflecting the blood group distribution of the general population. The prevalence of Rh D negative status in this Obstetrics population was 6.8%.

Analysis of the Blood Ordering and Utilization in Obstetrics Transfusions: Upon analysis of the Blood Ordering and Utilization in Obstetrics Transfusions, PRBCs were mostly requested by the patients and transfused to the patients (Table 1).

Table 1 Overall blood ordering/utilization in Obstetrics

Overall Utilization	Total		Total WB		Total RBC		Total FFP		Total Platelets		Total Cryo	
	patients	Units	patients	units	patients	units	patients	units	patients	units	patients	units
Requested	1010	1788	76	140	981	1443	94	136	35	62	03	07
Transfused	969	2240	70	133	941	1393	88	497	34	191	03	26
Cancelled	41	84	06	07	40	50	06	21	01	06	00	00

The plasma, platelets and cryoprecipitate had been utilized by the complicated cases of Caesarean delivery (Caesarean hysterectomy) with the blood components utilization percentage of 21.1%, 18.3%, and 25.7% respectively. The cases of Obstetric Hemorrhage comprised 21% of the study population and utilized 16.8% of the RBC units (Table2).

Blood Utilization vs Obstetric Conditions

Anemia complicating pregnancy was common among the study population (50.1%), which had also utilized the red cell component (30.1%) to a maximum followed by the Caesarean section cases (20.6%).

Table 2 Blood Utilization vs Obstetric Conditions

Diagnosis	Patient percentage	Utilization percentage	
		WB	RBC
Anemia	50.1%	2.2%	30.1%
Abortion	6.3%	1.5%	3.6%
Ectopic pregnancy	2.8%	7.1%	1.8%
Hydatidiform Mole	0.1%	0.6%	0.2%
APH	6.6%	11%	5%
Abruptio Placenta	4.3%	7.9%	2.9%
Placenta Praevia	2.4%	3.1%	2.1%
Vaginal delivery	34.9%	8.9%	18.7%
Caesarean Sections	34.9%	18.3%	20.6%
PPH	14.4%	20.7%	11.8%
DIC	2.2%	6.5%	2.3%
HELLP	0.3%	5.3%	0.7%
Overall	100% (n=1010)	95%	96.5%

Utilization percentages for plasma, platelets, cryoprecipitate were 95.6%, 97% and 100% respectively for the high risk cases like Ante partum and Postpartum Hemorrhage, Disseminated Intravascular Coagulation, and HELLP Syndrome.

Blood Utilization Indices for Red Cell Transfusion: CT ratio was within limits for both Primi and Multiparous women. The average number of units used per Patient (Transfusion Index) for both Primi and Multi was 1.3 and 1.4 respectively.

Table 3 Blood Utilization Indices for Red Cell Component usage

Diagnosis	C/T ratio	% T	TI	Maximum Blood Order (TI x 1.5)
Anemia	1.1	94.3%	1.5	2.25
Abortion	1	100%	1.4	2.1
Ectopic Pregnancy	1	96.6%	1.5	2.25
Hydatidiform Mole	1	100%	1.5	2.25
Ante partum Hemorrhage	1.02	92.5%	1.8	2.7
Abruptio Placenta	1.1	88.4%	1.8	2.7
Placenta praevia	1.02	95.8%	2.1	3.1
Vaginal delivery	1.04	93.8%	1.3	1.3
Caesarean delivery	1.04	96.6%	1.4	1.4
Postpartum Hemorrhage	1.02	96%	1.7	2.6
DIC	1	87%	2.4	3.6
HELLP	1	100%	1	1.5
Overall	1.03	96%	1.3	---

C/T Ratio – Cross-match/Transfusion ratio, %T – Transfusion probability, TI – Transfusion Index

Appropriateness for Red Cell Transfusion: Inappropriate Red Cell transfusion rate was 28.6% given to the cases undergone Emergency Caesarean Sections done in the Hemoglobin range of 8to 10 gm% and more than 10 gm%.

Single Red Cell Transfusion: The rate of single unit transfusion was 61.3%.It was 33.4%, 34.7% and more than 12.1% in the hemoglobin range 7 to 8gm%, 8-10 gm% and 10 gm% respectively.

Whole Blood Transfusion: The usage of whole blood was 5.7%, indicated for Obstetric Hemorrhage.

DISCUSSION

In the developing countries, the blood demand is high but handicapped with the short fall in its supply. Blood non-availability could contribute to about 25% of maternal mortality and 40% of the mortality in children. Lackritz *et al.*, Bugge *et al.*, Natukunda *et al*¹⁰. had documented a 13%, 17%, and 17% of blood transfusion rates for the pregnancy related complications respectively in their studies¹⁰.

Blood usage in developed countries is for surgical and advanced medical conditions like chemotherapy induced anemia¹³ but these countries too contribute to the inappropriate transfusions of about 18-35%¹¹. And the scenario in developing world is that the Obstetrics blood usage stands high (37%)¹². In India, inappropriate utilization of the blood resources is about 30 -60%¹¹.

Blood transfusion is the fail safe element in the Obstetrics and its significant role in reducing the maternal mortality. Optimal utilization of the same is the need for the hour to overcome its clinical and economical disadvantages. The studies on the Allogenic Blood Transfusion alternatives, intraoperative cell saver, clotting factor concentrates, Recombinant Factor VIIa (rFVIIa), Erythropoietin (EPO) are to a limited access to a resource poor countries¹². Also Perioperative hemodilution are to be used with caution in pregnancy.

The appropriate use of blood is the subject of debate, due to the lack of consensus among clinicians. Monitoring the transfusion practice with the established guidelines helps to use the resource appropriately, avoid unnecessary transfusions. This study prospectively evaluated the blood utilization practice in Obstetrics.

Obstetrics in-patients admitted during the study period were 3169. The Obstetrics in-patient included in the study, for whom blood transfusion requests given were 1010(31.9%) and the transfused population constituted 30.6% among the total admissions.

Our hospital is a tertiary centre, handling all types of Obstetric emergencies. Added to this, was also a high Caesarean section rate, as mostly the Primary Health Centre takes care of the normal deliveries. The Obstetrics transfusion rate in Natukunda *et al*¹⁰ , Buggie *et al.*¹⁰ was 17%.and that of J.A. Patterson *et al.*¹³ was 1.4%. A dramatic change in reduction of red cell usage for General surgical cause by 40% in the past 10- 12 years had been reported by Hazel Tinagate *et al.* which was not monitored in Medical or Obstetrics and Gynecological setting. WHO has documented a 37% transfusion rate for the pregnancy related complications

Analysis of the blood ordering practice in Obstetric Transfusions: As in our institute it is not a routine practice to reserve blood for the normal deliveries and uncomplicated Caesarean deliveries, only 4.1% patients had not utilized the requested blood. For the outcome of vaginal or operative delivery in the healthy and uncomplicated parturient the routine cross-match is not recommended by the American Society of Anesthesia Practice Guidelines for Obstetric Anesthesia¹⁴.

The maximum requests were for Red Cell component (80.7%) followed by Whole Blood requests (7.8%). A Blood request

rate of 2.7% was unused in overall transfusion. The Blood requests rate of 2.6% and 1.5 % was the unused for the cases of Anemia complicating pregnancy and Caesarean sections respectively. The number of elective caesarean cases were 10% and 0.2 % of the requests were unused among their Blood reservations. But the studies by Penney *et al*¹⁵ had the 89% requests has the cover for surgeries or diagnosis in Obstetric conditions.

Blood Utilization, based on specific diagnosis and indication of the transfusion

It is difficult to accurately quantify the Obstetric hemorrhage as she is bestowed with the high-level capacity to tolerate the Obstetric hemorrhage masking the vital signs¹⁶. Blood transfusion in Obstetrics differs from other field, as most of the transfusions are given for the unexpected hemorrhages occurring in otherwise healthy women with a considerable variation in the Obstetric transfusion practice¹³. The guidelines formed for the Obstetric transfusion practice, especially on massive hemorrhage is usually are from the experiences of the general surgical population and from the War field¹⁷, which could not be applied /suitable for this unique population. Thus all the potential mothers constitute a unique high risk population and are a challenge to the health care provider²¹ although pregnancy is physiological¹⁸.

Obstetric Hemorrhage continues and leads the cause for maternal mortality-34% in Africa, 31% in Asia, 21% in Latin America and 13% in the developed countries¹². The MMR in India is 254 /1, 00,000 live births. As per the Millennium Development Goal, it is set as 100/1, 00,000 live births¹⁹. In spite of improved Obstetric care than ever before, maternal deaths due to hemorrhage is 26% in sub-Saharan Africa and these are direct consequences due to lack of blood transfusion services. Access to safe blood transfusion could have averted 150,000 maternal deaths each year^{20,21}. But in developed countries, blood is safer than ever before with molecular screening methods.

In the present study, the overall blood utilization rate was 96.4%. Obstetric Hemorrhage required a Whole blood transfusion rate of about 31.7% (APH-11% PPH-20.7%). Caesarean sections, DIC and HELLP cases had utilized whole blood -18.3%, 6.5%, and 5.3% respectively. Red cell transfusion rate was high (30.1%) in cases of anemia, followed by the cases of Caesarean delivery (20.6%) and Obstetric Hemorrhage had utilized 16.8%. Silverman *et al.*²² in his study noted, PPH (34%) was the commonest cause for transfusion. Kameni *et al.*²³ had a similar outcome of blood usage for PPH (51%) in contrast to our study as the developing countries house the global burden of anemia .

Blood Transfusion vs Mode of delivery: The Caesarean section rate in our study was 48.9%, which was the above the upper limit set by WHO (Caesarean rate to be not more than >15%). The blood and blood components utilization was found to be high in Cesarean deliveries. While considering the mode of delivery, the Red cell usage was 52.6% in Caesarean deliveries and is due to rising trend of Caesarean sections .The red cell transfusion rate in Caesarean sections and Vaginal delivery was 20.1% and 18.7% respectively. The Klapholz *et al*²⁴ reported a transfusion rate of 1.7 % for vaginal deliveries and 5.2% for Caesarean deliveries. Goundan *et al*²⁵ in his study found the transfusion rate of 12.2% for caesarean sections.

Blood utilization Indices: Our study had the C/T Ratio of 1.03. A study by Kameni *et al.*²³ showed 2.9. A C/T ratio of 9.7 was the outcome of one another study by Khan *et al.*²⁶ in Pakistan. The total elective cases were 36 among a total of 352 caesarean sections. Being a CEmONC, with high rate of referral cases of high risk pregnancies, most of the transfusion requests are raised as the emergency transfusion episodes. The overall transfusion probability was 96% in the present study, but it is 9.3% in the study of Penny *et al.*¹⁵ Transfusion index was 1.3 in the present study.

Appropriateness of Red Cell units: The present study had 28.6% as the inappropriate transfusions. Under the Hemoglobin range of 8-10 gms%,110 cases had undergone emergency Caesarean sections. In cases with Hemoglobin >10 gms %,29 case had undergone Caesarean sections. So- Osman *et al.*²⁸ study showed 46% as the inappropriate transfusions. A study by Parker *et al*²⁹ revealed inappropriate transfusion were 31% in the patients with Hb of >7 gms% in the absence of ongoing bleeding in asymptomatic anemic case.

Single Unit: One study in Canada addresses this issue that it would be an effective but simple, blood and cost -saving strategy reducing the ABT risks. Studies by Sabeen Afzal¹¹, Khan *et al.*²⁵ and Ozumba *et al*³⁰ had documented a rate of 11.1%, 66.2%, and 43.1% of single unit transfusion respectively. In the present study the single unit transfusion rate was 61.3%. If the anemia identified early in pregnancy, an opportunity exists for patients to receive the most appropriate transfusion sparing strategy and reduction in single unit transfusion.

Whole Blood Transfusion: WHO states that the usage of 80-85% as the Whole Blood (WB) in clinical transfusion practice contributes to 25% of inappropriate use due to WB, rather than the component usage. International Red Cross estimates that the usage of blood would come down to 30% if appropriately used¹¹.

Whole blood transfused more commonly in Obstetric Hemorrhage accounting 31.7%. Among the 29 cases of ectopic pregnancy, 25 units of whole blood transfused which more commonly encountered a hemoperitoneum of around 2000ml. Osaheni *et al*²². reports 70% as the whole blood utility in Obstetrics transfusion practice. James *et al.* reported a 43% usage of whole blood in Obstetrics³¹

Table 4 Comparison Table of present study outcome with other studies

1. Obstetrics Transfusion Rate				
Place	Author	Year of Study	Study Population	Transfusion rate
Chennai, India	Present Study	2015	1010	30.6%
New South Wales, Australia	J.A. Patterson <i>et al.</i> ¹³	2015	3914	1.4%
Malawi	Bugge <i>et al.</i> ¹⁰	2013	-	17%
Abakaliki, South -East Nigeria	Osaheni <i>et al.</i> ³²	2012	151	7.4%
Uganda	Natuknda <i>et al.</i> ¹⁰	2010	-	17%
Netherlands	So -Osman <i>et al.</i> ²⁸	2009	2873	3%
Toronto	Silverman <i>et al.</i> ²²	2004	33795	0.65%
Kenya	Lackritz <i>et al.</i> ¹⁰	1993	-	13%
2. Parity				
Chennai, India	Present Study	2015	1010	Primi-34.7% Multi-65.3%
Abakaliki, South- East Nigeria	Osaheni <i>et al</i> ³²	2012	151	Primi-44.4% Multi-44.6%
3.Age distribution				

Chennai, India	Present Study	2015	1010	>20 years-12.6% 21-30 years-79.4% >30years-3.1%
Abakaliki, South -East Nigeria	Osaheni <i>et al</i> ³²	2012	151	>20 years-6.6% 21-30 years-57.6% >30years-25.8%

4. Blood component usage

Chennai, India	Present Study	2015	1010	WB-6.9% RBC-93.1%
Texas	James <i>et al.</i> ³¹	2009	66369	WB-43% RBC-39%
Abakaliki, South -East Nigeria	Osaheni <i>et al</i> ³²	2012	151	WB -70% RBC -30%

5. Indication of Transfusion

Chennai, India	Present Study	2015	1010	Anemia-30.1% OH-16.8%
Abakaliki, South -East Nigeria	Osaheni <i>et al</i> ³²	2012	151	Anemia-72.2% OH-19.2%
Toronto	Silverman <i>et al.</i> ²²	2004	216	OH-34%
-	Kamani <i>et al.</i> ²⁷	1988	6003	Anemia-12% OH-73%
-	Parker <i>et al.</i> ²⁹	2006	222	Anemia-43% OH-22%

6. Mode of delivery vs Transfusion Rate

Chennai, India	Present Study	2015	1010	Vaginal-18.7% CS-20.6%
Pune, India	Madhusudan Dey <i>et al.</i> ³³	2013	173	CS1.7%
Chandigarh, India	Goundan <i>et al.</i> ²⁵	2011	1769	CS-12.2%
Enugu	Ozumba <i>et al.</i> ³⁰	2006	463	CS -25.2%
Nigeria	Faponle <i>et al.</i> ³⁴	2005	641	CS-8.9%
Massachusetts	Klapholz <i>et al.</i> ²⁸	1990	30621	Vaginal-1.7% CS-5.2%

7. Blood Utilization Indices

Chennai, India	Present Study	2015	1010	C/T Ratio-1.03
Chandigarh, India	Goundan <i>et al.</i> ²⁵	2011	1769	C/T RATIO-5.46
-	Kameni <i>et al.</i> ²³	1988	6003	C/T Ratio-2.9
South West Nigeria	Oluwarotimi <i>et al.</i> ³⁵	2010	1056	C/T Ratio-7.4
Karachi, Pakistan	Khan <i>et al.</i> ²⁶	2002	126	C/T Ratio-9.7
Netherlands	So-Osman <i>et al</i> ²⁸	2009	2873	Inappropriate-46%
-	Parker <i>et al.</i> ²⁹	2006	222	Inappropriate-31%
Toronto	Silverman <i>et al.</i> ²²	2004	216	Inappropriate-32%

8. Single unit Transfusion

Chennai, India	Present Study	2015	1010	61.3%
Abakaliki, South -East Nigeria	Osaheni <i>et al</i> ³²	2012	151	44.4%
Islamabad	Sabeen Afzal ¹¹	2011	350	11.1%
Enugu	Ozumba <i>et al</i> ³⁰	2006	463	43.1%
Karachi, Pakistan	Khan <i>et al.</i> ²⁶	2002	126	66.2%
-	Kameni <i>et al.</i> ²³	1988	6003	5%

CONCLUSION

According to the WHO, the corner stones for safe and effective blood transfusion services depend on 1. National blood transfusion service system existence, 2. Voluntary donations, 3. Blood testing and 4. Avoidance of unnecessary transfusions²⁰.

The challenges ahead in the developing countries are the limited infrastructure, high cost for blood procurement, screening, storage, questionable safety of the available blood, low blood donation rates and the highest mortality rates. It is evident that blood non-availability, directly affects maternal mortality. Misconceptions regarding blood transfusion and alternate therapeutic option availability are to be discussed early with the pregnant women. If the needs for the blood arise in them, this could help to prevent the undue delay in getting the consent for the same

In our study, 71.4% of the red cell units transfused were considered appropriate according RCOG guidelines for blood transfusion in Obstetrics. In the present study, single unit PRBCs transfused were (61.3%). It could be kept to a minimum if the treatment of anemia is optimal during the pregnancy. Blood utilization indices were well within normal limits because majority of the blood units (86.1%) reserved were transfused and were for emergency LSCS. However, inappropriate use of red cell units can be reduced further (to less than 28%) by avoiding transfusion for patients with Hemoglobin of more than 10 gm% and also for asymptomatic anemic patients with Hemoglobin of 8-10 gm% in early pregnancy. Iron and nutritional supplements greatly to be emphasized in early pregnancy.

Adequate blood inventory always allays obstetrician's apprehension of blood availability. At the same time, in a country like India where demand is always more than supply, appropriate use of blood components is repeatedly emphasized.

In recent times, optimal use of blood products has become an integral part of National Hemovigilance system in few countries like Belgium, Ireland, and Netherlands.⁵ Regular audits on the clinical transfusion practice together with Continuous Medical Education programs disseminate the knowledge on the appropriate and optimal use of the blood resource.⁶

In this age of Genomics, we are yet to find an ideal blood substitute. We depend only on the human resource. Blood, an altruistic resource, has to be maximally utilized, taking into the consideration of the future growing demand for red cells in modern therapeutics. It is an uphill task to meet growing demand for the safe volunteer blood, due to the changing donor demographics leading to diminished donor pool even in developed countries. Blood transfusion – a mini transplantation procedure is also potentially hazardous in spite of measures to aspire a 'zero risk' Moreover, the small but definite risk of blood transfusion still exists. Emerging infections also threatens the blood safety and the patients' outcome. Hemovigilance for the donor and patient safety is blooming on its way in different parts of the world, as because blood is life!

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