Review Article

Blood Product Transfusions In Critically Ill Patients

Gaurav N*, Durga K **, Anitha A*

*Senior Resident, **Professor, Department of General Medicine, Chettinad Academy of Research and Education, Chennai.

V.S. Gaurav Narayan is a Senior Resident in the department of General Medicine, Chettinad Academy of Research and Education. He completed his MBBS from Annamalai University and MD in General Medicine from SRM Medical College, Chennai. His areas of interest are gastroenterology and rheumatology.

Corresponding author - V.S. Gaurav Narayan (gauravadi2000@gmail.com)

Chettinad Health City Medical Journal 2019; 8(2): 52 - 54

Abstract

The Intensive Care Unit in every hospital consumes a large number and variety of blood products on a daily basis. Although commonly used, there is no consensus on the trigger and outcomes of usage of packed cells, plasma, platelets and other products.

Multiple studies have shown the detrimental effect of the inadvert use of packed cells, thus cautioning against a low threshold for transfusion in most ICU patients. It has been emphasised that transfusion based on patient related factors such as symptoms of hypoxia, lactic acidosis and heart failure should be utilised rather than an arbitrary haemoglobin value.

Also, prophylactic use of platelets or plasma in non-bleeding patients has been shown to not have any benefit, in addition to causing worse outcomes. This review article focuses on highlighting some evidence based key points related to threshold and indications for various blood product transfusions in the ICU.

Key Words: Blood transfusions, ICU- Intensive Care Unit, Anaemia, Coagulopathy.

Introduction

It has been estimated that nearly fifty percent of patients getting admitted in the intensive care unit require some blood product transfusion during their stay in the hospital.[1] Thirty to 45% receive red cell transfusion,[2] 10–30% receive plasma transfusion and 10–20% receive platelets.[3] However, no single guideline exists for the initiation of such said transfusions, leading to a widespread variability in outcome. Also, the impact of these transfusion on the length of hospital stay and the increase in adverse events have not been established. This article deals with an analytical approach to each blood product transfusion, emphasising on threshold for usage, and possibly, its impact on outcome.

Red Blood Cell Transfusion

RBC transfusions are the most commonly used blood products in the ICU. It has been well established that RBC transfusions in the setting of acute blood loss are lifesaving.[4] However, in the setting of a long term critically ill patient, RBC transfusions have been shown to be detrimental.[5] The extent of blood loss due to frequent sampling in the ICU has been undermined and is an important cause of anemia in the critical care unit. The tolerance threshold for anemia varies greatly between critical and non-critical patients. Red blood transfusions have been shown to be detrimental in multiple studies.[6] In acute coronary syndrome, blood transfusions have been shown to have adverse outcomes. However, blood transfusions may be useful for STEMI patients, especially those in the elderly age group.[7] We have most evidence for the transfusion threshold in critically ill from the TRICC (Transfusion Requirements in Critical Care) trial. It showed that patients with a restrictive threshold (Hemoglobin of 7 g%) had a better outcome than patients with a liberal threshold (9 - 10 g%).[8,9] However, it is recommended to have a higher threshold (8 g%) in patients with sepsis and symptoms suggestive of poor tissue perfusion. Hence, a patient centric approach is advisable. The decision to transfuse a patient should be tailored, taking into account several factors, including signs and symptoms of tissue hypoxia (angina pectoris, cognitive dysfunction), increased blood lactate levels or electrocardiographic changes suggestive of myocardial ischemia.[10]

Plasma Transfusions

Fresh frozen plasma is an active way to provide multiple coagulation factors to a bleeding patient. However, a large number of plasma transfusions are done on non-bleeding patients. There is no proper consensus on the outcome associated with prophylactic plasma transfusion. Furthermore, prophylactic plasma transfusions can cause acute lung injury, leading to increased time on the ventilator.[11]

Although commonly used, the International Normalised Ratio is not an ideal tool to assess the risk of bleeding. In fact, 30% of ICU patients have an INR >1.5. The risk of procedure related bleeding is extremely low even in patients with elevated INR. The risk of major bleed after central venous line insertion has been found to be only 0.1-0.8%, whereas that of minor bleed 2.2-6% in patients with INR>1.5.[12] This raises further questions on the role of prophylactic plasma transfusions. The other issue on hand is the volume of plasma to be transfused. It has been shown in large scale randomised controlled trials that administration of low dose plasma(12mL/kg) produces a similar improvement in the coagulation profile as a high dose of plasma(20mL/kg).[13]

To conclude, use of elevated INR, or other factors such as a drop in systolic blood pressure as a predictor of active bleeding is obsolete. Also, use of plasma should be restricted to patients having active or major bleeding which does not include mucosal bleed. The OASIS criteria defines major bleeding as that causing reduction in hemoglobin of >2g%, intracranial, intraocular or retroperitoneal haemorrhage, or bleeding requiring at least two packed cell transfusions. Also, prophylactic peri procedural plasma transfusion is also not advised as the procedural bleeding risk is negligible. Finally, lower volumes of plasma transfusion are sufficient to protect against bleeding in most clinical situations in the critically ill.

Platelet Transfusions

Platelets are the third most commonly used blood product in the ICU. They are used in various settings such as blood malignancy, sepsis with coagulopathy, viral haemorrhagic fevers, liver disease associated thrombocytopenia and bone marrow failure. However, the elevation of platelet count post transfusion varies between patients, so as the wide variability in clinical improvement. The thrombocytopenia seen in the ICU is usually multifactorial, induced by a combination of inflammation, infection and coagulopathy in contrast to the chemotherapy induced thrombocytopenia seen in non-critical care patients. Hence, there should be a difference in approach as well.

It was initially believed that single donor platelet transfusions (SDP) are safer as compared to random donor platelet (RDP) transfusion due to the reduced risk of alloimmunization. However, studies have shown that leuko-reduced RDP transfusion has a similar safety profile to SDP transfusions.[14] Also, storage of SDP requires more complicated equipment, hence making RDP more cost efficient, especially in developing countries. Moreover, after 5 days of storage, SDP have been seen to lose their efficacy.

For the purpose of hemostasis, the number of platelets required is quite low. Studies have shown that platelets as low as 5000/cumm are sufficient to maintain endothelial integrity.[15]

Also, it has been observed that above a threshold of 10,000/cumm, increasing platelets iatrogenically has not shown a reduction in the incidence of spontaneous bleeding. This was observed majorly in Dengue patients.[16] Platelets administered can either be apheresis units or blood derived platelets. A standard platelet transfusion is that containing a single apheresis units or blood derived platelets equivalent of $3x10^{11}$ to $6x10^{11}$ in number. Any dose double this is considered a high dose platelet transfusion.[17] A standard platelet dose has been shown to elevate the blood platelets by 10,000-19,000 / cumm, whereas that of a high dose transfusion raises platelets by 24 - 38,000 / cumm. However, this increase in platelets has not been seen to have an impact on mortality, with outcomes similar in both groups. Hence, prophylactic transfusion of platelets is not recommended, and must be reserved for those with levels <10,000/cumm or active bleeding manifestations. Random donor platelets are cheaper and more practical for usage in a third world setting.[18]

Cryoprecipitate Transfusion

Cryoprecipitate is less commonly used, and not easily available as compared to other blood products. It is useful in two major setting- haemophilia and low fibrinogen disorders. There is very little published data on the use of cryoprecipitate in the ICU in low income countries. In most countries, it is licensed for use only in congenital bleeding disorders such as haemophilia and congenital hypofibrinogemia syndromes. It has also proven to be useful in some patients with Von Willebrand disease.

It would be apt to transfuse cryoprecipitate when the fibrinogen levels are <1g/L, as is commonly practiced in North America and Canada. A disadvantage seen with cryoprecipitate use is if not used within 4 hours of thawing, it loses it efficacy. A standard dose established from various studies is one unit per 5-10kg body weight, which will raise the blood fibrinogen levels by 1g/L. To conclude, the usage of packed cells with plasma in the event of acute blood loss has been well documented. Hence, due to lack of availability of cryoprecipitate, plasma may be administered in the event of an appropriate clinical setting.[19]

Conclusion

There is no uniform consensus on the use of various blood products in the critical care unit. Also, various studies have established that arbitrary lab values do not reflect on patients' eventual outcome. Hence, it prudent to choose the type and volume of blood product based on relevant information obtained on the clock, with emphasis on patient centric parameters observed on the bedside, which will have a better impact on patient prognosis.

References

1) Shehenta N,Foster A J,Lawrence N et al.Transfusion Patterns in All Patients Admitted to the Intensive Care Unit and in Those Who Die in Hospital: A Descriptive Analysis, PLoS One. 2015; 10(9): e0138427.

2) Vincent JL , Baron JF, Reinhart K et al. Anemia and blood transfusion in critically ill patients. JAMA. 2002. ;288(12):1499–507.

3) Stanworth SJ, Walsh TS, Prescott RJ et al. A national study of plasma use in critical care: clinical indications, dose and effect on prothrombin time. Crit Care. 2011;15(2):R108.

4) Vymazal T. Massive hemorrhage management—a best evidence topic report. Ther Clin Risk Manag. 2015;11:1107–11.

5) Unroe KT, Greiner MA, Hernandez AF et al. Resource use in the last 6 months of life among medicare beneficiaries with heart failure, 2000–2007. Arch Intern Med. 2011.

6) Marik PE, Corwin HL .Efficacy of red blood cell transfusion in the critically ill: a systematic review of the literature. Crit Care Med. 2008 36(9):2667-74.

7) Sabatine MS, Morrow DA, Giugliano RP et al. Association of hemoglobin levels with clinical outcomes in acute coronary syndromes. Circulation. 2005; 111(16):2042-9.

8) Hebert PC, Wells G, Blajchman MA et al. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care: Transfusion Requirements in Critical Care Investigators, Canadian Critical Care Trials Group. N Engl J Med 1999; 340:409 – 417.

9) Hebert PC, Tinmouth A, Corwin HL. Controversies in RBC transfusion in the critically ill. Chest. 2007;131:1583–1590.

10) Weiskopf RB, Feiner J, Hopf H et al.Fresh blood and aged stored blood are equally efficacious in immediately reversing anemia-induced brain oxygenation deficits in humans. Anesthesiology. 2006; 104(5):911-20.

11) Dara SI, Rana R, Afessa B et al.Fresh frozen plasma transfusion in critically ill medical patients with coagulopathy. Crit Care Med. 2005; 33(11):2667-71.

12) Fisher NC, Mutimer DJ . Central venous cannulation in patients with liver disease and coagulopathy--a prospective audit. Intensive Care Med. 1999; 25(5):481-5.

13) Tinmouth A, Chatelain E, Fergusson D et al. A Randomized Controlled Trial of High and Standard Dose Fresh Frozen Plasma Transfusions in Critically Ill Patients. Transfusion. 2008; 48:2 6 A–27A.

14) Kumar ND, Tomar V, Singh B et al. The Trial To Reduce Alloimmunization To Platelets Study Group Leukocyte reduction and ultraviolet B irradiation of platelets to prevent alloimmunization and refractoriness to platelet transfusions. N Engl J Med. 1997;337(26):1861-9Slichter SJ.

15) Slichter SJ.Relationship between platelet count and bleeding risk in thrombocytopenic patients. Transfus Med Rev18: 153-167.

16) Kumar ND, Tomar V. Platelet transfusion practice during dengue fever epidemic. Indian J Pathol Microbiol,2000, 43: 55-60.

17) Sherrill J. Slichter. Dose of Prophylactic Platelet Transfusions and Prevention of Hemorrhage N Engl J Med. 2010; 362(7): 600–613.

18) Hersh JK, Hom EG, Brecher ME .Mathematical modeling of platelet survival with implications for optimal transfusion practice in the chronically platelet transfusion-dependent patient Transfusion. 1998; 38(7):637-44.

19) Alport EC, Callum JL, Nahirniak S et al. Cryoprecipitate use in 25 Canadian hospitals: commonly used outside of the published guidelines. Transfusion. 2008;48(10):2122–2127.