International Journal of Research in Medical Sciences
Ali Z et al. Int J Res Med Sci. 2017 May;5(5):1858-1861
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20171806

Original Research Article

A review of the blood transfusion practices in neuroanesthesia in the perioperative period in a tertiary care hospital

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Received: 10 April 2017
Accepted: 11 April 2017

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ABSTRACT

Background: Blood transfusion involves the administration of blood and blood components. Neurosurgical procedures are associated with significant blood loss with the need for blood transfusion in the preoperative, intraoperative and postoperative period to maintain optimal hemodynamic and cerebral oxygenation. Various neurosurgical procedures as traumatic brain injury, complex spinal surgeries, and endovascular neurosurgical procedures may need blood transfusions to maintain the optimal physiology.
Methods: This study was performed prospectively at a tertiary care hospital in northern India with about a work load of 800 to 1000 elective neurosurgical surgical procedures being done per year. This data was collected prospectively over a period of one year from the patients being operated for elective neurosurgical procedures and later on shifted to the neurosurgical intensive care unit and the neurosurgical wards. The patients operated for emergency procedures for traumatic brain surgery were not included in the study.
Results: A total of 455 elective neurosurgical procedures were done during the study period. Out of these 455 patients there were 95 patients who were in the paediatric age group with age less than 12 years. Out of 360 adult patients 85 patients were in need of blood transfusion which constituted 23.6 percent of the operated patients. Out of these 85 patients 45 patients needed two transfusions in the form of whole blood or packed cells, 40 patients needed a single transfusion.42 units of fresh frozen plasma were transfused to 17 patients with 15 patients receiving platelet transfusions.
Conclusions: In conclusion, neurosurgical population is associated with significant blood loss and a requirement of blood transfusion. About 47 percent of paediatric population needed blood transfusion in our study with around 24 percent of adult population. The transfusion requirement was mainly seen in patients with craniostenosis, meningiomas, cerebello pontine tumours and meningiomas.

Keywords: Blood transfusion, Neuroanesthesia, Neurosurgery

INTRODUCTION

The World Health Organization identifies anemia as hemoglobin thresholds of 11.0 g/dl for children between 0.50-4.99 year, 11.5 g/dl for children 5.0-11.99 year, 12.0 g/dl for children 12.0-14.99 year, and nonpregnant women ≥15.0 year, 11.0 g/dl for pregnant women and 13.0 g/dl for men ≥15.0 year.[1] Blood transfusion refers to the perioperative administration of blood and blood components (e.g. autologous blood, allogeneic whole blood, red blood cells, fresh frozen plasma [FFP], platelets, and cryoprecipitate).[2] Neurosurgical procedures

are associated with significant blood loss with the need for blood transfusion in the preoperative, intraoperative and postoperative period to maintain optimal hemodynamic and cerebral oxygenation. Various neurosurgical procedures as traumatic brain injury, complex spinal surgeries, and endovascular neurosurgical procedures may need blood transfusions to maintain the optimal physiology. The minimal acceptable hemoglobin values for transfusion are not well understood in patients with cerebral injuries who undergo various neurosurgical procedures. Brain injury may occur even when the Hb is above a threshold of 7.0 g/dl.[3] Blood transfusions may be allogenic or autologous. Allogeneic blood transfusions needs the presence of donors and facilities for blood grouping, cross matching and storage with a risk of transmission of blood borne infections. However, autologous blood transfusions involve the donation of red blood cells (RBCs) by the patient. Though autologous transfusion may be cost effective however it may lead to occurrence of iatrogenic anemia.[4]

The current transfusion strategies in patients with cerebral injury are ill well defined with lots of variations from centre to centre. This study will try to identify the causes of blood transfusion practices in the neurosurgical population and try to understand the need for blood transfusion in the heterogeneous neurosurgical populations.

METHODS

This study was performed prospectively at a tertiary care hospital in northern India with about a work load of 800 to 1000 elective neurosurgical surgical procedures being done per year. This data was collected prospectively over a period of one year from the patients being operated for elective neurosurgical procedures and later on shifted to the neurosurgical intensive care unit and the neurosurgical wards. The patients operated for emergency procedures for traumatic brain surgery were not included in the study.

The preoperative demographic data and hemodynamic values were noted. Similarly, intraoperative heart rate, invasive arterial blood pressure, electrocardiography and end tidal capography was noted by the attending anaesthesiologist. Blood loss estimation was carried out by the attending anaesthesiologist by noting the amount of blood present in the surgical drapes, surgical gauzes, suction bottles and the cavitron ultrasonic surgical aspirator machine.

A note was taken of the normal saline used for surgical irrigation. Based on the blood loss, hemoglobin values and hemodynamic parameters a decision to transfuse or not to transfuse the blood was taken by the attending anaesthesiologist. The number and nature of blood products used and any complications that occurred during transfusion were noted. A noted was also made of other non-RBC products used for transfusion.

A need for post-operative blood transfusion was noted by the attending intensivist based on the haemoglobin values and the overall clinical condition of the patient. Postoperative hemodynamic parameters, need for mechanical ventilation and the course in the intensive care unit were followed till the patient was discharged or died in the intensive care unit.

The data collected was expressed as mean±S.D. The variables as age, weight, hemoglobin values, pulse rate, mean arterial blood pressure, estimated blood loss by the attending anesthesiologist, the total volume of intravenous fluid transfused and the amount of urine output were analysed by Student's t-test. Similarly, the number of hypotensive episodes defined as a drop in mean arterial blood pressure greater than 20 percent from baseline and the number of transfusion units in various types of surgery were noted. A p-value<0.05 was considered statistically significant.

RESULTS

A total of 455 elective neurosurgical procedures were done during the study period. Out of these 455 patients there were 95 patients who were in the pediatric age group with age less than 12 years. Out of 360 adult patients 85 patients were in need of blood transfusion which constituted 23.6 percent of the operated patients. Out of these 85 patients 45 patients needed two transfusions in the form of whole blood or packed cells, 40 patients needed a single transfusion. 42 units of fresh frozen plasma were transfused to 17 patients with 15 patients receiving platelet transfusions. All patients who received platelet transfusion received it, in the neurosurgical intensive care unit with most of them having thrombocytopenia. There was no difference in the demographic data, preoperative hemoglobin values, heart rate and mean arterial blood pressure in the group that received transfusion and the group that did not receive transfusion (Table 2). However the heart rate was higher and the mean blood pressure lower in the patients intraoperatively in the group that received transfusion than the group that did not receive transfusion.

Table 1: Patient characteristics.

Total patients 455	Paediatric <12 years 95 (20.87%)	Adult 360 (79.12%)
360 adult patients	85 transfused	275 not transfused
	23.61 %	76.38 %
95 patients	45 transfused	50 not transfused
	47.36 %	52.63 %

The volume of blood loss and the distribution of blood transfusion among the various surgical procedures is described in Table 3. Patients with meningiomas and cerebellopontine tumours needed the highest amount of blood transfusion in the intraoperative period. Though only 2 patients of aneurysmal subarachnoid hemorrhage

received transfusion in the intraoperative period, there was an increased need for blood transfusion in aneurysmal subarachnoid haemorrhage in the postoperative period in the intensive care unit. Out of 95 paediatric patients, less than 12 years of age, 45 patients required transfusion. The incidence of blood transfusion 47.36 percent was double than in the adult age group (23.6 percent). Among the pediatric population blood transfusion was mainly required for intracranial tumours and craniostenosis. Among the craniostenosis patients, only 5 out of 9 patients who underwent suturectomy required blood. However, all 4 patients undergoing frontonasal advancement procedures required blood. Pediatric patients undergoing surgery for ventriculoperitoneal shunt and repair of cervical and lumbar spinal myelomeningoceles were in need of minimal transfusion requirements.

Table 2: Patient characteristics in transfused and non-transfused patients.

Characteristic	Patient who received blood transfusion	Patient who did not receive blood transfusion
Age (years)	31.4±16.4	34.4±13.4
Weight (kgs)	47.3±14.4	45.4±12.9
Preinduction heart rate- beats per minute	79±18	77±16
Intra operative heart rate- beats per minute	138±23	79±15
Preinduction mean arterial blood pressure mm Hg		
Intra operative mean arterial blood pressure mm Hg		
Estimated blood loss (approximately) - ml	757±372	194±151
Crystalloid received (ml)	4325±1130	3210±980
Urine output (ml)	2941±1231	2105±1102

Table 3: Profile of patients receiving blood transfusion.

Paediatric (Total patients receiving transfusion 45 out of 95)	
Diagnosis	**Number of patients receiving blood transfusion**
Intracranial tumours	20
Craniostenosis	6
Ventriculoperitoneal shunt	5
Meningomyelocele/encephalocele	7
Others	7
Adult (Total patients receiving transfusion 85)	
Meningioma	25
Cerebello pontine angle tumours	15
Gliomas	20
Aneurysm clipping	4
Spine surgeries	8
Others	13

DISCUSSION

Despite considerable improvements in the neurosurgical practices and technological advancements in the last two decades blood transfusion is still frequently required in the neurosurgical subset of surgical population. The blood transfusion may not be innocuous and may be associated with numerous non-infectious and infectious complications. Hence judicious usage of blood transfusion and regular periodic audits may help us to improve the transfusion practices. The awareness about complications (as haemolytic reactions, transmission of infections, metabolic disturbances, coagulation disorders, and immunosuppression) has changed the transfusion practices in the last two decades and the development of rational transfusion practices. The present study was aimed to understand the current practices of blood and blood product transfusion in a neurosurgical center. This understanding is expected to minimize transfusion rates in future. From present study, we saw that the transfusion requirement in the pediatric population was more than that of the adult population. This was similar to the results of Bhatnagar et al.[5] The increased requirement of blood transfusion in the pediatric population is expected because of the lower amount of blood volumes in this patient population.

However simple procedures as ventriculoperitoneal shunts and meningomyeloceles required less amount of blood transfusion when compared to intracranial tumours and craniostenosis. Among the craniostenosis patients, the transfusion requirement was mainly in patients who underwent fronto nasal advancement procedures, while as patients undergoing suturectomy did not require blood transfusion. The higher incidence of blood transfusion in neurosurgical population may be a result of higher transfusion trigger required in this patient population (9 gms/dl against a transfusion trigger of 7gm/dl in a patient admitted in medical intensive care unit). In a pediatric age group the transfusion trigger may be more when compared to an adult population.[6] In present study in the adult population we found that around 85 patients needed

blood transfusion which was about 23.61 percent of the total adult population. Out of this patient population the highest requirement of blood transfusion was mainly seen in patients with meningiomas and cerebellopontine tumours. With the advent of better neurosurgical techniques, introduction of microscope and early surgery coupled with a better understanding of cerebral physiology the transfusion requirement in vascular clipping was very low.

It has been seen that red blood cell transfusion increases the O_2-carrying capacity of erythro-cytes with a better oxygen delivery, and a brain tissue oxygenation.[7,8] Naidech et al. a found that a higher haemoglobin concentration was associated with a better outcome with a reduction in disability and handicap.[9] This was later confirmed by a later prospective, randomized trial by the same group of authors.[10] In view of this evidence many of our patients who did not need blood transfusion intraoperatively were transfused blood in the postoperative period whenever there haemoglobin concentration dropped below 9gm/dl. Brain tumour surgeries are associated with significant amounts of blood loss due to increased vascularity and inherent hemostatic challenges.[11] Cerebral vasospasm may be seen after skull base surgeries which needs to be managed with triple-H therapy.[12] It has been also seen that intracranial tumour surgery may result in a post-operative fibrinogen deficiency leading to a poor outcomes and increased need for blood transfusions [13]

In present study, we saw that the mean heart rate was higher and the mean blood pressure was lower in the transfused group than in the non-transfused group. Similarly, the patients in transfused group received more crystalloid infusion than those in non-transfused group. There were certain limitation in present study. We did not take into consideration the patients with traumatic brain injury in present study. The transfusion requirement in this patient population is substantial due to underlying brain injury and associated injuries.

CONCLUSION

Neurosurgical population is associated with significant blood loss and a requirement of blood transfusion. About 47 percent of pediatric population needed blood transfusion in our study with around 24 percent of adult population. The transfusion requirement was mainly seen in patients with craniostenosis, meningiomas, cerebello pontine tumours and meningiomas. Further research is required for a better understanding and the optimal utilization of blood products in neurosurgical population for better patient outcome.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Nutritional anaemias. Report of a WHO Scientific Group. World Health Organ Tech Rep Ser. 1968;405:5-37.
2. American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Practice guidelines for perioperative blood transfusion and adjuvant therapies: an updated report by the American Society of Anesthesiologists Task Force on Perioperative Blood Transfusion and Adjuvant Therapies. Anesthesiology. 2006;105(1):198-208.
3. Hare GM, Tsui AK, McLaren AT, Ragoonanan TE, Yu J, Mazer CD. Anemia and cerebral outcomes: Many questions, fewer answers. Anesth Analg. 2008;107:1356-70.
4. Cataldi S, Bruder N, Dufour H, Lefevre P, Grisoli F, Francois G: Intraoperative autologous blood transfusion in intracranial surgery. Neurosurgery. 1997;40:765-71.
5. Bhatnagar S, Udaya IB, Rao UGS. An audit of blood transfusion in elective neuro-surgery. Indian J Anaesth. 2007;51:200-4.
6. Ali Z, Hassan N, Syed S. Blood transfusion practices in neuroanaesthesia. Indian J Anaesth. 2014;58:622-8.
7. Kurtz P, Helbok R, Claassen J, Schmidt JM, Fernandez L, Stuart RM et al. The effect of packed red blood cell transfusion on cerebral oxygenation and metabolism after subarachnoid hemorrhage, Neurocrit. Care. 2016;24(1):118-21.
8. Dhar R, Scalfani MT, Zazulia AR, Videen TO, Derdeyn CP, Diringer MN. Comparison of induced hypertension, fluid bolus, and blood transfusion to augment cerebral oxygen delivery after subarachnoid hemorrhage: Clinical article. J neurosurgery. 2012;116(3):648-56.
9. Niadech A. Higher hemoglobin is associated with improved outcome after subarachnoid hemorrhage, Crit. Care Med. 2007;35(10):2383-89.
10. Naidech A.M, Shaibani A, Garg RK, Duran IM, Liebling SM, Bassin SL, B et al. Alberts, Prospective, randomized trial of higher goal hemoglobin after subarachnoid hemorrhage, Neurocrit Care. 2010; 13(3):313-20.
11. Nagash I. Evaluation of acute normovolemic hemodilution and auto transfusion in neurosurgical patients undergoing excision of intracranialmeningioma. J. Anaesthesiol. Clin. Pharmacol. 2011;27(1):54-8.
12. Bejjani G. Vasospasm after cranial base tumor resection: pathogenesis, diagnosis, therapy, Surg. Neurol. 1999;52(6):577-58.
13. Wei N, Jia Y, Wang X, Zhang Y, Yuan G, B. Zhao, Y.et al. Risk factors for postoperative fibrinogen deficiency after surgical removal of intracranial tumors, PLoS. One 2015;10(12):e0144551.

Cite this article as: Ali Z, Hassan N, Mehdi S, Shah MA, Bijli AH, Khan T. A review of the blood transfusion practices in neuroanesthesia in the perioperative period in a tertiary care hospital. Int J Res Med Sci 2017;5:1858-61.