Incidence of Anaemia and Blood Transfusion Practice in Neurosurgical and Neurotrauma Intensive Care Units at National Hospital of Sri Lanka

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A prospective cross-sectional single centre clinical study was performed to determine the incidence of anaemia and blood transfusion practice in neurosurgical and neurotrauma intensive care units (ICU). All the adult patients who met the criteria and were admitted to the neurosurgical and neurotrauma ICUs of National Hospital of Sri Lanka from 15thApril to 14th June 2013 were included in the study.
Out of the 100 patients in the study, 82% were anaemic on admission and 95% had anaemia at some point during ICU stay. The mean haemoglobin (Hb) level was less than10g/dl in 30% of patients. 47% of patients received blood transfusion in the ICU. Only 23.6% of the transfusion events met the standards for the transfusion trigger.

Key words: anaemia, haemoglobin, blood/ red cell transfusion, critical illness

Introduction

Anaemia is a common problem among the patients admitted to ICUs and it is frequently treated with transfusion of packed red blood cells. By reducing the oxygen supply to the tissues, anaemia increases the morbidity and mortality.[1]

Since critical illness significantly elevates metabolic demands, the consequences of anaemia might be aggravated in this population. In patients with ischemic heart disease (IHD), a positive correlation between anaemia and increased cardiac morbidity has been shown.[2] Anaemia could be a contributory factor for hypoxic secondary brain injury. In neuro critical care patients, anaemia has been identified as an independent risk factor for poor neurological outcome and increased mortality.[3]

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However, blood transfusion itself can increase the morbidity and mortality in ICU patients.[4] Blood transfusion brings the risks of allergic and anaphylactic reactions, immunomodulation, transmission of blood borne infections, transfusion related acute lung injury and circulatory overload. Patients who had blood transfusions showed increased length of ICU stay, more severe organ failure and higher mortality than the patients who had no transfusion.[5]

A study done in United States revealed that about 60% of patients have Hb levels less than 12g/dl on admission to ICU, followed by a daily reduction of 0.5g/dl during ICU stay.[6] Incidence of anaemia in patients for elective neurosurgery is 21.4%,[7] but higher in neurocritical care patients, up to 50% in patients managed for traumatic brain injury and 47% in patients with subarachnoid haemorrhage.[8]

Vincent et al reported blood transfusion rates of 37% in European ICUs, and the mean pre transfusion haemoglobin level of 8.4g/dl.[9] In a prospective study in Canada, 62% of patients received a mean of 3.4 ± 5.3 units of packed red blood cells at a mean haemoglobin trigger of 7.7 ± 0.9 g/dl.[10] Scottish studies showed that 39.5% of ICU admissions received transfusion while 47% of which had been carried out without any significant bleeding.[11]

A randomized controlled trial by the Canadian critical care trial group showed that a restrictive strategy of red cell transfusion is as efficacious as and perhaps better than a liberal transfusion strategy in critically ill patients.[12] Restrictive blood transfusion strategy seems to be safe in most critically ill patients with cardiac disease, with the possible exception of patients with acute myocardial infarction and unstable angina.[13]

A study comparing the Hb transfusion trigger of 7g/dl vs 10g/dl in patients with traumatic brain injury, reported an increased incidents of thromboembolic complications with liberal transfusion than the restrictive strategy, without any added benefits in outcome.[14] Secondary analysis of this study showed that the incidence of progressive haemorrhagic insult was 2.3 times higher in the group with higher Hb trigger (10g/dl) in contrast to lower trigger (7g/dl).[15]

Though several studies have been done worldwide, there is no published literature regarding the incidence of anaemia or blood transfusion practice in ICUs in Sri Lanka.

Methodology

The objectives were to find out the incidence of anaemia in patients in the neurocritical care unit and to assess the blood transfusion practices compared with the standards.

It was a prospective cross-sectional single centre study. The required data was collected from the bed head tickets and the investigation reports. Data collection sheets were filled daily from the second day of admission until discharge from the ICU (or death) or for a maximum of 30 days.

According to the guidelines published by the Association of Anaesthetists of Great Britain and Ireland,[16] the handbook of transfusion medicine published by the United Kingdom Blood Services,[17] and the audit recipe published by the Royal College of Anaesthetists[18] the following transfusion triggers and target haemoglobin levels were considered as standards to audit the current practice of blood transfusion in patients with critical illness.

Clinical condition	transfusion trigger Hb	target Hb
No IHD	7-8 g/dl	7-9 g/dl
Stable IHD	7-8 g/dl	7-9 g/dl
Acute coronary syndrome (ACS)	8-9 g/dl	> 9g/dl
Early resuscitation phase of sepsis	10g/dl	> 10g/dl

All the adult patients admitted to the neurosurgical and neurotrauma ICUs at National Hospital of Sri Lanka (NHSL) from 15th April to 14thJune 2013 were included in the study except for patients who had a length of ICU stay of less than 24 hours, primary haematological diseases and patients receiving erythropoietin. Neurosurgical & neurotrauma intensive care complex consists of 38 level 3 beds and has an annual admission rate of 2300 patients.

Collected data included patient details (age, sex, type of admission, co-morbidities), length of ICU stay, admission haemoglobin level, daily haemoglobin level, blood transfusion events, number of units of blood transfused in each transfusion event, pre transfusion haemoglobin level, post transfusion haemoglobin level, presence or absence of active bleeding during transfusion and whether or not the patient is in early resuscitation phase of sepsis during

WHO definition was used to define and assess the severity of anaemia as follows.

Population	Anaemia		
	Mild	Moderate	Severe
Men	11-12.9g/dl	8-10.9g/dl	<8g/dl
Women	11-11.9g/dl	8-10.9g/dl	<8g/dl

transfusion. The data was entered and analysed using the Microsoft excel.

Results

Among the patients admitted to the neurosurgical and neurotrauma intensive care units of NHSL, there were 100 who met the criteria from 15th April to 14th June 2013.

Age distribution among the collected sample is depicted below. (Figure 1)

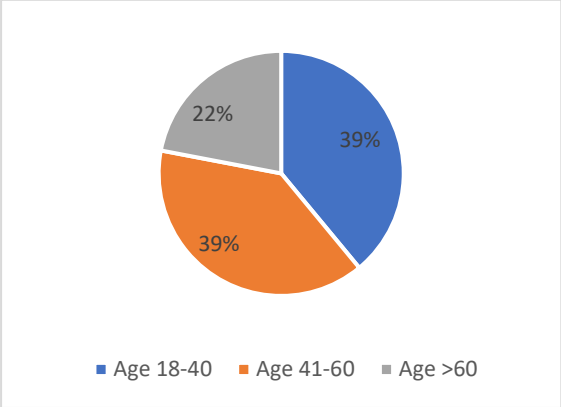

Figure 1. Age distribution among the collected sample

Males predominated in admission to these units at 64%.

The most common indication for admission was traumatic head injury, with or without surgery.

Indication for admission	Percentage
Traumatic head injury	45
Post elective surgery	34
Post emergency surgery	8
Other	13

The category of emergency surgery included the emergency neurosurgeries other than for the traumatic head injury. Other types of admissions included admissions for monitoring purposes for neurological conditions like spontaneous intracranial haemorrhage, meningoencephalitis, space occupying lesions etc.

Among the studied sample population, 4% suffered from stable IHD while 2% developed ACS during the critical care stay.

ICU stay of the sample population is depicted below. (Figure 2)

Out of the 100 patients in the study, 82% were anaemic on admission and 95% had anaemia at some point during the ICU stay. The mean haemoglobin level was less than 10g/dl in 30% of patients.

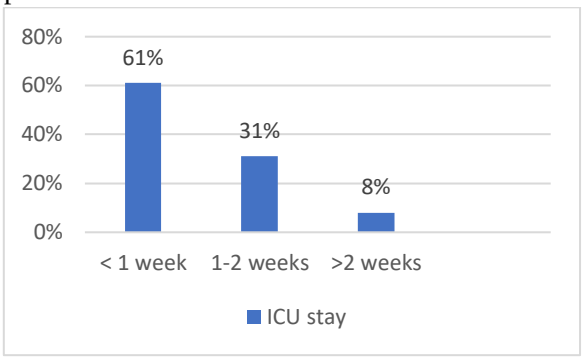

Figure 2. ICU stay of the sample population

The bar chart below depicts the percentage of patients with different degrees of anaemia on admission and during ICU stay. (Figure 3)

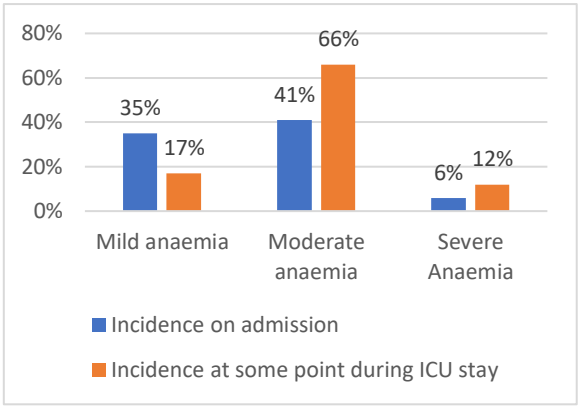

Figure 3. Percentage of patients with different degrees of anaemia on admission and during ICU stay.

47% of the studied population received blood transfusion and 55.3% of them had ≥ 1 week of ICU stay. 29.6% of transfusion events during the study period were not associated with significant bleeding. More than one unit of blood was transfused in 21.1% of transfusion events. 46.7% of transfusion events were not associated with acute bleeding. None of the patients received blood at the time of early resuscitation phase of sepsis.

Among all the transfusion events, only 23.6% met the standards for the trigger of transfusion. 62 transfusion events were carried out in patients without ischemic heart disease. Only 24.2% of them were given blood when the haemoglobin level was below 8g/dl.

Out of the 8 transfusion events in patients with stable IHD, only 25% met the standard for the trigger (<8g/dl). Among patients who suffered ACS, none of the transfusion events met the standards (< 9g/dl). Only 23.6% of the transfusion events were followed by a post transfusion target haemoglobin level which fell within the target range.

The following chart depicts the percentage of patients who had post transfusion Hb level above target range. (Figure 4)

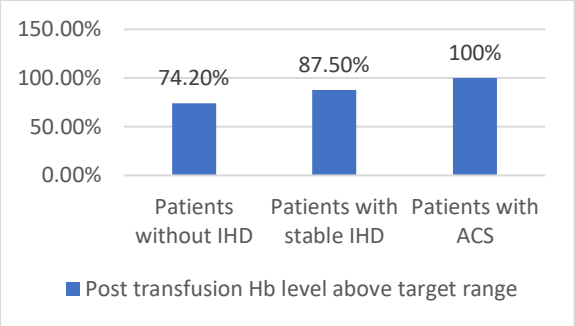

Figure 4. percentage of patients who had post transfusion Hb level above target range.

The mean haemoglobin trigger and mean post transfusion haemoglobin level are given below.

Population	Mean Hb trigger (g/dl)	Mean post transfusion Hb (g/dl)
No IHD	8.5	9.8
Stable IHD	8.3	10.2
Acute coronary syndrome	9.6	10.3

Discussion

Anaemia is one of the common complications in patients with critically illness and it can be simply treated with blood transfusion. Various factors may contribute to the increased incidence of anaemia in ICU patients, including frequent blood sampling, acute bleeding, haemodilution associated with intravenous fluid administration, and suppression of erythropoietin release or bone marrow due to systemic inflammatory response.

The incidence of anaemia in our study population was 82% on admission and 95% at some point during ICU stay, which is extremely high compared to the available literature from the developed world. The reasons were not analysed in this study, but it could be explained by the high prevalence of iron deficiency anaemia in the general population in Sri Lanka.[19]

Frequent blood sampling could be another reason, as it was observed that full blood count and other investigations were performed daily in all the patients admitted to the neuro surgical and neurotrauma intensive care units, whereas the standard in ICUs globally is to perform it once in every 2-3 days unless otherwise indicated.

Based on the available evidence, transfusion practice has become more restrictive worldwide. Though there are concerns about the secondary brain injury in neurocritical patients due to anaemia, at the time this audit was conducted the threshold for transfusion was the same in neurocritical patients as the other critically ill patients.

Currently there is an increasing interest in identifying a specific trigger for blood transfusion in neurosurgical patient but there is no sufficient evidence. There are neither consensus guidelines nor recommendations on this regard.

From this audit it was identified that the mean Hb trigger for transfusion was 8.5 g/dl for patients without any IHD. The trigger was almost similar at 8.3 g/dl for those with stable IHD and 9.6 g/dl for those who had ACS.

Only 23.6% of the transfusion events met the standard for both the transfusion trigger and for post transfusion Hb level. This poor adherence to the audit standards may be the manifestation of the common practice among the neuro anaesthetists and neurosurgeons to target Hb levels at a minimum of 9 to 10 g/dl in the neurocritical care patients.[20]

Drawbacks

The standards of threshold for transfusion were considered as same for any other critically ill patients. However, it is unclear whether these are widely applicable to neurocritical care population.

Assessing the transfusion trigger in patients undergoing early goal directed therapy for sepsis was also planned, however no patients in this study period were identified to receive a blood transfusion in that state.

There were only 2 patients with ACS and 4 patients with stable IHD in the study population, which could have impacted the calculations for mean transfusion trigger.

Conclusion

The incidence of anaemia is significantly high in the studied patient population. The transfusion practice is adhered to in only 23.6% of the studied population with regards to transfusion triggers and post transfusion haemoglobin level.

Recommendations

1. Local guideline to be created with the available evidence and consensus from the consultants in the unit.
2. Full blood count and other investigations done according to requirements instead of daily basis
3. Re-audit after introduction of local guidelines to see whether there is improvement in the practice

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