Audit of Perioperative Blood Transfusion

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SUMMARY

The main goal of perioperative transfusion is to reduce the morbidity and mortality associated with inadequate delivery of oxygen to the tissues during surgery. In this audit, the primary trigger for transfusion was clinical anaemia assessed by examination of a patient's conjunctiva [40.7%] followed by estimation of blood loss of greater 20% of total blood volume [29.3%]. Haemoglobin estimation in the operation theater was not done in 45.9% of studied patients and only 7.8% patients had transfusion based on this criteria. A common practice is to transfuse blood for hypovolaemia. This was the indication for blood transfusion in 96 patients (7.8%). Inappropriate use of blood in this way has led to wastage of a valuable resource and exposed patients to potential risks of unwanted side effects. Analysis of haemoglobin estimation at recovery room showed 32% of patient with co-morbidities had Hb > 10 gm% while 65% and 29.5% of patients without co-morbidities had Hb > 8 gm% and 10 gm% respectively. This reflects the practice of anaesthetists in maintaining a target of Hb of 10 gm% for both groups of patients while a target of 8 gm% is still relatively safe for patients with good cardiovascular reserves. This has resulted in signifant use of homologous blood which will certainly burden the blood bank and increase the cost of healthcare.

KEY WORDS:
Blood transfusion, Audit of perioperative blood use, Group and screen

INTRODUCTION

The main goal of perioperative transfusion is to reduce the morbidity and mortality associated with inadequate delivery of oxygen to the tissues during surgery. Oxygen delivery to the tissues is dependent primarily on cardiac output and the oxygen content of the blood. Two problems develop during acute blood loss that may result in tissue hypoxia: a) hypovolemia – loss of effective circulating blood volume, resulting in decrease venous return to the heart, stroke volume and cardiac output b) loss of hemoglobin (Hb) – the oxygen-carrying units needed to transport oxygen to the tissues. In the presence of both hypovolemia and anemia, inadequate oxygen delivery (shock) results, leading to anaerobic metabolism, lactate production, cell injury and organ dysfunction.

Decisions regarding preoperative transfusion are often difficult to make and involved clinical judgement. When the decision is made to transfuse a specific patient, one should take into consideration the duration of anaemia, intravascular volume, extent of the operation, probability for massive blood transfusion and presence of coexisting conditions such as impaired pulmonary function, inadequate cardiac output, myocardial infarction, cerebrovascular or peripheral vascular disease. Additional help can be gained by reviewing laboratory data: Hb level, arterial oxygenation, mixed venous oxygen tension, cardiac output, oxygen extraction ratio and blood volume.

Allogenic blood misuse has been widely reported and despite recommendations and other educational efforts, it is still a problem. In studies attempting to determine unnecessary transfusions, there is a remarkable difference in the criteria of appropriateness adopted among studies. Criteria include selected guidelines clinical indicators, specific Hb concentrations algorithms, some criteria of these or other criteria. The rates of unnecessary or inappropriate red cell use range from 4% to 67%.

MATERIALS AND METHODS

A cross-section survey with questionnaire was conducted for a period of three months covering 29 hospitals (Ministry of Health Malaysia, including university hospitals). The aim was to evaluate the use of red blood cells transfusion during elective and emergency surgery by anaesthetists and surgeons. All perioperative blood transfusions in patients aged between 12 to 90 years (elective, as well as emergency cases) were captured. Data collection involved all participating perioperative mortality review committee (POMR) coordinators as supervisors for their respective hospitals. Analysis of data was done with SPSS software.

RESULTS

A total of 1367 patients were included for the study. Due to lack of haemoglobin estimation results in recovery room, only 1112 patients were included for analysis.

Demographic data

This study included 1112 patients for analysis whose age ranged from 12 to 90 years. Majority were young and only 8.8% were above 70 years old. The gender distribution had a male to female ratio of 40.3: 58.8. Racial distribution reflected the general population with Malay, Chinese and Indian in descending order. The predorminant medical co-morbidities seen in some patients were: hypertension, diabetes mellitus and anaemia.

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Transfusion data

Preoperative order of bank blood were requested mainly by anaesthetists (54.5%). A great majority requested a full crossmatch (95%). The number of units requested was mainly 2 units or 4 units (34% and 32.4% respectively). The criteria used to evaluate the rate of appropriate transfusion were Hb < 8 g/dl for healthy patients, Hb < 10 g/dl in patients with medical comorbidities. Intraoperative assessment of haemoglobin level was done in 43.9% of patients. 32.6% of patients had intraoperative haemoglobin below 10 gm/dL. Main indication for transfusion is shown in Table II.

Procument of emergency blood

There were 1112 cases where emergency blood cross-match were required. Personnel responsible for obtaining emergency blood from the blood bank included: houseman (25.4%), attendant (32.8%) and nurse (36.6%). Only 68 cases (6.1%) experienced delay of greater the 30 minutes. Out of the 68 cases of delay the personel responsible was as follows: nurse (55.9%), attendant (38.2%) and houseman (5.9%). Main reason for delay of getting blood was transportation problems and this was statistically significant (p=0.01). The attendant failed to provide reliable procurement of emergency blood to satisfy the need for the operation theater and in 61.8% of cases either a nurse or the houseman had to do the job analysis of haemoglobin patterns in healthy patients and patients with medical co-morbidities is shown in Tables III and IV respectively. 51.5% of patient with comorbidities had Hb >10gm% while 80.4% and 47.9% of patient without co-morbidities had Hb > 8 gm% and 10 gm% respectively.

DISCUSSION

Decisions regarding perioperative blood transfusion are often difficult and usually based on clinical judgment. Anaesthetists and surgeons base their decision to transfuse red cell on several factors: rate and magnitude of estimated blood loss; patient's cardiopulmonary reserve; co-morbidities and laboratory results of haemoglobin and haematocit levels. In 1992, the American College of Physicians (ACP) recommended distinguishing between stable and unstable vital signs in determining whether to transfuse anaesthetised patients[1]. They concluded that patients with stable vital signs and no risk of myocardial and cerebral ischaemia do not require RBC transfusion, independent of Hb level, and recommended transfusing patients with unstable vital signs only if risks of myocardial or cerebral ischaemia were present. In 1966, the American Society of Anesthesiologists established transfusion guidelines for perioperative transfusion practice (Appendix).

Table I: Reporting Rates on blood transfusions during study period

Hospital	No. of blood transfusion cases reported	Number of anaesthetics administered in the corresponding months	% of patients with blood transfusion/ Total number of anaesthetics
1. Alor Setar	90	1883	4.8%
2. Bintulu, Sarawak	10	513	2.0%
3. Ipoh	166	2181	7.6 %
4. Kajang	63	1537	4.1%
5. Kangar	57	975	5.8%
6. Kelang	87	2180	4.0%
7. Keningau	14	457	3.1%
8. Kota Bahru	108	2217	4.9%
9. Kota Kinabalu	60	2376	2.5%
10. Kuala Pilah	6	399	1.5%
11. Kulim	31	862	3.5%
12. Labuan	2	148	1.4%
13. Melaka	109	2882	3.8%
14. Miri	16	932	1.7%
15. Muar	60	1155	5.2%
16. Pulau Pinang	32	1541	2.1%
17. Sandakan	31	359	8.6%
18. Sebarang Jaya	48	1360	3.5%
19. Selayang	126	2535	5.0%
20. Seremban	64	2003	3.2%
21. Seri Manjung	42	736	5.7%
22. Taiping	77	1898	4.1%
23. Tawau	48	827	5.8%
24. Teluk Intan	19	1060	1.8%
Total	**1366**	**33016**	**4.1%**

Table II: Main indication for transfusion

Main indication for transfusion:	N=1112	%
Blood loss > 20% total blood volume	330	29.7
Hb < 7 g/dL or Hct < 21%	81	7.3
Sustained hypotension (MAP < 20% baseline) despite colloids and crystalloids	81	7.3
Clinical anaemia: conjunctiva very pale	456	41.0
Instructed by Specialist Anaesthetist	77	6.9
Instructed by Surgeon	64	5.8
Others	7	0.6
Not documented	16	1.4

Table III: Haemoglobin patterns in recovery room and ward

Hb gm/dL	Recovery room (N=1112/ %)		Ward (N=1112 / %)	
< 7	88	7.9	39	3.4
7 – 9.9	381	43.3	483	43.5
10 – 13.9	493	44.3	538	48.4
⊇14	50	4.5	24	2.2
Unknown	0	0.0	28	2.5

Table IV: Subset of patients with co-morbidities

Recovery roomHb gm/dL	With co morbidity*(N=307 / %)		Without comorbidity (N=805/ %)	
< 7	17	5.6	71	8.8
7 – 9.9	132	43.0	349	43.4
10 – 13.9	140	45.5	353	43.8
⊇14	18	5.9	32	4.0
Subtotal	307	100	805	100

* Patient with one or more of the following: hypertension, ischaemic heart disease, diabetes mellitus

Table V: Complications of blood transfusion

Complications of Transfusion:	
Pulmonary Oedema	1
Hypothermia (Core Temperature < 35°C)	3
Rashes	9
Bronchospasm	1
Urticaria	10

In a study done by G Niraj *et al* to assess intraoperative blood transfusion practice during elective non-cardiac surgery, they found that inappropriate use of blood was 19.2%[3]. There was a significantly higher incidence of appropriate use of blood for patients in whom haemoglobin measurement were done intraoperatively. They concluded that intraoperative haemoglobin estimation was an effective and simple measurement to improve appropriate use of blood.

The aim of blood transfusion is to replace loss due to acute haemorrhage following surgery. Oxygen delivery is adequate in healthy patients with a haemoglobin level of 8 g /dl. In patients with co morbidities in whom there may be reduced cardiorespiratory reserves a level of 10 g /dl is generally acceptable. In this audit, the primary trigger for transfusion was clinical anaemia assess by examination of patient's conjunctiva [41.0%] followed by estimation of blood loss of greater 20% of total blood volume [29.7%]. Haemoglobin estimation in the operation theater was not done in 45.9% of studied patients but only [7.3%] patients had transfusion based on this criteria. Transfusion based on clinical choice of anaesthetists [6.9%] and surgeons [5.8%] were inappropriate, if not substantiated with objective indications. Intraoperative blood loss estimation depends on assessment of drainage collection, swabs and operative site inspection, is subjective and often unreliable. Even laboratory results of haemoglobin and haematocrit levels can be misleading due to inter-compartmental fluid shifts and dilutional effects of crystalloid therapy. There were 366(31.4%) patients in whom estimated blood loss was less than 1L, but were given blood transfusions. These transfusions may be avoided, if judicious use of plasma expanders and close monitoring is emphasized. The use of a single bag of blood 355 patients (31.9%), is often judged to be inappropriate when there are no relevant indicators to suggest further blood loss from surgery.

A common practice is to transfuse blood for hypovolaemia. This was the indication for blood transfusion in 81 patients(7.3%). Inappropriate use of blood in this way lead to waste of a valuable resource and expose patients to potential risks of unwanted side effects. Analysis of haemoglobin estimation at recovery room 51.5% of patient with comorbidities had Hb >10gm% while 80.4% and 47.9% of patient without comorbidities had Hb > 8gm% and 10gm% respectively. This reflects the practice of anaesthetists in maintaining a target of Hb of 10gm% for both groups of patients while a target of 8gm% is still relatively safe for patients with good cardiovascular reserves. This has resulted in signifant use of homologous blood.

The use of homologous blood transfusion is not without risks. In our study complications from blood transfusion were minor and there were none as a result of clerical error.

An important milestone in perioperatvie haemotherapy is the introduction of Maximum Surgical Blood Order Schedule (MSBOS) and the practice of Group Screen and Hold (GSH) procedure instead of a full cross-match. A maximum surgical blood order schedule (MSBOS) is a list of the commonly performed elective surgical procedures performed in a hospital with the maximum number of units of blood which will be crossmatched preoperatively for each. In a study by Friedman, recommendations are offered for 63 common elective surgical procedures. Specific reference is made to blood utilization during hysterectomy, transurethral resection of the prostate, and Cesarean section. A preoperative type and screen order is adequate for the vast majority of patients undergoing these latter procedures[4].

Efficiency of blood utilization can be judged by several methods: decision whether to request for a full crossmatch or GSH procedure; the crossmatch to transfusion ratio (C:T ratio) and the rate of overtranfusion calculated from preoperative and postoperative haemoglobin levels. Judicious use of these policies leads to more efficient use of banked blood. Known advantages include, the reduced work-load of cross-matching and the wastage of blood due to out-dating. Another valuable information for clinicians is the transfusion index (TI) of common procedures. Procdures with low TI may only need GSH as the potential of actual

transfusion is low. College of American Pathologists Q-Probes studies use the following quality indicators for blood utilization: C:T ratio; the rate of red blood cell unit expiration and the rate of red blood cell wastage. They found the C:T ratio to vary amongst different institution: top-performing 1.5; mid-range 1.8 and bottom-performing 2.4 or greater[5]. A study done in Univerity of Malaya by Jayaranee *et al* [6] found a reduction of full crossmatch blood order (from 40.6% to 31.2%) and the overall crossmatch to transfusion ratio to be 5.0. They also found that a significant number of surgical procedures have a low transfusion index and concluded that there was 47.7% rate of over-transfusion. In this audit, due to lack of blood bank participation, the cross match transfusion ratio could not be determined. From this audit, it can be seen that the use of homologous blood is substantial and will certainly burden the blood bank and increase cost of health care to the Ministry of Health. The use of autologous blood by intraoperative isovolaemic haemodilution technique, blood salvage and retransfusion are valuable ways of conserving blood usage. Although this was not studied, clinical observation is that, these are rarely practiced in majority of our hospitals for non-cardiac surgeries.

CONCLUSION

Efficient use of homologous blood is not be achieved in majority of our hospitals. The practice of group screen and hold procedure is not developed and over ordering of bank blood for elective cases is frequently encountered. Haemoglobin estimation in the operation theater was not done in majority of patients and only a small number of patients had transfusion based on this criteria. Transfusion based on clinical choice of anaesthetists and surgeons were inappropriate if not substantiated with objective indications. Anaesthetists still maintain a target of haemoglobin of 10 gm% for both groups of patients (health and with co-morbities), although a target of 8 gm% is still relatively safe for patients with good cardiovascular reserves. This has resulted in signifant use of homologous blood which is avoidable.

Appendix

Current recommendations for RBC transfusion (established by the American Society of Anaesthesiologists in 1996):

- Transfusion is rarely indicated when the Hb concentration is > 10 g/dl. It is almost always indicated when Hb conc. Is < 6 g/dl especially when the anemia is acute
- Whether RBC transfusion is required with intermediate Hb concentration (6-10 g/dl) depends on the patitent's risk for complications of inadequate oxygenation
- The used of a single Hb "trigger" is not recommended
- When appropriate, preoperative autologous blood donation, intraoperative and postoperative blood recovery, acute normovolemic hemodilution and measures to decrease blood loss (deliberate hypotension and pharmacologic agents) may be beneficial
- Indications for transfusion of autologous RBC's may be more liberal than for allogenic RBC's because of the lower risks associated with the former.

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