



GUIDELINES AND AUDIT
IMPLEMENTATION NETWORK

BETTER USE OF BLOOD IN NORTHERN IRELAND

Guidelines for Blood Transfusion Practice

March 2009

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FOREWORD

Better Use of Blood in Northern Ireland – Guidelines for Blood Transfusion Practice

These guidelines have been published by the Guidelines & Audit Implementation Network (GAIN), a team of health care professionals established under the auspices of the Department of Health, Social Services & Public Safety in 2008. The aim of GAIN is to promote quality in the Health Service in Northern Ireland, through audit and guidelines, while ensuring the highest possible standard of clinical practice is maintained.



These guidelines were produced by Dr Kieran Morris, Consultant in Blood Transfusion Services and assisted by Dr Damien Carson, Consultant Anaesthetist at the Ulster Hospital. Following widespread consultation across the HPSS responses were received and considered. A full list of respondees is available from the GAIN office.

The guidelines were written and have been effective from September 2007. The publication date is March 2009. Please note there is no material change in information since September 2007. The guidelines have been endorsed by the membership of the Northern Ireland Regional Transfusion Committee (September 2007).

GAIN wishes to thank all those who contributed in any way to the development of these guidelines.

A handwritten signature in black ink that reads "Tom Trinick". The signature is written in a cursive, flowing style.

Dr T Trinick
Chairman of GAIN



GUIDELINES FOR RED CELL TRANSFUSION (ADULTS)

Introduction

Despite a large amount of work published since the last CREST publication on this topic in 2001 – there still are no definitive studies to indicate the exact level of haemoglobin (Hb) that a blood transfusion should be given at. This gap in knowledge reflects many patient variables that are present in this decision making process. These variables include the current health status of the patient, their co-existing morbidities, adaptive responses to anaemia, their haemoglobin value and its trend, their blood volume status, performance scores, nutritional status and bone marrow response to anaemia. In a strict sense every patient will have his or her own ideal transfusion threshold where the benefits of transfusion outweigh the risks to that patient. For some this transfusion threshold will be below 7g/dl and for others it may be above 10g/dl.

Physiological Adaptations to Anaemia and Problems with Hb Transfusion Trigger

There are many compensating mechanisms which come into play with the development of anaemia. Oxygen delivery is a function of oxygen content (largely circulating Hb or red cell mass) and cardiac output. With decrease in Hb there is an increase in stroke volume and then an increase in heart rate. Tachycardia is only apparent at Hb <7g/dl in healthy fit young adults. There are other physiological changes such as increase in tidal volume, increase in respiratory rate, decrease in peripheral vascular resistance, increased O₂ extraction ratio and increase in 2, 3, DPG which shifts the Hb oxygen dissociation curve to the right with greater offloading of oxygen to the tissues. Red cell transfusion should be given to improve oxygen delivery or prevent tissue hypoxia. The direct measure of this would be intracellular pH or blood lactate/blood base excess as a surrogate marker. These measurements, of course, are not readily available and even in intensively monitored patients measurements such as mixed venous oxygen saturation and arterial oxygenation level are governed by other factors which interact and



complicate interpretation. Understandably Hb is used to make decisions about red cell transfusion because it is readily accessible. This will be of value in acute anaemia though Hb can be artificially lowered because of non blood volume replacement. In the context of chronic anaemia, patients may be euvolaemic or hypervolaemic, distorting the Hb measurement. It is probably the case that clinicians do not take sufficient account of physiological adaptations to anaemia when they are transfusing to a formula to maintain the Hb > 10g/dl.

Experimental Evidence

Experiments in healthy human volunteers which measure oxygen delivery indicate a fall-off in oxygen delivery only at low levels of Hb, i.e. 5 g/dl. Similar experiments have been conducted in animals and surprisingly low levels of Hb can be tolerated. Some experiments have induced coronary artery stenosis in animals mimicking coronary ischaemic syndromes in humans and fall-off in delivery of oxygen is perceptible at about twice the level of Hb in non-injured animals. It is incorrect to extrapolate these findings to a clinical setting. In essence no two patients are the same and Hb = 8g/dl in a 21 year old fit healthy young male is a different proposition from Hb = 8g/dl in an 81 year old with ischaemic heart disease. Almost all recent guidelines published offer the expert opinion that a universal threshold of Hb = 10g/dl is no longer justified.

The Decision to Transfuse Red Cells

In deciding whether or not to transfuse red cells the clinician should consider the cause of the anaemia and whether or not it is reversible. Other relevant factors include the absolute level of haemoglobin, the trend in haemoglobin and the rate of change of haemoglobin. The clinician should consider the patient's adaptive responses to anaemia and also the cardio pulmonary reserve of the patient. Where the Hb < 7g/dl, transfusion should be considered in all but the most healthy, youngest stable patients and conversely where Hb > 10g/dl, transfusion should

rarely be considered. The previous CREST guidelines in 2001 suggested that intermediate levels of $7\text{g/dl} < \text{Hb} < 10\text{g/dl}$ requires individual assessment.

A recent large audit carried out into the Appropriate Use of Red Cells in Northern Ireland using regionally agreed criteria for transfusion identified many deficiencies in practice.

- Some 80% of patients who were transfused were admitted to hospital with anaemia – a significant number of whom could have been treated by simple means other than transfusion.
- Some 19% of patients transfused were judged to have an unnecessary transfusion – most of these patients fell into the stable, healthy patient group both under and over 65 years of age who were transfused with their Hb between 7 and 10g/dl for no obvious reason.
- Some 29% of patients transfused were overtransfused.

These three areas of deficiency should be addressed:

Treatment of Anaemia

The underlying principle is to diagnose the cause of anaemia. Many causes of anaemia are reversible with appropriate treatment. If a patient has iron deficiency anaemia due to a bleeding peptic ulcer, the peptic ulcer should be treated appropriately and iron replacement given for the iron deficiency.

Elective surgical patients with expected blood loss likely to require transfusion should have their Hb checked in advance, be optimised if necessary and if the patients are anaemic and their surgery can be delayed – it should be until their Hb count is optimised. There is increasing evidence that even simple administration of oral iron to certain subgroups of patients such as those with bowel cancer for even



a short period before surgery can increase pre-op Hb and significantly reduce transfusion. Some patients become and remain anaemic because they cannot absorb enough iron because of dietary reasons, absorption difficulties or increased iron requirement and these patients should be considered for parenteral iron therapy. Anaemia caused by deficiencies of B12 and folate should be treated appropriately with oral or parenteral supplements and not by transfusion.

Making an Appropriate Decision to Transfuse

Most inappropriate transfusions seem to occur in stable and healthy patients who can tolerate anaemia well but are transfused when their Hb lies between 7-10g/dl. The 2001 CREST guidelines very much left it up to the clinician to decide on transfusion in this group when the Hb value was in the 7-10g/dl range. The new GAIN guidelines attempt to offer more specific advice and will reflect the criteria used in the Appropriate Use of Red Cells in Northern Ireland Audit. **A graded incremental approach** is suggested for considering red cell transfusions and transfusion should not be routinely administered above these thresholds. While consideration should be given to administering red cell transfusions below these thresholds - this does not mean transfusion should always be given – particularly if the patient's clinical state does not warrant transfusion.

There is a caution in that the compensating mechanisms in patients with vascular disease particularly cardiac and cerebrovascular are not as effective. There are physiological studies confirming the redundant capacity in tolerating hypoxia of the coronary vasculature is less than the peripheral vasculature. When coronary artery stenosis lesions are induced mimicking coronary ischaemic syndromes fall off, in delivery of oxygen is perceptible at about twice the level of haemoglobin in non-injured animal subjects. In modelling studies in human volunteers the increase in oxygen extraction is of the order of four in the peripheral vasculature from the resting state and of the order of two in coronary vasculature which is diseased.

These considerations are reflected in the higher thresholds permitted in older patients and in patients with cardiovascular/cerebrovascular disease.

As part of the consultation exercise in the writing of these Guidelines, two special situations are included:

- 1 Obstetric haemorrhage in childbirth can be unpredictable and erratic and a less restrictive approach may be justified.
- 2 In palliative and terminal care settings it may be expedient to administer red cell transfusions for symptomatic relief and the balance of the decision may favour transfusion at a higher threshold because of the patient's shortened life expectancy

Adult Red Cell Transfusion Guidelines

- For otherwise healthy patients **under 65** years of age consideration of transfusion should be when the Hb is below 7g/dl.
- For otherwise healthy patients **over 65** years of age consideration of transfusion should be when the Hb is below 8g/dl.

It is in these first two categories of patients above that the majority of inappropriate transfusions were documented in the regional audit and so particular care needs to be applied in the transfusion decisions of these groups.

- For patients with additional risk factors of cardiac and cerebrovascular insufficiency, a higher trigger of 9g/dl is permitted.
- A higher threshold of up to 10g/dl is reserved for patients who have significant active ongoing bleeding of more than 500ml/hour that cannot be promptly controlled. This threshold is also appropriate for patients who are truly symptomatic of anaemia with symptoms such as dyspnoea, angina, palpitations or syncope and signs including tachycardia and orthostatic hypotension which is documented and specified. This higher Hb threshold of up to 10g/dl may also be appropriate for patients who have marrow



malfunction due to effects of chemotherapy, radiation therapy or a primary marrow disorder.

- Patients with symptoms of fatigue alone at any level of Hb should not be considered for transfusion when it is likely that they can quickly regenerate their own Hb to compensate for this. However in palliative situations exceptions are to be expected to improve the short term quality of life in patients as there are unlikely to be long term risk issues with transfusion. Here the short term benefits of transfusion could clearly outweigh the long term risks.

Overtransfusion

Overtransfusion is similar to inappropriate transfusion as units of blood are given to a patient exposing them to the risks of unnecessary transfusion. This has been defined as an Hb more than 2g/dl above the defined transfusion threshold.

Consideration should be carefully given to the number of units prescribed. This will often include a single unit transfusion if the no transfusion option has been exhausted. The size of the patient and his/her estimated blood loss along with the ongoing trend in bleeding or in Hb are all important factors. The audit demonstrates that in patients who are not bleeding heavily - the additive effect per unit transfused can result in an increase anywhere between 0.5 and 2.5 g/dl on the patient's pre-transfusion Hb. This reflects wide variation in recipients' blood volume in non-bleeding patients.

In any decision to transfuse red cells the clinical benefit must outweigh the real and perceived risks for patients. Clinicians should be somewhat more restrictive in their approach to red cell transfusion therapy and compliance with these revised and updated guidelines which are consistent with UK and other guidelines is the expected norm.

Collection of Minimum Data Sets

The Appropriate Use of Red Cells in Northern Ireland audit also demonstrated the failure to record reasons for transfusion in the clinical record. Often there was little other than an Hb result recorded in the notes and in some 35% there was nothing at all recorded in the notes. It is important from the point of view of tracking and for review and audit of prescribing practice documentation requirements are complied with. These documentation requirements are outlined in clinical practice guidelines.



Guidelines for Red Cell Transfusion (Adults)

Wall Chart

- Always diagnose the cause of anaemia
- Treat reversible causes of anaemia

Stable Patients	Transfusion Threshold
< 65 years old with no cardiovascular or cerebrovascular problems.	Usually only consider transfusion when Hb < 7g/dl
> 65 years old with no cardiovascular or cerebrovascular problems.	Usually only consider transfusion when Hb < 8g/dl
Known cardiovascular or cerebrovascular history (previous myocardial infarction, angina, hypertension, heart failure, peripheral vascular disease pulmonary oedema).	Usually only consider transfusion when Hb < 9g/dl

Patients with symptoms due to anaemia Unstable patients bleeding heavily Impaired marrow function	Transfusion Threshold
Symptoms (dyspnoea, angina, palpitations, tachycardia, orthostatic hypotension, syncope) likely to be due to the anaemia.	Consider transfusion when Hb < 10g/dl
<i>Note - Tiredness alone is not an appropriate symptom for transfusion</i>	
Documented/obvious evidence of ongoing significant bleeding at time of transfusion causing symptoms as above or bleeding more than 500ml per hour and not stopping.	Consider transfusion when Hb < 10g/dl
Current or recent (within 3 months) marrow failure or chemotherapy or radiotherapy.	Consider transfusion when Hb < 10g/dl

Patients should only be transfused to a target of 2.0g/dl haemoglobin in excess of the chosen threshold for transfusion above.

Consider patient's estimated blood volume and any ongoing bleeding.

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APPROPRIATENESS OF RED CELL TRANSFUSION - AUDIT PROFORMA

1. Hospital Code Number:
Identifier code – Number allocated to hospital and will remain the same for the entire data collection period.

2. Patient Code Number:
This number must be an individual identifier code number that is generated so that the chart can be traced at a later date if required for peer review. At the conclusion of the audit the master record will be destroyed.

3. Gender: Male Female

4. Speciality patient admitted under:

Enter the admitting speciality the patient comes under e.g. medicine/surgery.

5. Patient age: Years
At time of transfusion

6. Patient postal code:
B T 1 5 3 A B

7. Admitting condition/diagnosis/reason for admission:
Usually found in the doctors or nurses admission notes e.g. Pneumonia, Heart Failure, Knee surgery etc
-
-



8. Admission date: / /
Day Month Year

Date of the admission to hospital in the admission episode that the patient was transfused.

9. Co-Morbidity (Please tick as indicated):

Other diseases the patient may have on admission – can be found on the admission notes

Cardiac Cerebrovascular
Previous MI, Angina, Previous CVA (Stroke, TIA)
Hypertension, Heart failure,
Pulmonary oedema,
Peripheral vascular disease

Other, please specify

Current Chemotherapy Current Radiotherapy
(or treatment in last (or treatment in last
3 months) 3 months)

Current Marrow failure
(or treatment in last 3 months)

Pre-optimisation

10. Haemoglobin on admission: . g/dl

This should be the haemoglobin result from the Full Blood Count done on the day the patient was admitted to hospital or the first haemoglobin done in the hospital – use lab computers if result is not in notes. For outpatients use the haemoglobin immediately before admission if a pre-transfusion hospital haemoglobin is unavailable.



11. Red Cell MCV on admission: MCV
Obtain from first Full Blood Result

From hospital reference values – MCV

Low Normal High

Each hospital has its own reference range for MCV readings – find out the appropriate reference range and determine if MCV is low, normal or high for your hospital reference range.

12. If anaemic on admission (Males <13.0g/dl, Females <11.5g/dl) – was the patient on any of the following:

Iron therapy Yes Folic acid Yes Vitamin B12 Yes

You need only answer this if the patient was anaemic on admission. Check the patient's admission drugs in the doctors or nursing admission notes.

Surgery

13. Did the patient have any surgery during this hospital admission?

As identified from notes or operation sheet – the patient may have had elective surgery (reason for admission) or required emergency surgery.

Yes No Date of / /

surgery:

If yes, please provide a brief description of the surgery: e.g. Tonsillectomy, knee replacement, etc.



Transfusion Episode

14. Who decided that the patient was to have the blood transfusion?

Unknown

Identify the most senior person involved in this decision from the documented notes

Speciality: (if known)

Grade of doctor: (if known)

Date of documented decision: / /

Not documented

This is the date in the notes that there was a decision made to give blood

15. Documented reason for transfusion request

Please record in free text the reason documented in the notes e.g. anaemia, bleeding, symptomatic etc. Otherwise write "Not documented".

.....
.....
.....

16. Pre-transfusion haemoglobin: . g/dl

This should be the haemoglobin immediately (or closest) prior to the patient being transfused – if not documented you may need to use lab computer. For outpatients use the most recent pre-transfusion haemoglobin result.

17. Date of this haemoglobin result / /

Date of above result



18. Was the patient actually transfused: Yes No
Check if any documentation (filled out compatibility form or fluid chart etc) to confirm this.

19. Date of transfusion: / /
Actual date patient received blood

20. Number of days since last Hb check days
Please calculate difference between Q.19 and Q.17 – if same day enter 0.

21. How many units were transfused at this episode? units
On compatibility form or fluid balance sheet. All blood transfusions before the next haemoglobin check or within a 24 hour period after starting that transfusion if the haemoglobin is not checked is to be regarded as one episode?

22. Patient's haemoglobin after this transfusion: . g/dl
First haemoglobin done after transfusion.

23. Date of this haemoglobin result / /

24. Discharge date: / /

Still inpatient Died

Enter here the date of discharge home, transfer from hospital or death. If patient is still an inpatient please document this below. Also please tick box if the patient has died.



25. Was the patient further transfused on a separate date before discharge?
Such information may be found from examination of the notes, compatibility records or blood bank.

Yes No

26. Total number of units transfused during this hospital stay:

units

Such information may be found from examination of the notes, compatibility records or blood bank.

27. **If inpatient** last haemoglobin before discharge: . g/dl

Last haemoglobin before discharge, transfer or death – may be found in notes or lab computer matching the date to or immediately before the discharge date. If none available since the pre-transfusion haemoglobin please tick box below.

Date of this haemoglobin result / /

No result available

If outpatient (or day case transfusion for e.g. marrow failure) please record next available haemoglobin post-transfusion whether it is in hospital or in outpatients.

. g/dl

Date of this haemoglobin result / /

Comments/Discrepancies Noted:

Please record below any discrepancies or incidents noted during data collection i.e. incorrect results recorded in notes and acted upon, results available but not acted upon etc.



APPROPRIATENESS OF TRANSFUSION AT THE TIME OF THIS TRANSFUSION

- If patient is <65 and has no cardiovascular/cerebrovascular problems
 - **The transfusion threshold is below 7g/dl**
 - If patient is >65 and has no cardiovascular/cerebrovascular problems
 - **The transfusion threshold is below 8g/dl**
 - If patient has known cardiovascular/cerebrovascular history
 - **The transfusion threshold is below 9g/dl**
 - If the patient is appropriately symptomatic* and this is documented whichever the group above
 - **The transfusion threshold is below 10g/dl**
- * *Symptoms such as dyspnoea, angina, palpitations, tachycardia, orthostatic hypotension and syncope that is documented and likely to be due to anaemia. (Tiredness alone is not an appropriate symptom for transfusion)*
- If there is documented / obvious evidence of ongoing significant bleeding at time of transfusion
 - Causing symptoms as above or bleeding > 500ml / hour and not stopping*
 - **The transfusion threshold is below 10g/dl**
 - If there is current or recent (within 3 months) marrow failure or chemotherapy or radiotherapy
 - **The transfusion threshold is below 10g/dl**

**CIRCLE
THE MOST
APPROPRIATE
DESCRIPTION OF
THIS PATIENT**

1. Please indicate the most appropriate description of this transfusion episode:

Appropriate transfusions Inappropriate transfusion
Transfusion occurred when Hb was below threshold value *Transfusion occurred when Hb was above the threshold value*

Possibly inappropriate
Unsure - for review

2. In the **absence** of significant active bleeding, was the patient transfused more than 2.0 g/dl above their appropriate threshold value?
Active bleeding to cause symptoms as above or bleeding > 500ml / hour and not stopping

Yes No

3. If the patient was admitted with anaemia – was there appropriate iron, folic acid or vitamin B12 therapy?
(If MCV low – patient should be on iron therapy. If MCV high patient should be on folic acid / vitamin B12)

Yes No Admitted anaemic and MCV was normal Not applicable

If patient not anaemic when admitted – tick “Not applicable”

4. If the patient was in hospital for more than 7 days – were they continued / commenced on any oral or IV iron therapy in hospital prior to the transfusion?
Check the patient's drug chart for Galfer or some other iron preparation tried before transfusion

Yes No

Only review this if patient transfused after 8+ days in hospital.

Not applicable

Tick if transfusion within 7 days of admission.





Further copies of these guidelines and wall chart may
be obtained from the GAIN Office

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