



A RESEARCH REVIEW™
EDUCATIONAL SERIES

Patient blood management

About the Reviewers



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Abbreviations used in this review

ADHB = Auckland District Health Board
FFP = fixed frozen plasma
IDA = iron-deficiency anaemia
IVIG = intravenous immunoglobulin
MTP = Massive Transfusion Protocol
OR = odds ratio
PBM = Patient Blood Management
RBC = red blood cell
RR = rate ratio

This publication is intended as an educational resource for health care professionals managing patients potentially requiring blood transfusions. The review outlines the Australian National Blood Authority's Patient Blood Management (PBM) Guidelines and presents the three established and internationally recognised pillars of blood management.¹ These guidelines are considered relevant to New Zealand practice. This publication has been funded by Aspen Pharmacare. The content is entirely independent and based on published studies and the authors' opinions. It may not reflect the views of Aspen Pharmacare. Treatment decisions based on these data are the full responsibility of the prescribing physician. Aspen Pharmacare (c/o Healthcare Logistics, Auckland, NZ).

Introduction

Blood transfusion, one of the great advances in modern medicine and one of the most frequently performed therapeutic procedures, has been identified as one of the top five overused therapies.² In the current era, transfusion is no longer considered essential for the management of a wide range of diseases and it is well recognised that most uncomplicated elective surgeries in well-prepared patients can be undertaken without the need for this intervention.³ However, a number of international observational studies have found wide variation in transfusion practices.⁴

Associated with negative patient outcomes and increased costs, transfusions even appear harmful in some clinical situations.^{2,5} In 2008, Marik and Corwin systematically reviewed 45 studies (n = 272,596) investigating the independent effects of red blood cell (RBC) transfusion on outcomes in high-risk hospitalised patients.⁶ They found RBC transfusions to be associated with increased morbidity and mortality and concluded that overall the risks of transfusion outweigh the benefits. Subsequently, an analysis of 495 studies revealed no benefit of RBC transfusions in 59.3% of clinical situations, uncertain benefit in 28.9% and benefit in only 11.8% of cases.⁷

Based on current evidence, The Australian National Blood Authority has deemed transfusion medicine practice as an area at need of urgent change.¹ The Authority has developed a Patient Blood Management (PBM) programme to engender a realignment of transfusion practice from a product focus to a patient focus. The aim of PBM is to improve clinical outcomes for individual patients by managing the patient's own blood as standard of clinical care.⁴ The Australian Commission on Safety and Quality in Health Care has listed the National PBM collaborative as a top national priority.⁸

In the Auckland District Health Board (ADHB) in 2008, a program using Lean change methodology based around better compliance of guidelines of stable anaemia and a "Why use two when one will do" philosophy reduced red cell use by 17% over 2 years.⁹ Reduction in waste of thawed plasma in addition to this led to a \$4.6M saving over 5 yrs.⁹

The Waikato District Health Board has been the first to implement a PBM strategy employing PBM nurses and has based its service on the guidelines developed by the Australian National Blood Authority. The service recognises that 'the safest and best blood product for a patient is their own'. One of the aims of the service is to prepare patients for procedures where blood products might be required, by maximising their haemoglobin levels prior to the treatment or procedure. The Waikato PBM team is part of a multidisciplinary team approach to optimise patient outcomes.

What is Patient Blood Management?

PBM is a patient-focused, evidence-based and systematic, multidisciplinary approach aimed at optimising patient outcomes by improving the patient's medical and surgical management in ways that boost and conserve the patient's own blood, thus avoiding unnecessary exposure to blood components.^{1,4} Such management is critical as it optimises the use of donor blood and reduces transfusion-associated risk. In cases where blood components are likely indicated, transfusion should not be a default decision, rather, the full range of alternative therapies should be considered and the benefits and risks assessed. For most patients, blood transfusion can be minimised or avoided by this 'standard of care' management.⁴ Allogeneic blood transfusions should only be considered when there are no other available options.⁴

While the primary goal of PBM is to improve patient's outcomes, minimising or avoiding the use of allogeneic blood, a precious and limited resource, and reducing health costs are desirable secondary benefits.³

The Three Pillars of PBM

PBM includes three key components, termed the Three Pillars of PBM: optimisation of blood volume and red cell mass; minimisation of blood loss; optimisation of the patient's tolerance of anaemia (see **Figure 1**).^{1,2} This Three Pillar, nine-field matrix of PBM, details how various practices can be initiated during the preoperative, intraoperative and postoperative stages of surgery in order to ensure optimisation of the patient's own blood volume, minimise blood loss and optimise the patient's physiological tolerance of anaemia. The historic overuse of transfusions has resulted partly from failure to address the Three Pillars of PBM.³

Clinical practice of the Three-Pillar Matrix is determined by:⁴

- Medical or surgical context
- Age and sex of the patient
- Time frame for managing the primary clinical problem – urgent, emergent or elective
- Reversibility and treatability of the primary disease
- Presence of comorbidities
- Availability and costs of alternatives to blood transfusion
- Specific patient preferences.



	PILLAR ONE	PILLAR TWO	PILLAR THREE	THREE PILLARS OF PATIENT BLOOD MANAGEMENT
	Optimise RBC Mass	Minimise Blood Loss	Manage Anaemia	
PREOPERATIVE	<ul style="list-style-type: none"> > detect/treat anaemia & iron deficiency > treat underlying causes > optimise haemoglobin > cease medications 	<ul style="list-style-type: none"> > identify, manage & treat bleeding/bleeding risk > minimise phlebotomy > plan/rehearse procedure 	<ul style="list-style-type: none"> > patient's bleeding history & develop management plan > estimate the patient's tolerance for blood loss > optimise cardiopulmonary function 	
INTRAOPERATIVE	<ul style="list-style-type: none"> > time surgery with optimisation of erythropoiesis & red blood cell mass 	<ul style="list-style-type: none"> > meticulous haemostasis/surgical/anaesthetic techniques > cell salvage techniques > avoid coagulopathy > patient positioning/warming > pharmacological agents 	<ul style="list-style-type: none"> > optimise cardiopulmonary function > optimise ventilation & oxygenation > restrictive transfusion strategies 	
POSTOPERATIVE	<ul style="list-style-type: none"> > manage anaemia & iron deficiency > manage medications & potential interactions 	<ul style="list-style-type: none"> > monitor & manage post op bleeding > keep patient warm > minimise phlebotomy > awareness of drug interactions & adverse events > treat infections promptly 	<ul style="list-style-type: none"> > maximise oxygen delivery > minimise oxygen use > treat infections promptly > tolerance of anaemia > restrictive transfusion strategies 	

Figure 1. The Three Pillars of PBM.^{1,2}

Pillar 1 – Maximising total red cell mass

The timely diagnosis and management of anaemia is essential.⁴ 'Protection' of the patient's red cell mass is imperative and diagnostic blood sampling should be kept to a minimum (micro-sampling should be considered).⁴ Haemorrhagic complications (especially gastrointestinal bleeding) should be diagnosed and treated.

Most cases of anaemia are correctable within 2-3 weeks, without RBC transfusion. If surgery is urgent, transfusion may be required, however, it may ultimately be deemed unnecessary upon further consideration of the other two pillars of PBM. Ultimately, the clinical impact of anaemia on the patient, comorbidities and reversible factors should be factored into the decision regarding RBC transfusion.⁴ The patient should be included in decision-making regarding the management of their anaemia.⁴ Following a transfusion, the cause of the anaemia should be followed up for definitive diagnosis and treatment.

Pillar 2 – Minimising blood loss

Risk factors for bleeding should be identified and a management plan developed before surgery (or other therapies) is commenced.⁴ The use of blood-sparing surgical and anaesthetic techniques, and the meticulous attention to haemostasis and surgical techniques is essential. Antifibrinolytic therapy should be considered; tranexamic acid is increasingly being used in the perioperative and trauma setting. The use of phlebotomy should be minimised.

Pillar 3 – Managing anaemia

The patient's physiological tolerance of anaemia should be optimised by identifying and managing any comorbidities.⁴

The Australian PBM Guidelines

The National Blood Authority (NBA) of Australia PBM Guidelines comprise six modules.¹ Designed around evidence-based practice, the six modules assist and guide clinical decisions and coordination of health care across the primary, secondary and tertiary care settings for patients potentially requiring blood or blood products in the following settings: Critical Bleeding/Massive Transfusion (Module 1); Perioperative (Module 2); Medical (Module 3); Critical Care (Module 4); Obstetrics and Maternity (Module 5); Neonatal and Paediatrics (Module 6).

The guidelines promote a patient's own blood as a valuable and unique resource that should be conserved and managed appropriately. They emphasise that altruistically donated blood is a valuable, unique and costly resource that should only be used as therapy when there is evidence of potential benefit and minimal potential harm, and that transfusion alternatives should be considered. The guidelines also stress the need for quality products to be available in a timely and safe manner, and emphasise that potential hazards of blood transfusion should be considered and balanced against the benefits (patients/relatives should have these benefits and risks explained). The modules are briefly outlined below.

Module 1: Critical Bleeding/Massive Transfusion

Module 1 provides information to assist and guide health care professionals managing patients experiencing critical bleeding who require, or are likely to require, massive transfusion. The module includes a Massive Transfusion Protocol (MTP) template designed to guide health care professionals initiating massive transfusion. This module is currently being updated and the updated version is expected to be available in late 2017.

The ADHB has developed an MTP protocol specific to practice in NZ (see Figure 2).¹⁰

Module 2: Perioperative

Module 2 supports the introduction of PBM practices in the perioperative setting. The module includes 22 recommendations and 20 practice points for treating patients potentially requiring blood transfusions. The module includes the useful adaptable Preoperative Haemoglobin Assessment and Optimisation Template (Figure 3). Anaemia and blood loss are independently associated with poorer outcomes and increase the likelihood of transfusion.² With regard to iron and erythropoiesis-stimulating agents, recommendations include the use of preoperative oral iron therapy in surgical patients with, or at risk of, iron-deficiency anaemia. Surgical patients with suboptimal iron stores (ferritin level <100 µg/L) in whom substantial blood loss is anticipated, should receive preoperative iron therapy. Individuals with preoperative iron-deficiency anaemia or depleted iron stores, should be treated with iron alone. In those with anaemia of chronic disease, erythropoiesis-stimulating agents may be indicated. In cases of preoperative anaemia where an erythropoiesis-stimulating agent is indicated, this must be combined with iron therapy.

Of all the strategies utilised by PBM, the timely detection and management of anaemia is perhaps the most important.¹¹ Studies in major surgery patients have demonstrated a substantial postoperative morbidity and mortality increase as preoperative haemoglobin concentration decreases.¹¹ There is strong evidence that IV iron reduces the need for blood transfusion in patients undergoing major surgery, and results in shorter hospital stays, enhanced restoration of iron stores, and a higher mean haemoglobin concentration 4 weeks post surgery.^{12,13} An International Consensus statement on the perioperative management of anaemia and iron deficiency has recently been released, stressing the importance of this area in managing patients undergoing surgery.¹⁴

Module 3: Medical

Module 3 includes eight recommendations and practice points for blood management in patients with various medical conditions/diseases.

Module 4: Critical Care

Module 4 includes four specific recommendations including the use of erythropoiesis-stimulating agents and tranexamic acid. The module also includes the Massive Transfusion Protocol (MTP) template.

Module 5: Obstetrics and Maternity

Module 5 was developed to assist and guide health care professionals in making clinical decisions when managing pregnant and postpartum women. The module focuses on blood loss and when to use iron supplementation and erythropoiesis stimulating agents.

Module 6: Neonatal and Paediatrics

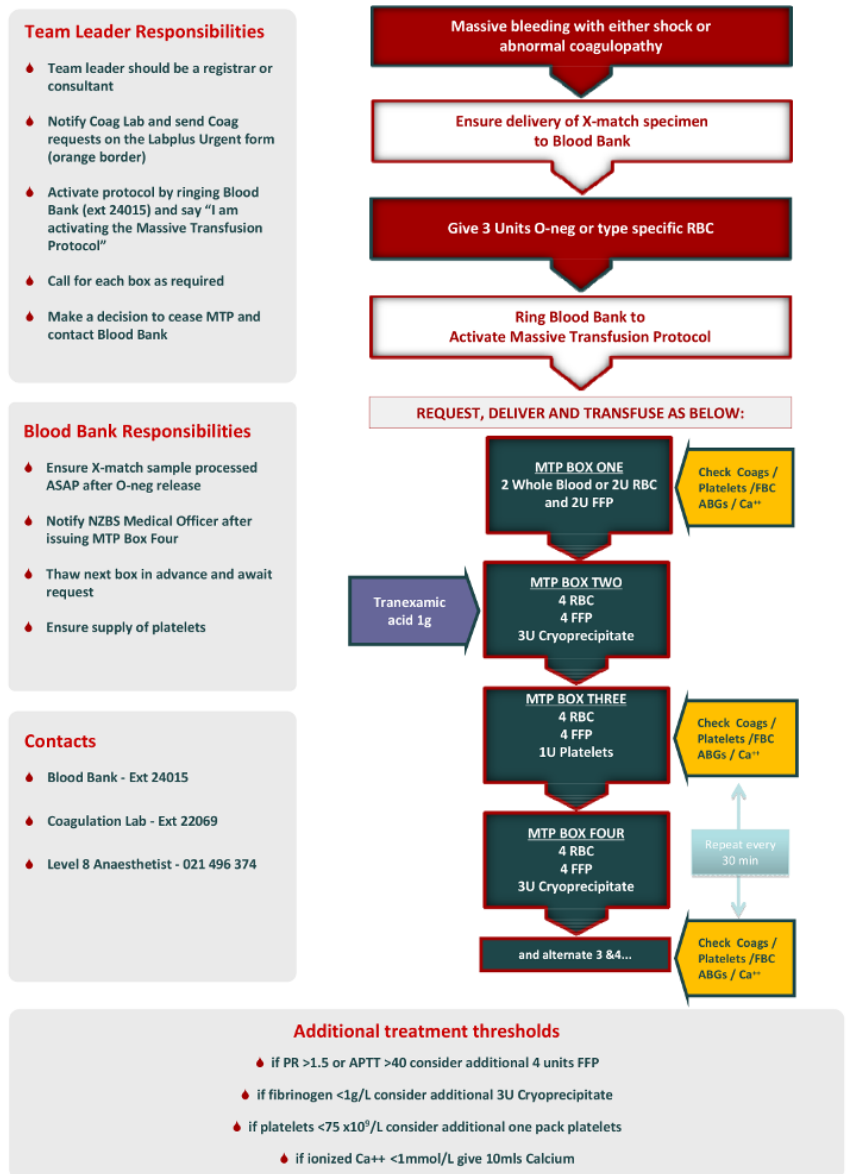
Module 6 assists and guides health care professionals in making clinical decisions about blood management in neonatal and paediatric patients. The module includes a useful critical bleeding protocol for infants and children and a haemoglobin assessment and optimisation template (Figure 4).

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ABGs = arterial blood gases; APTT = activated partial thromboplastin time; ASAP = as soon as possible; FBC = full blood count; FFP = fresh frozen plasma; MTP = Massive Transfusion Protocol; NZBS = New Zealand Blood Service; RBC = red blood cell

Figure 2. Auckland District Health Board (ADHB) Massive Transfusion Protocol (MTP).¹⁰

Evidence supporting the use of PBM

Improved outcomes and reduced costs with PBM – the Australian experience

The implementation of the world's first comprehensive health-system-wide PBM programme in Western Australia has reduced transfusion rates and improved patient and economic outcomes.² Prior to the implementation of the programme, this Australian state already had one of the world's lowest RBC issuance rates; 31.8 per 1000 population in 2008-9, compared with rates in Germany, Denmark, the UK and the US of 57.3, 60.0, 36.3 and 48.8 per 1000 population, respectively.²

Patient and economic outcomes investigated over 6 years in 605,046 inpatient admissions at four major Western Australian adult tertiary care hospitals partaking in the PBM programme during the period 2008-14, revealed a 41% (RR 0.59; 95% CI 0.58-0.60, $p < 0.001$) decrease in units of RBCs, fresh-frozen plasma and platelet units transfused per 1000 discharges when baseline values were compared with end of study data (Figure 5).² During this period, the mean RBC pretransfusion haemoglobin level decreased from 7.9 g/dL to 7.3 g/dL ($p < 0.001$) and the proportion of single-unit RBC transfusions increased from 33.33% to 63.69% ($p < 0.001$). There was a significant reduction in the proportion of elective surgical patients admitted with anaemia (20.81% vs 14.42%; $p = 0.001$), a 28% risk-adjusted reduction in hospital mortality (OR 0.72; 95% CI 0.67-0.77; $p < 0.001$), a 21% risk-adjusted reduction in hospital-acquired infections (OR 0.79; 95% CI 0.73-0.86), a 31% risk-adjusted reduction in acute myocardial infarction/stroke (0.5% vs 0.4%; OR 0.69; 95% CI 0.58-0.82; $p < 0.001$), and an adjusted 15% reduction in mean length of hospital stay (5.9 days vs 5.3 days; incidence RR 0.85; 95% CI 0.84-0.87; $p < 0.001$).

These reductions translated to a product-acquisition cost saving of AU\$18,507,092 and an estimated activity-based saving of between AU\$80 million and AU\$100 million during the 6-year study period. The risk of all-cause emergency readmissions rose from 11.4% to 12.4% during the study period (OR 1.06; 95% CI 1.02-1.10; $p = 0.001$); this finding is contrary to the findings of other studies.²

The findings of the Western Australian study are consistent with those of smaller studies investigating the implementation of individual PBM strategies in selected patient groups.¹⁵⁻²⁰ A systematic review and meta-analysis of RCTs by Salpeter et al., demonstrated that trials with more restrictive transfusion thresholds demonstrate significantly reduced infection, cardiac events, rebleeding and mortality rates compared with those using less restrictive thresholds.²¹ Furthermore, there are numerous risk-adjusted observational studies showing independent dose-dependent associations between RBC transfusion rates and increased morbidity and mortality.²

The European Union follows suit

In April 2017, the European Commission announced the publication of two PBM guides recommending PBM as the standard of care for the European Union.²² The guides were modelled on the "impressive results" of the Western Australian PBM programme. Furthermore, the World Health Organisation has endorsed and promoted PBM and it is widely accepted as current best practice.²³

Local experience

'Blood as a gift' has been an ongoing initiative in NZ at Auckland City Hospital since 2010.⁹ The initiative was developed with the mission of introducing and embedding blood management principles and practice, in an aim to improve patient blood safety and reduce unnecessary transfusions. Between October 2010 and December 2013, the initiative improved the utilisation of RBC units, with an overall reduction of approx. 18% in mean consumption. In addition to the associated financial savings, there was a significant time saving for both patients and staff.

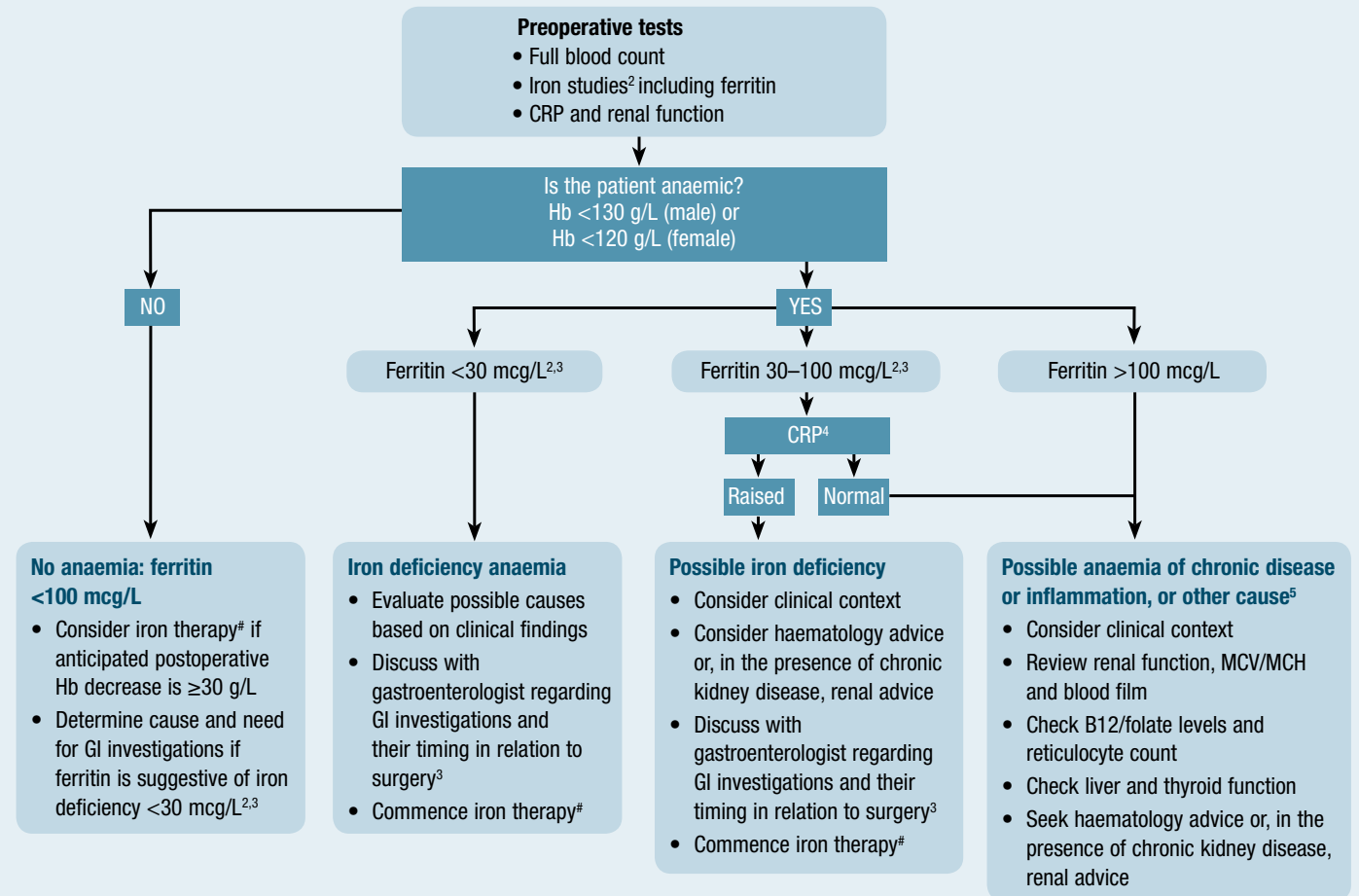
The status of PBM in NZ

Kerry Gunn: There are a number of subtle differences between NZ, Australia and other countries with regard to PBM. The costs of blood products are borne by the District Health Boards, unlike federally paid products in Australia. It may be that micromanagement of the effective use of NZ blood products has allowed to more rational use. Saying that, audits in the ADHB in 2003 showed 20% of prescribed red cells had no logical indication on modern criteria (as in the NBA guidelines), and a program to encourage better transfusion practice led to a 17% reduction in use.⁹ Similar programs with the use of fresh frozen plasma, platelets and group and antibody screens have led to reduced use. In fact in absolute terms, FFP use in 2017 is 50% of that in 2005, and red cell use has been dropping in the last four years, despite an increasing population and more complex surgery.⁹ While the more restricted use of blood products are logical in anaemic patients, or those with deranged coagulation screens, but not bleeding, the use of an MTP has led to reduced deaths due to exsanguination. This paradoxically is associated to a more liberal delivery of coagulation factors (predominantly fibrinogen dominant) to the patient rapidly. As these products are usually frozen, early thawing often leads to waste. The key to using these products wisely is to understand the indications for the activation of the MTP, use rapid assays (often the thromboelastogram [TEG]) to diagnose coagulopathy, and to stop the MTP at the correct time. Alternative approaches with a goal directed approach that differs in not following the empiric formula of an MTP are also being investigated.

The development of the NBA guidelines involved collaboration with NZ and Australian groups, and the endorsement of them by Colleges in Anaesthesia, Critical Care, Surgery and Haematology. They are relevant to NZ practice.

Preoperative haemoglobin assessment and optimisation template

This template¹ is for patients undergoing procedures in which substantial blood loss is anticipated such as cardiac surgery, major orthopaedic, vascular and general surgery. Specific details, including reference ranges and therapies, may need adaptation for local needs, expertise or patient groups. An editable electronic copy of this template is available on the National Blood Authority's website (www.nba.gov.au).



Iron therapy

Oral iron in divided daily doses. Evaluate response after 1 month. Provide patient information material.

IV iron if oral iron contraindicated, is not tolerated or effective; and consider if rapid iron repletion is clinically important (e.g. <2 months to non deferrable surgery).

NOTE: 1 mcg/L of ferritin is equivalent to 8–10 mg of storage iron. It will take approximately 165 mg of storage iron to reconstitute 10 g/L of Hb in a 70 kg adult. If preoperative ferritin is <100 mcg/L, blood loss resulting in a postoperative Hb drop of ≥ 30 g/L would deplete iron stores.

In patients not receiving preoperative iron therapy, if unanticipated blood loss is encountered, 150 mg IV iron per 10g/L Hb drop may be given to compensate for bleeding related iron loss (1 ml blood contains ~0.5 mg elemental iron)

Abbreviations

CRP = C-reactive protein

GI = gastrointestinal

Hb = haemoglobin

IV = intravenous

MCV = mean cell/corpuscular volume (fL)

MCH = mean cell/corpuscular haemoglobin (pg)

Footnotes

1 Anaemia may be multifactorial, especially in the elderly or in those with chronic disease, renal impairment, nutritional deficiencies or malabsorption.

2 In an anaemic adult, a ferritin level <15 mcg/L is diagnostic of iron deficiency, and levels between 15–30 mcg/L are highly suggestive. However, ferritin is elevated in inflammation, infection, liver disease and malignancy. This can result in misleadingly elevated ferritin levels in iron-deficient patients with coexisting systemic illness. In the elderly or in patients with inflammation, iron deficiency may still be present with ferritin values up to 60–100 mcg/L.

3 Patients without a clear physiological explanation for iron deficiency (especially men and postmenopausal women) should be evaluated by gastroscopy/colonoscopy to exclude a source of GI bleeding, particularly a malignant lesion. Determine possible causes based on history and examination; initiate iron therapy; screen for coeliac disease; discuss timing of scopes with a gastroenterologist.

4 CRP may be normal in the presence of chronic disease and inflammation.

5 Consider thalassaemia if MCH or MCV is low and not explained by iron deficiency, or if long standing. Check B12/folate if macrocytic or if there are risk factors for deficiency (e.g. decreased intake or absorption), or if anaemia is unexplained. Consider blood loss or haemolysis if reticulocyte count is increased. Seek haematology advice or, in presence of chronic kidney disease, nephrology advice.

For more information on the diagnosis, investigation and management of iron deficiency anaemia refer to Pasricha SR, Flecknoe-Brown SC, Allen KJ et al. Diagnosis and management of iron deficiency anaemia: a clinical update. *Med J Aust*, 2010, 193(9):525–532.

Disclaimer

The information above, developed by consensus, can be used as a guide. Any algorithm should always take into account the patient's history and clinical assessment, and the nature of the proposed surgical procedure.

Figure 3. Preoperative haemoglobin assessment and optimisation template.¹



ANAEMIA^a

Hb below reference range for age, sex and gestation

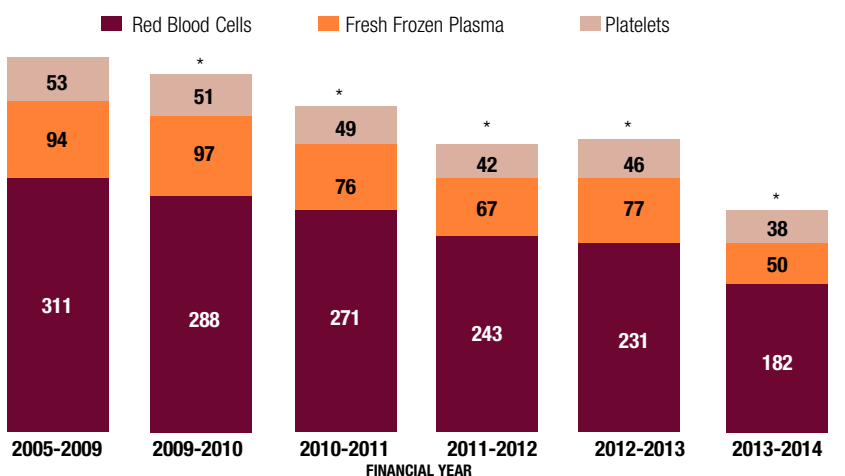
Ferritin <20 mcg/L Iron deficiency anaemia	Ferritin 20–50 mcg/L Possible iron deficiency anaemia	Ferritin >50 mcg/L Unlikely iron deficiency anaemia
<p>Review clinical history and identify cause (see Table H.1)</p> <p>Start treatment:</p> <ul style="list-style-type: none"> oral iron 3–6 mg/kg/day <p>Address causes of dietary iron deficiency:</p> <ul style="list-style-type: none"> increase dietary iron if <1 year of age, cease cow's milk and use an infant formula if 1–2 years of age, reduce cow's milk to <500 mL daily <p>Assess haematological response within 2–4 weeks</p> <p>Continue treatment for 3 months after Hb recovery</p> <p>If oral iron is ineffective or is not tolerated, consider other causes of anaemia (see Column 3) and use of IV iron</p>	<p>Review and address any causes of iron deficiency (see Table H.1 and Column 1)</p> <p>Correlate with MCV/MCH and CRP</p> <p>Consider therapeutic trial of iron:</p> <ul style="list-style-type: none"> oral iron 3 mg/kg/day <p>Assess haematological response within 2–4 weeks</p> <p>If anaemia persists, consider other causes (see Column 3)</p>	<p>Correlate with MCH/MCV and CRP Ferritin may be elevated in the setting of inflammation. However, iron deficiency may still be present, particularly where TSAT <20%.</p> <p>Consider alternative causes of anaemia:</p> <ul style="list-style-type: none"> thalassaemia and other haemoglobinopathies anaemia of chronic disease haemolytic anaemia B12 deficiency folate deficiency other

CRP = C-reactive protein; Hb = haemoglobin; IV = intravenous; MCH = mean corpuscular haemoglobin; MCV = mean corpuscular volume; TSAT = transferrin saturation.

^a This algorithm applies to all patients, including those undergoing procedures in which substantial blood loss is anticipated.

The reference ranges are based on criteria from the Royal College of Pathologists of Australasia, and they may require local adaptation.

Figure 4. Haemoglobin assessment and optimisation template for infants and children.¹



*p value <0.05 compared with reference year (2008-9)

Figure 5. Mean units of blood transfused per 1000 discharges following implementation of the Western Australian PBM programme.²

The role of surgeons, anaesthetists and GPs in PBM

Kerry Gunn: With the overwhelming evidence that surgery with less blood loss and transfusion leads to lower morbidity and mortality, a team approach to PBM by surgeons, anaesthetists and GPs makes sense. The three pillars give a structure to work together to limit unnecessary blood transfusions. As a basic rule, no anaemic patient with IDA should present for elective surgery with a probability of transfusion. The key objective is to diagnose the cause of the anaemia, eliminate gastrointestinal blood loss as something that needs to be investigated separately, and build iron stores for surgery. If the patient can be made non-anaemic, then the likelihood of them receiving a red cell transfusion drops by 60%. It is important to recognise that for this reason the NBA template allows more aggressive replacement of iron than patients in the community not having surgery. Anaesthetists need to approach surgery preparing patients to remove drugs that lead to excessive bleeding without benefit, reduce overzealous crystalloid administration and the induction of dilutional anaemia, and the use for drugs such as tranexamic acid that has now proof of reduction in bleeding without frequent side effects. The key role however is the surgeon. With a technique that limits blood loss, many of the operations that traditionally always required blood products, now rarely do. These techniques are done under a team approach that recognises blood products do not need to be given to patients on the basis of laboratory results alone, without taking into account the clinical context.

Iron treatment

Kerry Gunn: Oral iron still should be the first drug used in treating iron deficiency. In patients tolerant of the side effects, and with intact gastrointestinal absorption, replacement is near equivalent to a single bolus of IV iron. Unfortunately many of the patients presenting with low ferritins have a body deficit of iron of >1G. With daily absorption of oral iron approx. 5mg, replacement will take 2-3 months. Thus with a patient intolerant to oral iron, poor absorption due to elevated hepcidin, and surgery within the next month, the place of IV iron has become better defined. Modern preparations have a low side effect profile, unlike the older dextran preparations. They are able to be given as an undiluted slow IV injection in GPs' surgeries, and are effective. Peak elevations in haemoglobin are in the 2-4 week period, dependent of the nature of the deficiency, and the degree of concomitant bleeding. Post-operative oral iron has very limited absorption.

Implementing PBM in NZ

Kerry Gunn: The implementation of a PBM strategy in NZ has started, but has much promise to reduce further unnecessary blood transfusions, and consider reducing wastage. This has put considerable pressure on the New Zealand Blood Service (NZBS), who is adapting their donor population to meet the product demands of more fractionated products (IVG, Prothrombinex®, albumin and possible fibrinogen concentrate) and reduced FFP and red cell use. We do not have a well-funded overarching body like the NBA in NZ, but we do have an effective network of committed clinicians, mainly through blood transfusion committees to introduce systems to reduce variance in blood transfusion practices. We also need to ensure the public, who are the donors and recipients of blood at the same time, believe the decisions we make on their behalf are well founded in fact, and are not wasteful.

The recently developed '[Simplified International Recommendations for the Implementation of Patient Blood Management](#)' which include a series of simple cost-effective, best-practice, feasible and evidence-based measures, is a useful resource aimed at enabling any hospital to reduce both anaemia prevalence on the day of surgery or intervention and anaemia-related unnecessary transfusion in surgical and medical patients.²⁴



SPECIALISTS' CONCLUDING REMARKS

Dr Kerry Gunn

Prescribing blood has become a lot more complex. The old easy rules we learnt at medical school were that we transfused red cells to a level above 10 g/dL or just added a few units of plasma to a patient that had deranged coagulation results, have been shown to be misinformed. This leaves us knowing that a restrictive policy is something to aim for. The ability for modern perioperative teams to undertake surgery that we traditionally always used blood products for, but now lose minimal blood, has transformed surgery and improved patient outcome. But it has increased the need to identify the patients that will still be exposed to blood that they really do not need. Preoperative anaemia management, with a close relationship with the patients GP is key to this, then ensuring bleeding is reduced preoperatively, and when it occurs treated effectively with the right product at the right time. Behind that is a NZ Blood Service dedicated to providing quality blood products for the NZ community. Our challenge is to apply this potential to our patients.

Professor Ian Civil

Data from our group in Auckland have shown a reduction in mortality from haemorrhage from 32% to 8% over the last two decades. This is related to the success of the introduction of trauma systems, faster transfer of patients from the scene of injury to an operating room, but also to a fundamental change in the way we give blood products. The systems described here reflect international experience that avoiding crystalloid, and replacing it with blood that is high in plasma, cryoprecipitate and platelets manages the coagulopathy of trauma. It allows surgeons to deal with the site of injury and not have ongoing blood loss that historically led to complications later in the ICU. It has also contributed to a substantial reduction in abdominal compartment syndrome, and its consequences. The challenge for us in a trauma community is to ensure all members of the team understand how to use the protocols and how they integrate our modern, local trauma systems.

Educational resources on PBM

BloodSafe eLearning Australia has excellent online courses relating to PBM and clinical transfusion practice for health professionals. <https://bloodsafelearning.org.au>

The National Blood Authority provides a range of online tools to aid in the implementation of the PBM Guidelines at a health provider level. <https://www.blood.gov.au/implementing-pbm>

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