

Individual patient blood management for surgery

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What is patient blood management?

- > holistic approach to the use of blood for an individual patient
- > uses the premise of 'why transfuse' rather than 'why not'
- > balance carefully the benefit and potential harm
- > transfusion avoidance or minimisation stems from the understanding that blood and its components are biological products with effects that are still not fully understood
 - > including immunomodulation
 - > potential for emerging agents that could enter the blood supply

Patient blood management

- > individualised care with the patient at the centre
- > careful attention to detail
- > maximisation of haemoglobin e.g. pre-operatively
- > minimisation of blood loss including
 - > blood taking
 - > intra-operatively and post-operatively
- > use of alternative agents to blood transfusion where these are available and feasible
- > practical information and examples that a clinician can add to their tool kit for patient care
 - > aim being better treatment outcomes

Estimated residual risk of transfusion-transmitted viral infection

Agent	Estimate of residual risk per unit
HIV (antibody and RNA)	< 1 in 10 million
HCV (antibody and RNA)	Approx 1 in 3.2 million
HBV (HBsAg)	Approx 1 in 3.8 million
HTLV I&II antibody	< 1 in 10 million
CMV (antibody negative)	Approx 1 in 127,000
vCJD	Possible. Not yet reported in Australia.
Malaria (antibody)	Approx 1 in 4.9 million – 1 in 10.2 million

Data on file ARCBS. Published in each edition of MediLINK and available at www.transfusion.com.au

SHOT (Serious Hazards of Transfusion) adverse events reported 1996-2006 (n=3763)

<i>Adverse event</i>	<i>Number</i>	<i>Mortality</i>	<i>Morbidity</i>
IBCT (Incorrect blood component transfused)	2717	24 (0.9%)	100
ATR	420	13 (3%)	17
HTR	318	8 (2.5%)	29
TRALI	195	39 (20%)	118
TA-GVHD	13	13 (100%)	
Bacterial contamination	33	8 (24%)	

Adverse transfusion reaction	Incidence
Allergic	1 - 3% of plasma infusions
Febrile nonhaemolytic transfusion reaction	1:100
Circulatory overload	Up to 1% of patients
Delayed haemolytic transfusion reaction	1:4,000 - 9,000
Transfusion-related acute lung injury (TRALI)	1:5,000 - 10,000
ABO incompatibility	Variably reported as 1:12,000 - 77,000
Bacterial infection	For clinically apparent reactions, variously reported to be 1:100,000 for platelets, however probably under-reported.
Anaphylactoid reactions or anaphylaxis	1:20,000 - 170,000
Viral infection	ARCBS has calculated the residual risk per unit for the following viral infections, based on ARCBS data for the two-year period from 1 July 2000 until 20 June 2002 ⁴³ . The risk per unit for HIV is approximately 1:4,808,000; the risk for Hepatitis C is approximately 1:3,112,000; the risk for Hepatitis B is approximately 1:971,000 and the risk for HTLV I/II is considerably less than 1:1 million.
Classical Creutzfeldt-Jacob Disease (cCJD)	There have been no reported cases of transmission by transfusion of classical Creutzfeldt-Jacob Disease (cCJD) 44, and retrospective studies suggest that the possibility of such transmission of cCJD is remote.
Variant Creutzfeldt-Jacob Disease (vCJD)	While there have been no reported cases of transmission of variant Creutzfeldt-Jacob Disease (vCJD) in humans by transfusion to date, theoretical concerns and some experimental evidence ⁴⁵ suggest that the possibility of transmission of vCJD by transfusion is unknown and cannot be excluded.
Post Transfusion Purpura	Rare
Transfusion-acquired Graft-versus-host Disease	Rare
Metabolic complications	Variable
Iron overload	Not known but the risk should be considered with chronic transfusions, especially greater than 20 units.
Immune modulation	Not known

Increasingly recognized

- 3rd most common UK
- FDA 3rd most prevalent transfusion related mortality after haemolysis and sepsis

Most common TTI

- Second most common cause of transfusion related mortality in US

? Impact of TRIM and relationship to:
SIRS, ARDS, MOF, infection, thrombosis, tumor recurrence

Transfusion Medicine Manual, 2003
www.transfusion.com.au

Risk of blood component transfusion and isolated CABG, Koch et al, 2006

- > 11 963 patients, observational cohort study
- > Isolated CABG Jan 95 – July 2002
- > 5 814 transfused (48.6%)
- > Risk-adjusted probability of morbidity and mortality as function of blood component transfusion modeled using logistic regression
- > Previous studies limited
 - > examination RBC transfusion as binary variable
 - > limiting study of dose-dependent effect
 - > not included intra-op and post-op transfusions
 - > not included other components
 - > looked at heterogeneous surgical as well as cardiac surgical populations

Results₁

Post-op Event	Odds Ratio	Confidence interval	P value
Mortality	1.77	1.67-1.87	P<0.0001
Renal failure	2.06	1.87-2.27	P<0.0001
Prolonged ventilatory support	1.79	1.72-1.82	P<0.0001
Serious infection	1.76	1.68-1.84	P<0.0001
Cardiac complications	1.55	1.47-1.63	P<0.0001
Neurologic events	1.37	1.30-1.44	P<0.0001

Results₂

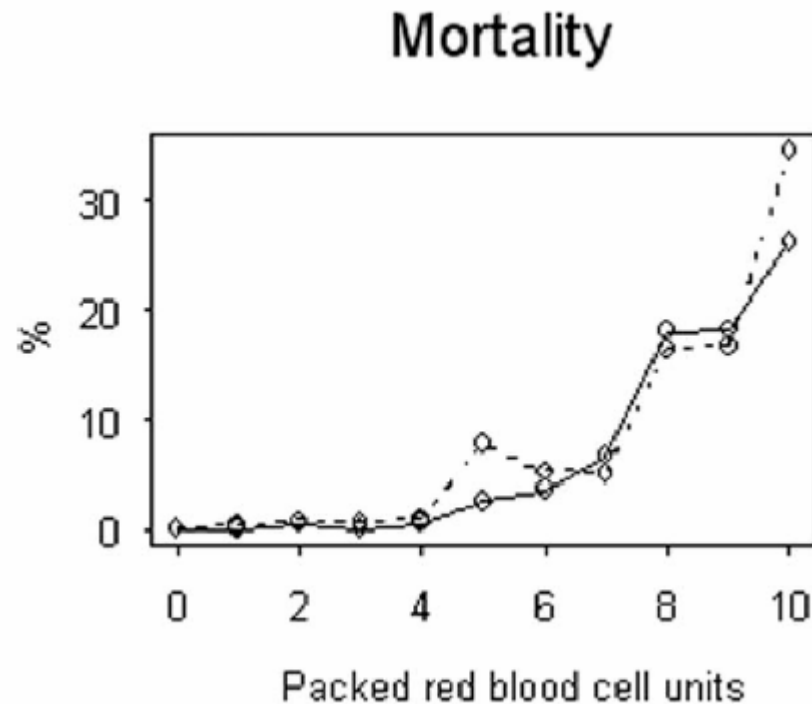



Figure 2. Unadjusted relationship between units of packed red blood cells, platelet transfusion, and morbidity and mortality outcomes is graphically depicted in this panel. The *solid lines* represent those patients who received platelet transfusions per unit of packed red blood cells transfused. The *dashed lines* represent those patients who received only packed red blood cells. As the number of units of blood transfused increases, so does the risk for every postoperative adverse outcome.

Conclusions

- > Transfusion of RBC associated with a dose-dependent increased risk of post-operative complications
- > Association remained strong after adjustment for risk factors known to be associated with adverse outcome after CABG
- > Older, smaller patients with low pre-operative hematocrit and those undergoing re-operative surgery were transfused most often
- > Impossible to eliminate possibility that transfusion was a marker for sicker patients or more extensive surgery

NHRMC guidelines

- > Promotion of appropriate use of blood components taking into account benefits and risks in the individual patient
- > Documentation of the decision



CLINICAL PRACTICE GUIDELINES

Appropriate Use of Red Blood Cells

Summary of NHRMC/ASBT guidelines


This summary is derived from the National Health and Medical Research Council (NHRMC)/Australian Society of Blood Transfusion (ASBT) Clinical Practice Guidelines on the Use of Blood Components (red blood cells, fresh frozen plasma and cryoprecipitate). The guidelines were produced in cooperation with the Commonwealth Department of Health and Ageing, the Royal Australasian College of Surgeons, the Australian and Zealand College of Anaesthetists, and other relevant groups. The coalition of organisations involved in developing the guidelines demonstrates the degree of interest across the specialties in promoting the appropriate use of blood components.

The recommendations included in this summary have been endorsed by the NHRMC and the ASBT. The recommendations aim to support:

- clinical decisions about the use of red blood cells;
- quality processes to promote appropriate use of blood components and optimise patient outcomes.

The clinical recommendations are summarised overleaf. For further details, consult the NHRMC/ASBT guidelines.

As well as a record of the clinical or laboratory indications for the use of blood components, other relevant data could include reasons for giving blood components if not in accordance with the guidelines (eg if red blood cells are given when the haemoglobin level is >100g/L); and other relevant medical history of the patient's condition.



CLINICAL PRACTICE GUIDELINES

Appropriate Use of Platelets

Summary of NHRMC/ASBT guidelines


This summary is derived from the National Health and Medical Research Council (NHRMC)/Australian Society of Blood Transfusion (ASBT) Clinical Practice Guidelines on the Use of Blood Components (red blood cells, platelets, fresh frozen plasma and cryoprecipitate). The guidelines were produced in cooperation with the Commonwealth Department of Health and Ageing, the Royal Australasian College of Surgeons, the Australian and New Zealand College of Anaesthetists, and other relevant groups. The coalition of organisations involved in developing the guidelines demonstrates the degree of interest across the specialties in promoting the appropriate use of blood components.

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CLINICAL PRACTICE GUIDELINES

Appropriate Use of Fresh Frozen Plasma and Cryoprecipitate

Summary of NHRMC/ASBT guidelines

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As well as a record of the clinical or laboratory indications for the use of blood components, other relevant data could include reasons for giving blood components if not in accordance with the guidelines (eg if fresh frozen plasma is given when there is no evidence of bleeding or abnormal coagulation); and other relevant medical history of the patient's condition.

In all situations where blood component therapy is given, a process for clinical review should be in place to monitor the appropriateness and safety of its use and to develop systems for the implementation of these guidelines.

Clinical review groups or transfusion committees should include senior representatives of relevant clinical specialties and administration, nurses, blood bank and staff involved in quality improvement. In larger hospitals this is likely to be a separate committee. However, this is not necessary and in smaller hospitals, the role could be undertaken by the medical advisory committee or through a local geographic or organisational network.

As part of the informed consent process, a patient should be given clear explanation of the potential risks and benefits of blood component therapy in his or her situation.

Community concern about blood issues and the safety of blood component therapy makes the consideration of consumer issues and processes for informed consent particularly important. Change at clinical and organisational levels within hospitals will help to standardise the use of blood components. Consumers can also be important drivers of change to practice, if they are aware of the issues surrounding use of blood components and know about the risks and benefits in their own situation.



CLINICAL PRACTICE GUIDELINES

Appropriate Use of Fresh Frozen Plasma and Cryoprecipitate

Organisational practice

Changing organisational practice through quality improvement is as important as changing clinical practice. A quality management system that includes monitoring, assessment, action and evaluation will allow audits of usage at the local level and eventual evaluation of changes in practice and effect on health outcomes.

Documentation used in ordering or administering blood components (eg request forms or blood administration forms) should summarise the clinical recommendations of these guidelines and collect standardised data items. Clinical and laboratory indications for blood components should be accurately recorded in that documentation and in the patient's medical record.


Contact Details

This document is one in a series of documents developed by the NHRMC/ASBT about the use of blood components. These documents are available from:


- NHRMC Website at: <http://www.nhrmc.gov.au>, or
- ASBT Website at: <http://www.asbt.org.au>

Print copies of all documents can be obtained by emailing:


- HEALTH ADVISORY CTREE@NHRMC.nhrmc.gov.au or by telephoning (02) 6289 9520 (24hr answering machine) or 1800 020 103. Alternatively you can contact the ASBT by telephoning (02) 9256 5456 or emailing to the.secretaire@asbt.org.au




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Available at www.transfusion.com.au

Principles of blood management

> Three pillars

Optimize red cell mass

Minimize blood loss

Physiological tolerance
of anaemia



Optimize red cell mass

- > Haematological assessment
 - > Careful history and examination
 - > Identify and treat haematinic deficiency
 - > Underlying conditions e.g. chronic inflammatory states, malignancy
 - > FBE, film, haematinic parameters (iron, B12, folate)
 - > Identify and manage occult bleeding
 - > Monitor response to treatment (reticulocyte count, inflammatory markers)
- > Augmentation of red cell mass
 - > Erythropoietin
 - > Iron - oral or IV
 - > Folate - 15mg/day
 - > B₁₂
 - > Vitamin C

Perioperative EPO in GIT cancer, Kosmadakis et al

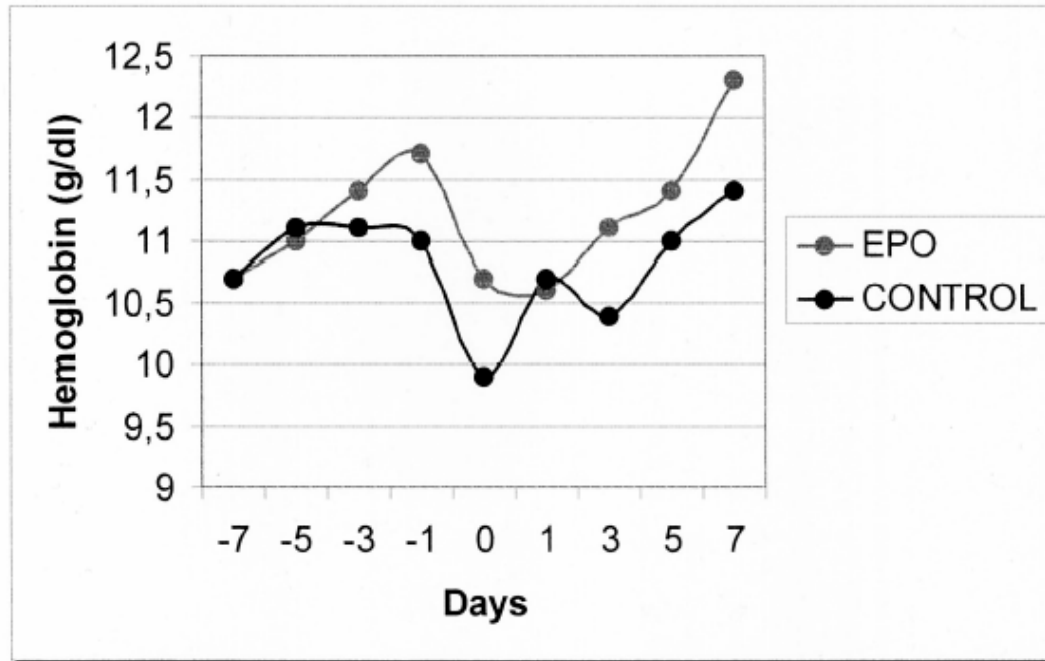


Figure 1. Hemoglobin levels in patients receiving erythropoietin and placebo regimens. Day 0: Day of operation for cancer of the gastrointestinal tract.

Erythropoietin precautions

- > Care augmentation not recommended beyond 120g/L
 - > Cardio vascular and thrombotic event risk
 - > Also care with rate of Hb rise >10g/L over 2 weeks
- > Growth factor potential and tumour progression
 - > Esp. with target Hb >120g/L
 - > In advanced head and neck cancer
 - > In metastatic breast cancer
 - > Theoretical concern with any tumour esp. myeloid malignancy
- > Monitor BP closely
 - > BP may rise during treatment
 - > Hypertensive encephalopathy and seizures have been reported

Erythropoietin Ab induced PRCA

- > Patients treated with EPO since 1987/1988
- > EPO induces antibodies very rare complication with only a few case reports
- > Upsurge of cases 1998 with associated pure red cell aplasia (PRCA)
- > Majority in CRF patients receiving SC treatment
- > About 250 cases reported worldwide
- > Large majority occurred out-side of USA
- > Peak 2001-2002 (4 Melbourne)
- > One case reported 2003 and no cases in first half of 2004
- > Cause remains uncertain
 - > Possibilities storage instructions not followed, contamination with silicone used to lubricate pre-filled syringes, release of chemicals from rubber stoppers of pre-filled syringes

Minimize blood loss

- > Haemostatic assessment
- > Haemostasis planning
- > Minimize iatrogenic blood loss
- > Anaesthetic techniques
- > Surgical techniques
- > Clinical monitoring

Haemostatic assessment

- > Detailed history and examination
 - > Past challenge including surgery, dental & trauma
 - > History of bleeding, bruising, menorrhagia
 - > Family history of bleeding
 - > Risk of Vitamin K deficiency – elderly, poor diet, liver disease, malabsorption states
- > Coagulation tests if positive history
 - > APTT, PT/INR, fibrinogen, vWD testing, platelet count & function
 - > follow up second line tests depending on findings
- > Detailed medication & OCP history targeting those with anticoagulant effect
 - > Aspirin, NSAIDS, antibiotics (betalactams), garlic, St John's wort
- > Management of anticoagulants
 - > Heparin, warfarin, anti-platelet agents

Haemostasis planning

- › Consider withholding
 - › Anti-platelet agent may irreversibly inhibit for 7-14days
 - › Risk assessment together with other medical specialist e.g. cardiologist
- › Consider use of an antagonist if reversal is required
 - › e.g. anticoagulants pre-surgery
- › Substitute easily reversible agent e.g. UFH for warfarin
- › Treat hereditary or acquired haemostatic disorders
- › Consider pharmacological enhancement of haemostasis e.g. Tranexamic acid, desmopressin, vitamin K
- › Topical haemostatic agents and vasoconstrictors

Pre-operative surgical & anaesthetic planning

Transfusion update 2007, Richard Seigne presented table to calculate *Maximum Allowable Blood Loss*

$$\text{MABL} = \text{Wt} \times \text{Blood Volume} \times \frac{\text{initial Hb} - \text{target Hb}}{\text{average of initial Hb \& target Hb}}$$

Surgical/anaesthetic approach to blood management

Use these charts to estimate the Maximum Allowable Blood Loss to produce a post-op Hb of 80 or 100g/L

Blood volume <90kg 70ml/kg >90kg 60ml/kg	<p style="text-align: center;">MABL ml, target haemoglobin 80g/L 501-1000, 1001-2000, 2001-3000, 3001-4000, >4000</p>													
	Initial Hb	95	100	105	110	115	120	125	130	135	140	145	150	155

Kg (value used e.g. 55, 65)															
40-50	540	700	851	995	1131	1260	1383	1500	1612	1718	1820	1917	2011	2100	
50-60	660	856	1041	1216	1382	1540	1690	1833	1970	2100	2224	2343	2457	2567	
60-70	780	1011	1230	1437	1633	1820	1998	2167	2328	2482	2629	2770	2904	3033	
70-80	900	1167	1419	1658	1885	2100	2305	2500	2686	2864	3033	3196	3351	3500	
80-90	1020	1322	1608	1879	2136	2380	2612	2833	3044	3245	3438	3622	3798	3967	
90-100	977	1267	1541	1800	2046	2280	2502	2714	2916	3109	3293	3470	3638	3800	
100-110	1080	1400	1703	1989	2262	2520	2766	3000	3223	3436	3640	3835	4021	4200	
110-120	1183	1533	1865	2179	2477	2760	3029	3286	3530	3764	3987	4200	4404	4600	
120-130	1286	1667	2027	2368	2692	3000	3293	3571	3837	4091	4333	4565	4787	5000	
130-140	1389	1800	2189	2558	2908	3240	3556	3857	4144	4418	4680	4930	5170	5400	

Blood volume <90kg 70ml/kg >90kg 60ml/kg	<p style="text-align: center;">MABL ml, target haemoglobin 100g/L ≤500, 501-1000, 1001-2000, 2001-3000, >3000</p>												
	Initial Hb	105	110	115	120	125	130	135	140	145	150	155	160
Kg (value used e.g. 55, 65)													
40-50	154	300	440	573	700	822	938	1050	1157	1260	1359	1454	
50-60	188	367	537	700	856	1004	1147	1283	1414	1540	1661	1777	
60-70	222	433	635	827	1011	1187	1355	1517	1671	1820	1963	2100	
70-80	256	500	733	955	1167	1370	1564	1750	1929	2100	2265	2423	
80-90	290	567	830	1082	1322	1552	1772	1983	2186	2380	2567	2746	
90-100	278	543	795	1036	1267	1487	1698	1900	2094	2280	2459	2631	
100-110	307	600	879	1145	1400	1643	1877	2100	2314	2520	2718	2908	
110-120	337	657	963	1255	1533	1800	2055	2300	2535	2760	2976	3185	
120-130	366	714	1047	1364	1667	1957	2234	2500	2755	3000	3235	3462	
130-140	395	771	1130	1473	1800	2113	2413	2700	2976	3240	3494	3738	

Prepared by Richard Seigne on behalf of the Transfusion Committee, 2003.

*MABL equation corrects for the dilutional effect of on going blood loss if adequately replaced by colloid/crystalloid. Anesthesiology 1983;58(3):177-8

If more accurate MABL required use adjacent blood volumes, ml/kg,		Male	Female		Male	Female
	Normal	70	65	Thin	65	60
	Obese	60	55	Muscular	75	70

*MABL = Wt x Blood Volume x (initial Hb - target Hb) / average of initial Hb & target Hb

Anaesthetic and surgical techniques

Anaesthetic and surgical blood management methods

Consideration of the following blood conservation methods should be undertaken in the preoperative assessment.

- Rigorous haemostasis and surgical technique
- Surgical positioning of the patient
- Tourniquets
- Haemostatic surgical devices
- Local vasoconstrictors
- Preoperative (prophylactic) and therapeutic angiographic embolization
- Mechanical occlusion of bleeding vessels
- Topical haemostatic agents and tissue adhesives and sealants
- Autologous techniques
- Blood cell salvage devices (intraoperative and postoperative)
- Haemodilution
- Pharmacologic prophylaxis of bleeding
- Control of intraoperative and post operative hypertension
- Controlled hypotension anaesthesia
- Tolerance of normovolaemic anaemia
- Fluid and volume management
- Oxygen therapeutics (RBC substitutes)

Minimize iatrogenic blood loss

- > Limit blood taking to only necessary diagnostic/monitoring tests
- > Reduced volume of phlebotomy
 - > Care to ensure use validated sample tubes for the equipment
- > Microsampling/analysis (ICU)
- > Minimise discard volumes removed from lines
- > Consider non-invasive monitoring
- > Prevent gastrointestinal bleeding
 - > Prophylaxis peptic ulcer – enteral nutrition, sucralfate, H2 receptor antagonist, proton pump inhibitor
- > Avoid blood loss during other interventions e.g. IV line insertion/removal
- > Avoid bed rest/unnecessary bed rest
 - > Caused physiological responses that lead to anaemia
 - > Pressure ulcers – chronic inflammatory state – anaemia of chronic disease

Clinical monitoring post-operatively

Blood conservation methods in the postoperative period

Methods relevant to the immediate postoperative period include;

- Close surveillance for bleeding
- Adequate oxygenation
- Restricted phlebotomy for diagnostic tests
- Postoperative cell salvage (if acceptable)
- Pharmacological enhancement of haemostasis (eg antifibrinolytics)
- Avoidance of hypertension
- Tolerance of normovolaemic anaemia
- Meticulous management of anticoagulants and antiplatelet agents

Physiological tolerance of anaemia

- > Maintaining normovolaemia
- > Acceptance of lower red cell mass
- > Oxygen therapeutics
 - > Oxygen therapy
 - > Minimizing O₂ demand
 - > ?Hyperbaric Oxygen
 - > ?Red cell substitutes

What is critical anaemia?

- > Deaths due to anaemia have generally been reported at Hb < 50g/L

Threshold Hb for adequate tissue oxygenation

- > Threshold for surgical and critically ill patients without risk factors is Hb of 70-80g/L
- > Threshold of 80-100g/L for patients with pulmonary disease, cardiac and cerebral ischaemia.

Herbert PC et al, NEJM, 1999;340:409-17

Carson JL et al, J of Am Assoc Med, 1998;279:199-205

Early experience with profound anaemia

- > Significant mortality rate reported with Hb < 50g/L early studies

Preoperative Hb (g/L)	Proportion died by end of hospital stay (%)
0-60	8/13 (61.5)
61-80	3/9 (33.3)
81-100	0/18 (0)
>100	6/85 (7.1)

Experience from management of critical anaemia

- > 128 patients with profound anaemia (2.5-7.0g/dL)
 - > Inpatients - Jan 2002-Aug 2005
 - > Mean age - 52 years
 - > Mean Hb - 5.4 g/dL
 - > Mean LOS - 11 days122/128 (95.3%) survived
- > Low mortality rate supports individualization of transfusion triggers

Hb level (g/dL)	Proportion who survived
2.5-3.0	6/7 (85.7%)
3.1-4.0	9/11 (81.8%)
4.1-5.0	29/32 (90.6%)
5.5-6.0	30/30 (100%)
6.1-7.0	48/48 (100%)
Overall	122/128 (95.3%)

Contribution of selected modalities to blood conservation in the surgical patient.

Intervention	Blood units
Preoperative options	
Tolerance of anaemia (reduced transfusion trigger)	1-2 units
Increased preoperative RBC mass (replacement of haematinics and/or r-HuEPO)	2 units
Preoperative autologous donation	1-2 units
Intraoperative options	
Meticulous haemostasis and operative technique	1 or more units
Acute normovolaemic haemodilution (ANH)	2 units
Blood salvage	1 unit
Post operative options	
Restricted phlebotomy	1 unit
Blood salvage	1 unit

Application to routine practise

- > Careful evaluation of benefit and risk of transfusion in each patient
 - > Pre-operative assessment
- > Meticulous individualized patient blood management
 - > Attention to detail, “art of medicine”
 - > Many small interventions when added together make a difference to an individual patient
- > Transfusion of one unit at a time with subsequent evaluation to determine clinical status and further requirements, if any
- > Multidisciplinary team approach
 - > Surgeon, anaesthetist, physician, haematologist
 - > Physiotherapist, nursing staff



Back

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The information in this site is addressed to health professionals



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Transfusion Update

Transfusion Update 2008: "Focus on Transfusion Medicine: trauma, obstetrics and paediatrics" takes place in Melbourne from 5 to 7 May. To find out more [click here](#).

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Information for Clinical Professionals

NEWS

Updated BCI for 2008
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Bacterial Contamination Screening [Read more here](#)



Q & A

Thanks for the recent version of the warfarin guidelines. There is one area which is unclear to me: could you please clarify? For high risk patients after surgery, do you recommend therapeutic heparinisation (either standard or LMWH) at 72 hours when the INR is subtherapeutic? I foresee 2

[Read more here](#)

KEYWORD SEARCH



http://www.health.vic.gov.au/best/index.htm

State Government of Victoria, Australia, Department of Human Services

Victorian Government Health Information



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Better Safer Transfusion

The Better Safer Transfusion Program (BeST) is a Victorian state government program for improving the quality of hospital transfusion care to patients. The work of the BeST program is supported by the BeST Advisory Committee, Secretariat and working groups.

BeST Program material now available

The [Serious Transfusion Incidents Reporting System](#) (STIR) is a central reporting system for serious adverse events with transfusion of blood or blood components including near-miss incidents.

[Transfusion Interest Group \(TIG\) Forum](#)

This Discussion Forum aims to provide an avenue for Transfusion practitioners to privately discuss current issues and clinical views in transfusion to inform and support transfusion practice improvements.

[Transfusion tools](#) - These tools have been provided by various organizations and project groups for the purpose of sharing knowledge of transfusion practice improvement strategies.

Documents for provision of transfusion information for consumers have been developed and can be found on the [consumer information page](#).

Posters picturing different blood products (Red blood cells, platelets, fresh frozen

Quick links

[Serious Transfusion Incidents Reporting System](#)[Transfusion Interest Group \(TIG\) forum](#)[Transfusion nurses - contact details](#)[Post Graduate Certificate in Transfusion Practice](#)

What's new

[Second report of the Victorian Better Safer Transfusion \(BeST\) Program May 2007](#)[Transfusion audits in 2007-08](#)

Related sites

[NHMRC Clinical Practice Guidelines for the use of blood components](#)[Guidelines for the Administration of Blood Components - \(ANZSBT/RCNA\)](#)[Royal Children's Hospital Melbourne website: 'Blood](#)

Internet

start

Microsoft PowerPoint ...

BeST: Better Safer Tr...

5:04 PM