Department of Health

health

Clinical audit of platelet use in Victorian and Tasmanian hospitals

2009

State Government Victoria

Australian Red Cross BLOOD SERVICE

Clinical audit of platelet use in Victorian and Tasmanian hospitals: 2009

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Abbreviations and acronyms

ANZSBT	Australian & New Zealand Society of Blood Transfusion
APTT	activated partial thromboplastin time
blood service	Australian Red Cross Blood Service
HDU	high dependency unit
ICU	intensive care unit
INR	international normalised ratio
MTP	massive transfusion protocol
NBA	National Blood Authority
NHMRC	National Health and Medical Research Council
PACU	post-anaesthesia care unit
PT	prothrombin time

Contents

1. Introduction

1.1 Background

Platelet transfusion is indicated for preventing and treating haemorrhage in patients with thrombocytopenia or platelet function defects. Previous studies have shown a wide variation in clinical practice in the transfusion of platelets. Previous results in assessing platelet transfusions conducted by Blood Matters (Department of Human Services 2008) revealed that 23 per cent of the transfusions did not align with the National Health and Medical Research Council (NHMRC) guidelines. There was a large variation in range of alignment from hospital to hospital (33 to 100 per cent alignment). Similarly, Schofield et al. (2003) found 33 per cent of the platelet transfusions were potentially inappropriate in New South Wales public hospitals. In addition, 53 per cent of platelet transfusions did not adhere to clinical guidelines in Australian and New Zealand intensive care units (The Blood Observational Study Investigators on behalf of the ANZICS Clinical Trials Group 2010).

The platelet count is the primary trigger for the use of platelets, with the risk of bleeding and the extent of bleeding also used as indicators for platelet transfusion.

The NHMRC and Australian and New Zealand Society of Blood Transfusion (ANZSBT) published guidelines for the appropriate use of transfusion of platelets (NHMRC/ANZSBT 2001, pp. 23–24). These guidelines are currently being reviewed under the auspices of the ANZSBT and the NHMRC, with funding and project management provided by the National Blood Authority (NBA). The review is being undertaken as a series of six modules. The *Patient blood management guidelines: Module 1 – Critical bleeding/massive transfusion* is the first in the series of modules of patient blood management guidelines and was released for public consultation in April 2010.

Revising the 2001 guidelines was considered necessary because of:

- increasing evidence of transfusion-related adverse outcomes, leading to the emergence of new practices, including restrictive transfusion strategies and the increased use of alternatives to transfusion in managing anaemia
- variable (and frequently poor) compliance with the recommendations of the 2001 guidelines, indicated by a high degree of variation in transfusion practices
- a failure of the 2001 guidelines to address a range of clinical settings where blood management is commonly required including chronic medical conditions, obstetrics, paediatrics, critical bleeding and massive transfusion (NBA 2010, p. 1).

The current guidelines recommend transfusion of platelets in the following specific situations.

For prophylactic use:

- in bone marrow failure when the platelet count is less than 10 x 109/L without risk factors or less than 20 x 109/L in the presence of additional risk factors (such as fever, antibiotics or evidence of systemic haemostatic failure)
- to maintain the platelet count at greater than 50 x 109/L in patients undergoing surgery or invasive procedures
- for surgical procedures with a high risk of bleeding (e.g. ocular or neurosurgery), where it may be appropriate to maintain a 100 x 109/L platelet count
- in inherited or acquired qualitative platelet function disorders, depending on clinical features and setting.

For therapeutic use:

- in any patient who is bleeding and in whom thrombocytopenia is considered a major contributory factor

- when the platelet count is less than 50 x 109/L in the context of massive haemorrhage/transfusion and less than 100 x 109/L in the presence of diffuse microvascular bleeding.

1.2 Aims and objectives

The overall aim of the Blood Matters program is to improve the quality of care provided to patients by ensuring the appropriate use of platelet component in patients within Victorian hospitals.

Objectives:

- To determine if platelet use in a sample of hospitals is aligned to clinical practice standards developed from NHMRC/ANZSBT guidelines.
- To determine contemporary patterns of use of platelets in hospitals.

It was also suggested to the invited hospitals that the audit process be used as an opportunity to ensure that relevant and accurate medical record documentation relating to platelet transfusion is being carried out. According to the *Guidelines for the administration of blood components* (ANZSBT 2004) these are:

- indication for platelet transfusion
- amount of platelets transfused
- assessment of the effectiveness of the platelet transfusion.

1.3 Methodology

Auditors

Each hospital's transfusion committee (or equivalent) was advised to designate a member of staff to record the information requested on the proforma provided. The designated data collector in participating hospitals was required to review the patient case notes and, using the audit proforma, collect the relevant data. It was also suggested that a clinical subgroup identified by the hospital's transfusion committee (or equivalent) review the local data on platelet transfusion.

Data collection

Participating hospitals were asked to collect data over a seven-month period (1 January 2009 and 30 July 2009). Hospitals were asked to audit 30 consecutive platelet transfusion episodes (or in low-frequency users, all platelet transfusion episodes). For hospitals that transfuse platelets very regularly, it was suggested that every third platelet transfusion be audited, up to a maximum of 30 episodes.

Since the first audit in 2007, participation has increased from Victoria and Tasmania to also include the ACT and Northern Territory.

Data was entered by the hospitals onto a web form designed for the audit. The web form included data validation on entry to ensure more accurate data and fewer incomplete fields. For example, validation tests occurred on entry for date sequences. The 2007 audit relied on a written audit form and Blood Matters staff entering data. The web form improved the quality of data and resulted in a low audit exclusion rate.

Data processing and analysis

Data were imported into a custom-designed Microsoft Access database. The data was checked for inaccuracies and inconsistencies using frequency and cross-tabulation procedures. The data check focused on dates, platelet counts and missing data. The statistical analyses were performed using PASW Statistics 18 (SPSS Inc, Chicago, IL). Significant changes in patterns from 2007 to 2009 data were analysed statistically by the Pearson chi-square test; $p < 0.05$ was considered statistically significant.

Audits excluded

A total of 684 platelet transfusion episodes from 26 hospitals were submitted. Five audits were excluded based on insufficient data provided for adequate medical review.

Medical reviewer

A primary medical reviewer assessed all proformas for sufficient data, alignment with guidelines, dose effectiveness, and diagnosis criterion. A secondary medical reviewer completed the same review on approximately 10 per cent of audits. See Appendix 4 for details of the guidelines and algorithm used.

1.4 Summary of findings

Patient sample

The types of transfusions submitted for the 2009 audit appeared to be a different sample than the previous 2007 audit. The age group distribution varied, with fewer neonates and more patients aged over 75 years. In addition, the indication for the need for a platelet transfusion also changed. It is difficult to tell if the change in patient mix and usage of platelets is due to different patient sampling or an actual shift in practice.

Alignment

Of the 30 hospitals invited to submit platelet transfusion reports, data was received from 26 (87 per cent) hospitals (20 public and six private hospitals) on 684 platelet transfusion episodes. Of the 679 transfusion episodes included in the final analysis, 67 per cent of the transfusions aligned with the NHMRC clinical guidelines. There was a large variation in range of alignment from hospital to hospital (22 to 96 per cent alignment). There was a decrease in the alignment rate compared with 2007 (77 per cent; range 33 to 100 per cent).

Indications

The most common reason for platelet transfusion was prophylaxis for bone marrow failure (33 per cent of aligned platelet transfusions), followed by prophylaxis for surgical or invasive procedures (15 per cent of aligned platelet transfusions). This pattern was similar in 2007, with the most common reason for platelet transfusion being prophylaxis for bone marrow failure (54 per cent of aligned platelet transfusions), followed by prophylaxis for surgical or invasive procedures (16 per cent of aligned platelet transfusions).

Non-alignment

Of those platelet transfusions audited, 33 per cent did not meet NHMRC clinical guidelines. The reported non-alignment of transfusion episodes does not necessarily indicate that all non-aligned transfusions were inappropriate but that platelets were transfused at a higher threshold than that recommended by the NHMRC clinical guidelines and no justification could be found in the clinical record. Individual hospitals are encouraged to review their own data and assess areas for improvement. To assist in this exercise, individual hospital audit results are presented throughout the report in comparison with all other participating hospital data. Some hospitals submitted fewer audits than other hospitals (due to lower transfusion rates or audits being excluded).

Greatest non-alignment was seen in the surgical/invasive procedure indication (where platelet triggers were exceeded) in 2009; while in 2007 bone marrow failure prophylaxis (where platelet triggers were exceeded) was the more common cause for non-alignment.

Transfusion location

Platelet transfusions occur mainly in the general ward, followed by ICU and then theatre (40 per cent, 24 per cent and 13 per cent respectively). Outpatient transfusion episodes accounted for 8 per cent of the episodes.

Type and quantity of platelet transfused

The majority of transfusion episodes were prescribed as single-bag transfusions in 2009 (74 per cent). Two-bag transfusions accounted for 19 per cent while three or more bags were used in 5 per cent of episodes. This was very similar to the results found in 2007.

Patients receiving aligned platelet transfusions for bone marrow failure most frequently were administered only one bag per episode (90 per cent for those with no risk factors and 93 per cent for those with risk factors). Two or more bags were more likely to be administered per episode when the indication for transfusion was based on abnormal microvascular bleeding (65 per cent), documented platelet function disorder (35 per cent), surgery (27 per cent) or haemorrhage (26 per cent).

There was a growing usage of apheresis platelet type in the haematological indications and this was in line with the available supply from the blood service. An area of possible future study may be the impact of apheresis platelet use in the period since leucodepletion of platelets to determine the additional benefit of this strategy.

When a patient was receiving antiplatelet medication, they were 1.5 times more likely to be administered more than one bag per transfusion episode in 2009, compared with 1.8 in 2007. This is an area of interest with the emergence of new antiplatelet agents. Currently no Australian guidelines exist on the optimal therapeutic choice and further study is needed.

Platelet count

Pre-transfusion platelet count was reported in 99 per cent of transfusion episodes. Where a pre-transfusion platelet count was reported (n = 672), it was checked on the same day as the transfusion in 84 per cent of transfusion episodes. In 13 per cent of transfusion episodes the platelet count was checked the day before transfusion. In the remaining 3 per cent (n = 21) of transfusion episodes, platelet count was performed more than two days prior to the platelet transfusion.

2. Your hospital results

(Available to organisations that submitted data to the audit)

Number of platelet transfusion episodes reported by your hospital:

Some results are included in this section; hospitals can also review their data in subsequent tables in section 3.

Information	Hospital		Overall results from all contributing hospitals: 2009				
	2009	2007					
Proportion of platelet transfusion episodes aligned with guidelines			Mean	0 to 25%	26 to 50%	51 to 75%	76 to 100%
			67%	n = 3	n = 2	n = 11	n = 10
Proportion of platelet transfusion episodes with pre-transfusion platelet count results			Mean	0 to 25%	26 to 50%	51 to 75%	76 to 100%
			99%	n = 0	n = 0	n = 0	n = 26
Proportion of platelet transfusion episodes with post-transfusion platelet count results			Mean	0 to 25%	26 to 50%	51 to 75%	76 to 100%
			90%	n = 0	n = 0	n = 2	n = 24
Proportion of platelet transfusion episodes with indication recorded in the medical record			Mean	0 to 25%	26 to 50%	51 to 75%	76 to 100%
			66%	n = 4	n = 2	n = 8	n = 12
Proportion of aligned platelet transfusion episodes with pre-transfusion platelet counts and medical record documentation for indication			Mean	0 to 25%	26 to 50%	51 to 75%	76 to 100%
			52%	n = 5	n = 6	n = 9	n = 5

n = number of hospitals within the specific quartile

A detailed table showing all hospital results covering the above variables is included as Appendix 7.

3. Cumulative results from contributing hospitals

A total of 684 platelet transfusion episodes from 26 hospitals were submitted. After exclusions based on form completion (that is, insufficient data provided for adequate medical review), 679 platelet transfusion episodes from 26 hospitals were analysed (a mean of 26 episodes per hospital; median 30 episodes per hospital; range 9 to 30 platelet transfusion episodes per hospital). Twenty-two hospitals reported data for both 2007 and 2009. The patient demographics (age, gender and indications) are shown in Tables 3.1.1 to 3.1.3.

3.1 Demographics

Age

Table 3.1.1: Age distribution of patients transfused with platelets: 2009 and 2007

	Year	Age						
Platelet transfusion episodes		Neonate	4 mths to 17 years	18 to 20 years	21 to 49 years	50 to 74 years	> 75 years	Missing data
(n)	2009	9	38	6	115	320	191	0
	2007	40	45	2	108	277	128	1
(%)	2009	1%	6%	1%	17%	47%	28%	0%
	2007	7%	8%	0.3%	18%	46%	21%	0.2%

The categorical age distribution of patients receiving platelet transfusions significantly differed between the two audit years, specifically in the neonate group and the over-75 age group ($p < 0.0001$). This is likely due to different hospitals reporting in the two years, rather than a shift in ages of patients receiving platelet transfusions.

Gender

Table 3.1.2: Gender of patients transfused with platelets: 2009 and 2007

		Gender		
Platelet transfusion episodes	Year	Male	Female	Missing data
(n)	2009	362	317	0
	2007	353	242	6
(%)	2009	53%	47%	0%
	2007	59%	40%	1%

There was also a difference in the distribution of gender between the two audit years ($p = 0.003$).

Indications for platelet transfusion

Table 3.1.3: Range of indications provided for patients treated with platelet transfusion: 2009 and 2007

*Clinical indications	‡Number of platelet transfusion episodes							
	As indicated in the medical record (identified by auditor)				As determined by the medical reviewer			
	2009		2007		2009		2007	
	n	%	n	%	n	%	n	%
Prophylaxis bone marrow failure and platelet count < 10 x 10^9/L	53	8%	70	12%	120	18%	135	22%
Prophylaxis bone marrow failure with risk factors and platelet count < 20 x 10^9/L	99	15%	90	15%	102	15%	111	18%
Massive haemorrhage/transfusion and platelet count < 50 x 10^9/L	34	5%	26	4%	46	7%	51	8%
Prophylaxis surgery/invasive procedure and platelet count < 50 x 10^9/L	72	11%	66	11%	101	15%	79	13%
Abnormal microvascular bleeding and platelet count < 100 x 10^9/L	33	5%	18	3%	17	3%	35	6%
Documented platelet function disorder	30	4%	22	4%	71	10%	62	10%
Other	169	25%	121	20%	1	0%	4	1%
†Not entered	217	32%	204	34%	222	33%	145	24%
Total	679		601		679		601	

*NHMRC/ANZSBT recommended categories for clinical practice.

† Note: 'Not entered' was used by the auditor when the indication for the transfusion episode was not documented in the medical record; 'Not entered' was used by the medical reviewer when the platelet transfusion episode did not align with the guidelines or insufficient data was provided to form a decision.

‡ One transfusion episode may have been allocated more than one clinical indication.

The most common reason for platelet transfusion (as identified by the medical reviewer) was prophylaxis for bone marrow failure (33 per cent of all platelet transfusions in 2009), followed by prophylaxis for surgical or invasive procedures (15 per cent of all platelet transfusions in 2009). This trend was similar in 2007.

Location of platelet transfusions

Table 3.1.4: Patient location for platelet transfusions (aligned and non-aligned): 2009

Patient location	Total count	Percentage
Ward	314	46%
ICU	161	24%
Theatre	88	13%
Outpatient	54	8%
Emergency department	41	6%
Critical care unit	12	2%
HDU/PACU	5	1%
NICU/special care nursery	4	1%
Total	**679**	**100%**

The majority of platelet transfusion episodes during the 2009 audit took place in wards, followed by ICUs. Transfusions occurring in an outpatient location accounted for 8 per cent (n = 54) of the reported platelet

transfusions. The majority of these cases were related to haematological malignancies, although three episodes were documented to be related to prophylaxis for invasive procedures. The location of transfusion was not collected in 2007; therefore, a comparison cannot be made. Comparison of location and the distribution of aligned and non-aligned cases is further analysed in Table 3.2.8.

3.2 'Alignment' of decision to transfuse platelets

There was a significant decline in alignment of transfusion episodes from 2007 to 2009 (77 per cent and 67 per cent respectively; $p < 0.000$). This decline was also seen when only considering the 22 hospitals involved in the audits for both years (80 per cent and 72 per cent; $p = 0.002$).

Individual hospital results

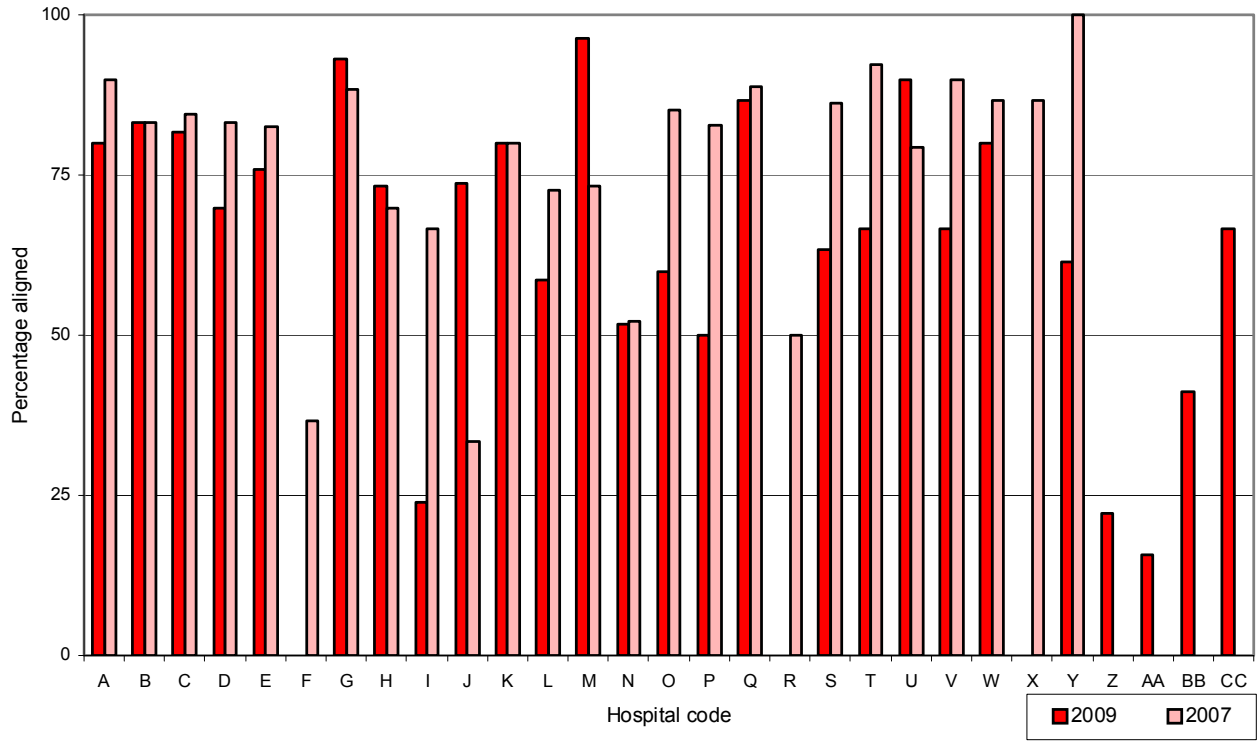
Table 3.2.1: Transfusion episodes aligned with clinical practice guidelines: 2009 and 2007

Hospital	Total audits reviewed (n)		Proportion (%) of transfusion episodes with indication recorded in medical record		*Proportion (%) of episodes aligned with clinical practice guidelines	
	2009	2007	2009	2007	2009	2007
A	30	30	60	63	80	90
B	30	30	97	87	83	83
C	22	13	86	100	82	85
D	30	25	77	40	70	83
E	25	23	88	87	76	83
F	n/a	30	n/a	73	n/a	37
G	29	26	100	85	93	88
H	30	21	73	86	73	70
I	25	30	4	33	24	67
J	19	24	84	4	74	33
K	30	30	80	53	80	80
L	29	11	55	82	59	73
M	28	30	89	83	96	73
N	27	24	70	21	52	52
O	30	27	73	89	60	85
P	30	29	60	66	50	83
Q	30	28	93	93	87	89
R	n/a	4	n/a	75	n/a	50
S	30	30	77	83	63	86
T	30	26	70	50	67	92
U	30	30	70	70	90	79
V	30	30	23	47	67	90
W	30	30	23	33	80	87
X	n/a	15	n/a	93	n/a	87
Y	13	5	100	100	62	100
Z	27	n/a	19	n/a	22	n/a
AA	19	n/a	32	n/a	16	n/a
BB	17	n/a	41	n/a	41	n/a
CC	9	n/a	100	n/a	67	n/a
All hospitals	**679**	**601**	**66**	**65**	**67**	**77**

*Alignment with clinical practice guidelines was only determined by the medical reviewer when the audit form was deemed to contain sufficient data to make an assessment (n = 679 in 2009, n = 594 in 2007).

There was no change from 2007 to 2009 in the level of reporting indication for the platelet transfusion in the medical records. However, if only transfusion episodes occurring at hospitals involved in both audits (n = 22) were considered, there was a slight improvement in reporting indication in the medical record from 64 per cent to 70 per cent (p = 0.053).

Figure 3.2.1: Proportion of platelet transfusions aligned to guidelines



Reaudit found that there was improvement in aligned platelet transfusion episodes in five hospitals, no change in two hospitals, and a reduction was seen in 15 hospitals that participated in both 2007 and 2009.

Hospital classification

Table 3.2.2: Proportion of transfusions aligned to clinical guidelines by hospital classification: 2009 and 2007

†Hospital classification	Frequency of hospital type		*Transfusion episodes aligned with clinical practice guidelines			
			Mean (%)		Range	
	2009	2007	2009	2007	2009	2007
Specialist and major referral	17	13	74%	80%	50–93%	37–92%
Large/medium	3	6	74%	74%	41–96%	33–100%
Private hospitals	6	6	43%	73%	16–76%	50–87%

*Alignment with clinical practice guidelines was only determined by the medical reviewer when the audit form was deemed to contain sufficient data to make an assessment (2007, n = 594; 2009, n = 679).

†See Appendix 8 for definitions of hospital classification. Please note hospital peer group is reviewed each fiscal year based on patient admissions and can change for a hospital from one year to another.

Non-alignment analysis

The 222 platelet transfusion episodes not aligned with the guidelines were further analysed to understand contemporary patterns of use. Table 3.2.3 lists the reasons why the episode was considered not to be aligned with the clinical guidelines.

Table 3.2.3: Patient circumstance where transfusion episode not aligned with clinical guidelines: 2009 and 2007

Reason not aligned by patient circumstance	Number of episodes	
	2009	**2007**
Surgery/invasive procedure – platelet trigger too high	81	32
Haematological prophylaxis – platelet trigger too high	43	57
Other diagnosis – platelet trigger too high	36	16
Other prophylaxis – platelet trigger too high (oncology and hepatic related)	18	2
Bleeding – platelet trigger too high	15	7
Recent surgery/bleeding but no bleeding on day of transfusion and platelet count < 50	12	3
Neonates not meeting NHMRC/ANZSBT guidelines	9	21
Other	8	7
Total	**222**	**145**

The most common reason for non-alignment in 2009 came from the use of platelet transfusions as prophylaxis for surgical or invasive procedures where platelet counts were greater than 50 x 109/L. This was followed by the use of platelet transfusions in bone marrow failure when the pre-transfusion platelet count was recorded as higher than the trigger used in the clinical guidelines. The distribution of reasons for non-alignment changed for the two audit years. Comparisons between 2007 and 2009 showed there was a significant change in reasons why a transfusion may not have been aligned ($p \leq 0.000$). In 2007 the primary reason for non-aligned platelet transfusions administered was for bone marrow failure when the pre-transfusion platelet count was recorded as higher than the trigger used in the clinical guidelines; there was less frequent use of platelet transfusions in 2007 compared with 2009 as prophylaxis for surgical or invasive procedures where platelet counts were greater than 50 x 109/L.

Platelet count trigger

Table 3.2.4: Pre-transfusion platelet level for non-aligned cases where a platelet count trigger is provided in the clinical guidelines: 2009 and 2007

Reason not aligned by patient indication	Pre transfusion platelet level: 2009		Pre transfusion platelet level: 2007	
	Range	Average	Range	Average
Surgery/invasive procedure – platelet trigger too high	29–352	134	52–399	114
Haematological prophylaxis – platelet trigger too high	13–171	36	13–104	29
Prophylaxis – platelet trigger too high	13–89	31	15–16	16
Bleeding – platelet trigger too high	56–938	162	55–306	137

The current clinical guidelines recommend that platelet transfusion may be indicated during surgery or invasive procedures in order to maintain a platelet count at a level greater than 50 x 109/L. The audit data revealed that prophylactic transfusions were occurring in some instances when platelet counts were as high as 352 (case notes: carotid endarterectomy on heparin infusion) without evidence of antiplatelet therapy provided on the audit form. It is acknowledged that antiplatelet therapy information may have been inadvertently missed when the form

was completed. Platelet transfusions were administered on 81 occasions when the pre-transfusion platelet count was greater than 50 x 109/L (average count 134 x 109/L).

Surgical indications

As noted, current clinical guidelines recommend that platelet transfusion may be indicated during surgery or invasive procedures in order to maintain a platelet count at a level greater than 50 x 109/L. Table 3.2.5 provides the breakdown of surgical and procedural indications in those cases designated by the medical reviewer as non-aligned with national guidelines.

Table 3.2.5: Pre-transfusion platelet count for surgery patients receiving platelet transfusions: 2009

Type of surgery/procedure	Number of episodes	Pre-transfusion platelet count range	Pre-transfusion platelet count average
Not aligned to guidelines (platelet trigger too high)			
Cardiothoracic surgery	30	53–313	153
Gastrointestinal	17	51–285*	95*
Line insertion/removal	4	71–218	113
Other	30	59–352	144
Aligned to guidelines			
All surgery and invasive procedures	101	3–123	30

* One platelet count has been excluded from range and average due to the pre-transfusion platelet count performed eight days prior to the procedure. The post-transfusion platelet count for this event was recorded as 120.

Haematological indications

The current clinical guidelines recommend that platelet transfusion may be indicated as prophylactic treatment for bone marrow failure at a platelet count of less than 10 x 109/L in the absence of risk factors or less than 20 x 109/L in the presence of risk factors. Table 3.2.6 details the pre-transfusion platelet count for episodes medically reviewed as aligned and non-aligned.

Table 3.2.6: Pre-transfusion platelet count for haematological patients receiving platelet transfusions: 2009

	Number of episodes	Pre-transfusion platelet count range	Pre-transfusion platelet count average
Not aligned to guidelines (platelet trigger too high)			
Prophylaxis bone marrow failure	24	3*–171	26
Prophylaxis bone marrow failure and risk factors	20	19–102	47
Aligned to guidelines			
Prophylaxis bone marrow failure	120	1–12	8
Prophylaxis bone marrow failure and risk factors	100	7–23	15

* Where pre-transfusion platelet = 3, patient diagnosis was mesothelioma and idiopathic thrombocytopenia purpura (ITP), with no bleeding or risk for bleeding.

Individual hospital data by indication

The data was further analysed to determine if there was a difference in rates of non-aligned platelet transfusions depending on the medical indication. In summary:

- 45 per cent of transfusion episodes for all patients undergoing surgery or an invasive procedure were not aligned
- 17 per cent of transfusion episodes for all haematological malignancy patients were not aligned (see Table 3.2.7).

Table 3.2.7: Comparison of rates of alignment by medical indication: 2009

	Haematological prophylaxis		Surgery/invasive procedure		* Other patient diagnosis/criterion		Total	
Hospital	Number of episodes	% aligned	Number of episodes	% aligned	Number of episodes	% aligned	Number of episodes	% aligned
A	12	75%	10	100%	8	63%	30	80%
B	9	100%	11	73%	10	80%	30	83%
C	9	78%	7	86%	6	83%	22	82%
D	14	79%	6	33%	10	80%	30	70%
E	16	88%	7	57%	2	50%	25	76%
G	11	91%	16	94%	2	100%	29	93%
H	10	90%	8	63%	12	67%	30	73%
I	5	80%	3	67%	17	0%	25	24%
J	17	71%	0	na	2	100%	19	74%
K	15	80%	7	71%	8	88%	30	80%
L	4	100%	10	30%	15	67%	29	59%
M	18	100%	7	100%	3	67%	28	96%
N	5	80%	15	27%	7	86%	27	52%
O	3	67%	8	0%	19	84%	30	60%
P	14	86%	6	50%	10	0%	30	50%
Q	11	91%	3	100%	16	81%	30	87%
S	4	100%	16	38%	10	90%	30	63%
T	9	100%	11	36%	10	70%	30	67%
U	15	100%	6	83%	9	78%	30	90%
V	16	81%	3	0%	11	64%	30	67%
W	22	86%	6	67%	2	50%	30	80%
Y	5	80%	6	33%	2	100%	13	62%
Z	6	33%	3	67%	18	11%	27	22%
AA	3	67%	3	0%	13	8%	19	16%
BB	9	56%	3	33%	5	20%	17	41%
CC	4	50%	1	0%	4	100%	9	67%
All hospitals	**266**	**83%**	**182**	**55%**	**231**	**58%**	**679**	**67%**

*Other patient diagnosis/criterion includes, for example, bleeding, sepsis, documented platelet function disorder and liver disease.

Note: Six episodes were reported to be aligned with two guideline criteria. In all instances the episodes were noted by the medical reviewer to be aligned to guidelines based on a documented platelet function disorder as well as five episodes with surgery/procedure and one episode with massive haemorrhage.

Treatment location and alignment

Alignment of platelet transfusions varied depending on patient location, ranging from zero alignment in the neonatal intensive care unit (NICU) to 80 per cent alignment in the emergency department. The data shows a lower alignment rate in locations where potentially more complex patients are seen. Alignment may be artificially reduced due to the difficulty in evaluating the appropriateness of a transfusion based on limited documentation included on the audit proforma. Risk factors like sepsis, renal failure, comorbidities, lines and bleeding may not be as well documented in these settings and consequently may limit the ability to assess alignment with a retrospective audit.

Table 3.2.8 Proportion of transfusions aligned to clinical guidelines by location of transfusion: 2009

Patient location	Aligned	Non-aligned	Total	Aligned	Non-aligned	Total
	Count			Percentage		
Ward	240	74	314	76%	24%	100%
ICU	93	68	161	58%	42%	100%
Theatre	46	42	88	52%	48%	100%
Day procedure*	40	14	54	76%	26%	100%
Emergency department	33	8	41	80%	20%	100%
Critical care unit	2	10	12	17%	83%	100%
HDU/PACU	3	2	5	60%	40%	100%
NICU/special care nursery	0	4	4	0%	100%	100%
Total	**457**	**222**	**679**	**67%**	**33%**	**100%**

*The majority of these cases are patients with haematological malignancies (n = 46, 87 per cent).

It may be expected that locations within a hospital with very high patient acuity may have a lower alignment where rapid response by the medical team is required, not always allowing for pathology results to be used in decision making due to the turnaround time.

3.3 Other medical indications of interest

Chronic liver disease

Thirty-four episodes (5 per cent of all submitted audits) were related to chronic liver disease, of which 65 per cent were considered to be aligned to the clinical guidelines as indicated by prophylaxis for surgery and/or bleeding.

Idiopathic thrombocytopenic purpura

Idiopathic thrombocytopenic purpura (ITP) was noted in eight transfusion episodes, of which 63 per cent (five of eight) were considered to be aligned to the clinical guidelines as significant bleeding was also present.

PICC insertion or removal

Three platelet transfusions were indicated for peripherally inserted central catheter (PICC) insertion or removal. All cases were reported as aligned by the medical reviewer. It would not be anticipated that a peripheral compressible site would require prophylactic therapy; however, therapeutic use of platelets may be warranted if bleeding was excessive.

Table 3.3.1: PICC case studies

Case	Procedure type	Diagnosis criterion (guideline indication)	Pre-transfusion count (x 109/L)
1	PICC removal	Prophylaxis for surgery/invasive procedure (platelets < 50)	17
2	PICC removal	Prophylaxis bone marrow failure (platelets < 10)	9
3	PICC insertion	Prophylaxis for surgery/invasive procedure (platelets < 50)	45

Bone marrow biopsy

Six transfusions were associated with bone marrow biopsies. Three patients received a prophylactic platelet transfusion to raise platelet counts for the procedure. Mean pre-transfusion count was 15 x 109/L and mean post-transfusion count was 42 x 109/L. All of the transfusions were considered to be aligned by the medical reviewer; three episodes were considered to be indicated based on the procedure, while the remaining three episodes were considered to be aligned based on general bone marrow failure. In routine bone marrow biopsy, even with profound thrombocytopenia, prophylactic platelet transfusion is generally not required. Therapeutic platelet therapy can be used if bleeding is excessive.

Table 3.3.2: Borrow marrow biopsy case studies

Case	Procedure type	Diagnosis criterion (guideline indication)	Pre-transfusion count (x 10^9/L)
1	Pre-biopsy	Prophylaxis for surgery/invasive procedure (platelets < 50)	13
2	Pre-biopsy	Prophylaxis for surgery/invasive procedure (platelets < 50)	17
3	Pre-planned biopsy, however, biopsy never performed	Prophylaxis bone marrow failure with risk factors (platelets < 20)	14
4	Post-biopsy	Prophylaxis bone marrow failure with risk factors (platelets < 20)	11
5	Pre-biopsy	Prophylaxis for surgery/invasive procedure (platelets < 50)	16
6	Post-biopsy	Prophylaxis bone marrow failure (platelets < 10)	5

3.4 The clinical guidelines and their use with neonates and children

The NHMRC/ANZSBT 2001 clinical practice guidelines recognise that the recommendations may not be applicable in acute situations, or to specialty areas such as paediatrics and obstetrics. The NHMRC/ANZSBT suggest that the guidelines be adapted to meet the needs of such specialty groups while maintaining the general principles of the guidelines.

A review of the current NHMRC/ANZSBT 2001 clinical practice guidelines is currently taking place by the NBA under the auspices of the ANZSBT and the NHMRC, with funding and project management provided by the NBA

on behalf of all governments. The review will result in the production of six clinically focused modules including paediatrics (that includes neonates). The other five modules are critical bleeding/massive transfusion, perioperative, medical, intensive care and obstetrics.

Of the transfusions episodes submitted in 2009, only nine were neonates (babies aged four months or under). The use of the draft neonate guidelines had little impact on altering the alignment rate for these cases. During the 2007 audit, 40 neonate transfusion episodes were submitted; the use of the neonate guidelines had a dramatic impact on the alignment rate, increasing it from 48 per cent to 93 per cent.

Table 3.4.1: Neonatal transfusion alignment: NHMRC/ANZSBT versus draft neonate guidelines: 2007 and 2009

	Transfusion met NHMRC and neonatal guidelines		Transfusion met neonatal but not NHMRC guidelines		Did not meet neonatal guidelines but met NHMRC		Transfusion did not meet either guidelines		Total	
	2009	2007	2009	2007	2009	2007	2009	2007	2009	2007
Count	0	19	1	18	0	0	8	3	9	40
Percentage	0%	47.5%	11%	45.0%	0%	0%	89%	7.5%	100%	100%

Table 3.4.2: Child transfusion alignment: NHMRC/ANZSBT versus draft children's guidelines: 2009

	Transfusion met NHMRC and children guidelines	Transfusion met children's guidelines but not NHMRC guidelines	Transfusion did not meet children's guidelines but met NHMRC	Transfusion did not meet either guidelines	Total
Count	22	4	2	10	38
Percentage	58%	11%	5%	26%	100%

The two transfusion episodes for children that aligned to the current NHMRC guidelines but not the draft children's guidelines is due to the fact that the children's guidelines do not cover the potential need for a platelet transfusion during surgery or an invasive procedure (see Appendix 6). The children's guidelines were not used in the 2007 audit review.

3.5 Type and quantity of platelet bags transfused

Two types of platelet components are used for transfusion and are described as either pooled or apheresis.

- Pooled platelets: a large dose of platelets prepared from a pool of buffy coats from ABO-identical donors and resuspended in a nutrient additive solution. The volume of a pooled bag is generally greater than 160 mL, and contains at least 240 x 10^9 platelets per pool. One bag of pooled platelets is approximately equivalent to four units of platelets (a concentrate of platelets separated from a single unit of whole blood and suspended in a small amount of the original plasma; volume 40–60 mL; platelet count 55 x 10^9/unit).
- Platelets apheresis: a large dose of platelets prepared by apheresis of a single donor and suspended in a portion of the original plasma. The volume of a bag is generally greater than 100 mL, and contains at least 240 x 10^9 platelets. One bag of platelets apheresis is approximately equivalent to 4 units of platelets.

Table 3.5.1: Number of platelet bags transfused per episode by platelet type: 2009 and 2007

	Frequency of multiple platelet bags transfused by episode by platelet type (proportion, %)							
	1 bag		2 bags		3 or more bags		Total	
	2009	2007	2009	2007	2009	2007	2009	2007
Adult								
Apheresis	143 (79%)	81 (85%)	26 (14%)	11 (12%)	11 (6%)	3 (3%)	182 (100%)	95 (100%)
Pooled	377 (80%)	318 (78%)	87 (18%)	76 (19%)	10 (2%)	14 (3%)	474 (100%)	408 (100%)
Apheresis and pooled	1 (7%)	0 (0%)	9 (64%)	12 (80%)	4 (29%)	3 (20%)	14 (100%)	15 (100%)
Total	428 (74%)	399 (76%)	110 (19%)	99 (19%)	26 (5%)	20 (4%)	670 (100%)	518 (100%)
Paediatric	7 (78%)	38 (86%)	1 (11%)	4 (9%)	0 (0%)	2 (5%)	9 (100%)	44 (100%)

Note: 2007 data reported on 562 transfusion episodes. Thirty-two episodes did not report platelet type, including 25 episodes from one hospital, which does not record the information routinely. In addition, seven episodes did not report on the number of bags transfused (four episodes reported neither platelet type nor number of bags).
2009 data reported on 676 transfusion episodes. Three episodes did not provide the number of bags transfused.

For adult patients in 2009, the majority of transfusion episodes (74 per cent) were prescribed as single-bag transfusions of apheresis or pooled platelets. Nineteen per cent received a second bag and 5 per cent received three or more bags. Overall the mean number of bags given to adult patients was 1.3 per episode. There was very little difference in results compared with 2007, with the majority of adult transfusion episodes (77 per cent) being prescribed as single-bag transfusions of apheresis or pooled platelets. Nineteen per cent received a second bag and 4 per cent received three or more bags. Overall the mean number of bags given to adult patients in 2007 was 1.3 per episode.

Table 3.5.4: Number of platelet bags transfused per episode by transfusion indication as determined by medical reviewer: 2009

	Frequency of multiple platelet bags transfused by transfusion indication			
	1 bag	2 bags	3 or more bags	Average
Prophylaxis bone marrow failure and platelet count < 10 x 10^9/L	112	6	2	1.1
Prophylaxis bone marrow failure with risk factors and platelet count < 20 x 10^9/L	92	10	0	1.1
Massive haemorrhage/transfusion and platelet count < 50 x 10^9/L	34	9	3	1.3
Prophylaxis surgery/invasive procedure and platelet count < 50 x 10^9/L	74	26	1	1.3
Abnormal microvascular bleeding and platelet count < 100 x 10^9/L	6	8	3	2.4
Documented platelet function disorder	46	16	9	1.6
Not aligned to guidelines	164	48	7	1.3

Note: 2009 data reported on 676 transfusion episodes. Three episodes did not provide the number of bags transfused.

Patients receiving aligned platelet transfusions for bone marrow failure most frequently were administered only one bag per episode (90 per cent for those with no risk factors and 93 per cent for those with risk factors). Two or more bags were more likely to be administered per episode when the indication for transfusion was based on abnormal microvascular bleeding (65 per cent), documented platelet function disorder (35 per cent), surgery (27 per cent) or haemorrhage (26 per cent).

In 2009, for patients with a haematological malignancy (n = 264), 68 per cent of episodes were transfused with pooled platelets, 31 per cent with apheresis platelets, and 1 per cent (n = 3) with pooled and apheresis platelets. For patients identified with a haematological malignancy in 2007 (n = 298), 72 per cent of episodes were transfused with pooled platelets, 20 per cent with apheresis platelets, and 2 per cent with pooled and apheresis platelets (the remaining six per cent did not report on platelet type).

There was an increase in the percentage of haematological malignancy-related platelet transfusions being apheresis compared with pooled from the 2007 to 2009 audit (20 per cent apheresis in 2007, compared with 31 per apheresis in 2009). During this period there has been an increase in the availability of apheresis platelets, with supply in Victoria reaching 35 per cent in the 2008–09 financial year, while at the end of 2006–07 it had reached 28 per cent. There has been limited research showing that apheresis platelet transfusions reduce the risk of alloimmunisation to human leukocyte antigen (HLA) by reducing donor exposure, although leucodepletion is the primary strategy. Use of apheresis platelets is dependent on access to limited blood service stock and inventory management arrangements (as apheresis platelets are currently suspended in plasma and this means that the component is predominantly used in same ABO blood group transfusion). Research investigating the number of patients with haematological malignancies developing platelet-immune refractoriness or alloimmunisation and therefore requiring HLA-compatible apheresis platelet components is needed. Further research to determine if patients receiving only apheresis transfusions have a lower incidence of HLA sensitisation than patients receiving pooled transfusions since the introduction of leucodepletion of red cells and platelets nationally would also be valuable.

Table 3.5.2: Number of platelet bags transfused per episode by use of antiplatelet drugs

Patient receiving antiplatelet drugs in the 5 days prior to transfusion*	Frequency of multiple platelet bags transfused per episode by use of antiplatelet drugs (proportion, %)									
	1 bag		2 bags		3 or more bags		Missing data		Total	
	2009	2007	2009	2007	2009	2007	2009	2007	2009	2007
Yes	60 (69%)	51 (62%)	17 (20%)	24 (29%)	10 (11%)	5 (6%)	0 (0%)	2 (2%)	87 (100%)	82 (100%)
No	468 (79%)	410 (79%)	106 (18%)	83 (16%)	15 (2%)	17 (3%)	3 (1%)	9 (2%)	592 (100%)	519 (100%)

*Data corrected for incorrectly categorised antiplatelet drugs

In 2009, 99 audits (15 per cent) submitted transfusion events as having a risk factor involving a patient receiving antiplatelet drugs within five days prior to the transfusion. However, 12 cases incorrectly noted a drug as having an antiplatelet action, for example, warfarin (n = 9), temazepam, heparin, and linezolid. Supporting information attached with the audit (see Appendix 2) which listed anticoagulant drugs alongside antiplatelet drugs may have contributed to the incorrect inclusion of drugs as an antiplatelet drug by the auditors. All data reported in tables 3.5.2 and 3.5.3 remove the drugs incorrectly categorised as an antiplatelet, namely, warfarin, temazepam, heparin, and linezolid. The 2007 audit did not request information about actual antiplatelet drug being administered only if the patient was taking such a drug.

Table 3.5.3: Antiplatelet drug use and transfusion volume: 2009

Antiplatelet drug reported*	Antiplatelet drug	Frequency	Average number of bags transfused
Yes		**87**	**1.5**
	Aspirin	65	1.5
	Clopidogrel	13	1.6
	Aspirin and clopidogrel	4	2
	Other NSAID (ibuprofen, celecoxib)	5	1.2
No		**592**	**1.3**

*Data corrected for incorrectly categorised antiplatelet drugs

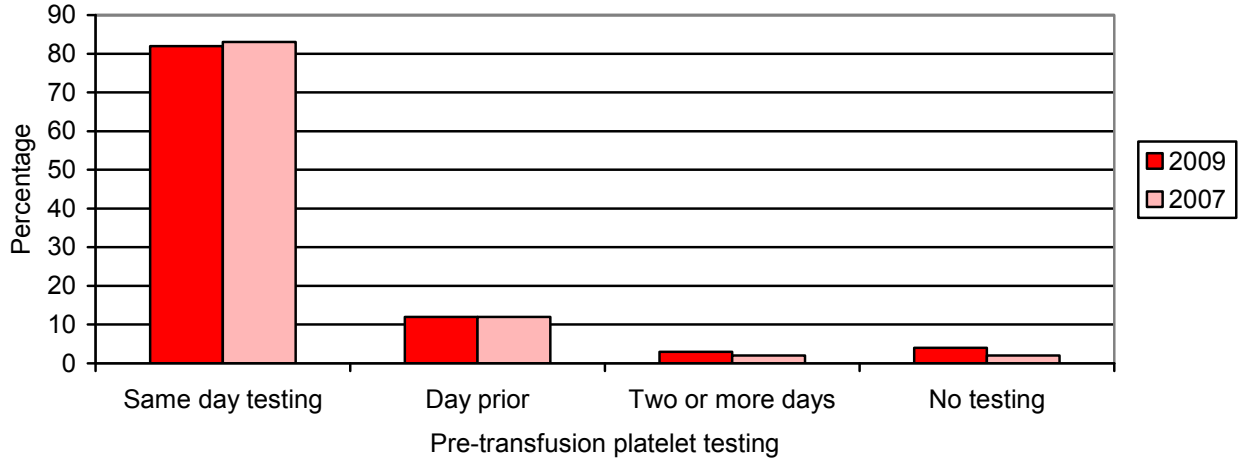
Greater than one bag of platelets transfused was more frequently associated with the use of antiplatelet medications. This observation was seen in 2007 and 2009 ($p = 0.0008$; $p = 0.01$ respectively); however, the impact of antiplatelet use on bags prescribed was lessened in 2009 ($p = 0.0008$; $p = 0.01$ respectively). When a patient was receiving antiplatelet medication, they were 1.5 times more likely to be administered more than one bag per transfusion episode in 2009, compared with 1.8 in 2007. This is an area of interest with the emergence of new antiplatelet agents. Currently no Australian guidelines exist on the optimal therapeutic choice and further study is needed.

3.6 Platelet count

The platelet count is one of the primary triggers for the use of platelet transfusion (with clinical risk factors of bleeding and the extent of bleeding also influencing the decision) under the current clinical guidelines; therefore, performing (and documenting) platelet counts pre-transfusion should be a critical step in the care of patients.

Pre-transfusion platelet count was reported in 99 per cent of transfusion episodes. Where a pre-transfusion platelet count was reported (n = 672), it was checked on the same day as the transfusion in 84 per cent of transfusion episodes. In 12 per cent of transfusion episodes the platelet count was checked the day before transfusion. In the remaining 3 per cent (n = 21) of transfusion episodes, platelet count was performed more than two days prior to the platelet transfusion. For purposes of this audit, it was considered to be good clinical practice to base transfusion decisions on a pre-transfusion platelet count performed on the same day, although this can be dependant on the clinical scenario.

Figure 3.6.1: Percentages of pre-transfusion platelet testing: 2009 and 2007



3.7 Risk factors

Of the 679 transfusion episodes reviewed, 82 per cent of cases had at least one risk factor present (or 18 per cent had no risk factors reported). Approximately 32 per cent of transfusion recipients had more than three risk factors reported per episode (see Table 3.7.1).

Table 3.7.1: Proportion (%) of transfusion episodes with identified risk factors: 2009

	Hospital classification			
Risk factors	**Specialist and major referral**	**Large/medium**	**Private**	**All hospitals**
Same-day active bleeding	203 43%	15 28%	56 37%	274 40%
Same-day surgery/invasive procedure	217 46%	15 28%	59 39%	291 43%
Fever	98 21%	9 17%	9 6%	116 17%
Lab coagulation abnormality	87 18%	4 7%	16 10%	107 16%
Antiplatelet drug	76 16%	5 9%	18 12%	99 15%
Uraemia	42 9%	2 4%	3 2%	47 7%
Cardiopulmonary bypass	28 6%	0 0%	26 17%	54 8%
IV antibiotics or antifungals	262 56%	22 41%	59 39%	343 51%
Total transfusion episodes (N)	**472**	**54**	**153**	**679**

*Each transfusion episode may have more than one risk factor identified; therefore, numbers will be greater than 100 per cent.

The most common risk factor present during a transfusion episode was the use of IV anitibiotics or antifungals, which was seen in 51 per cent of all transfusion episodes. This is most significant in the haematology patient setting where a high platelet trigger for transfusion is used in the setting of additional risk factors. Specialist and major referral hospitals reported the highest rate, with 56 per cent of transfusion episodes with IV anitibiotics or antifungals. This is not unexpected in the complex clinical care environment.

4. Comparison of audit results to other studies

Australian studies show a similar picture of alignment to clinical guidelines. A retrospective survey (Schofield 2003) of medical records in NSW public hospitals in 2000 found that of 414 patients receiving a platelet transfusion, 33 per cent were potentially inappropriate. There were significantly more inappropriate platelet transfusions at major metropolitan hospitals than at referral or major rural hospitals. A platelet transfusion was considered appropriate based on the same national clinical guidelines used in our audit.

The audit results for Blood Matters showed the same rate of alignment (67 per cent) to the guidelines as Schofield. This was in fact a decrease in alignment from the previous audit in 2007 (77 per cent).

A recent study (Australian and New Zealand Intensive Care Society 2010) in Australian and New Zealand ICUs evaluated the indications for blood transfusions and determined whether the transfusion practice matched current national guidelines. The study found 53 per cent of platelet transfusions did not match national clinical guidelines. Of the 161 platelet transfusions administered in the ICU during the Blood Matters audit, a similar rate of alignment was found (58 per cent). The National Health Service (UK) completed a national comparative audit of platelet transfusions and found that 51 per cent of ICU patients receiving platelet transfusions did not comply with the audit's standards (based on the British Committee for Standards in Haematology guidelines) (National Health Service 2007).

The National Health Service national comparative audit of platelet transfusions also looked at the appropriateness of platelet transfusions administered to haematological patients and found that 60 per cent of transfusions did not comply with audit standards. In contrast, the Blood Matters audit reported an alignment rate of 83 per cent against Australian national clinical guidelines for haematological patients.

5. Development of new patient blood management guidelines

The National Health and Medical Research Council (NHMRC) and Australian and New Zealand Society of Blood Transfusion (ANZSBT) published guidelines for the appropriate use of transfusion of platelets (NHMRC/ANZSBT 2001, pp. 23–24). These guidelines are currently being reviewed under the auspices of the ANZSBT and the NHMRC, with funding and project management provided by the National Blood Authority (NBA). The review is being undertaken as a series of six modules. The Patient blood management guidelines: Module 1 – Critical bleeding/massive transfusion is the first in the series of modules of patient blood management guidelines and was released for public consultation in April 2010.

Revising the 2001 guidelines was considered necessary because of:

- increasing evidence of transfusion-related adverse outcomes, leading to the emergence of new practices, including restrictive transfusion strategies and the increased use of alternatives to transfusion in managing anaemia
- variable (and frequently poor) compliance with the recommendations of the 2001 guidelines, indicated by a high degree of variation in transfusion practices
- a failure of the 2001 guidelines to address a range of clinical settings where blood management is commonly required including chronic medical conditions, obstetrics, paediatrics, critical bleeding and massive transfusion (NBA 2010, p. 1).

The draft guidelines released to date are presented in a significantly different way to the current guidelines in practice. The critical bleeding/massive transfusion module includes practice points related to the administration of platelets, among other recommendations. The draft module recommends that each institution develops or adapts and uses a massive transfusion protocol (MTP) that includes the dose, timing and ratio of blood component therapy. A template MTP is provided within the draft guidelines. The MTP is not considered to be strictly prescriptive and is intended to allow individual clinical discretion and local adaptation.

The systematic review, which formed part of the draft guidelines development, found no studies relevant to the identification of an international normalised ratio (INR) (or prothrombin time [PT]/partial thromboplastin time [APTT]), fibrinogen level or platelet count to trigger a blood component transfusion in patients with critical bleeding requiring massive transfusion. Consequently, the draft guidelines do not identify such triggers for transfusion in critically bleeding patients. Instead the practice points integrate information from other sources, including previously published guidelines and consensus recommendations, resulting in the recommendation of patient management by regular assessment of the efficacy of replacement therapy using clinical assessment and ongoing monitoring of coagulation parameters and blood counts. Because there is an unavoidable delay in provision of laboratory results, point-of-care testing is becoming more widely used.

Appendix 1: Audit proforma

Better Safer Transfusion Program

FORM 1: Clinical Audit of Platelet Use

Hospital Code:
Audit ID:

•During the study period please complete a form for each of 30 consecutive transfusion episodes where the patient has received platelets. For hospitals who transfuse platelets very regularly, every third platelet transfusion may be audited instead.
•*Definition of transfusion episode*: An episode will be defined as each time the participating blood bank issue one or more therapeutic doses of platelets to a patient. The same patient can only be entered into the database **twice**.

Transfusion Date

Sex: Male ☐ Female ☐

Age (years)

Patient Diagnosis:

Pre transfusion **Platelet count**

Platelet Count x10^9/L ☐ Not available *(please tick)* or ☐ Date ☐

Post transfusion **Platelet count**

Platelet count ☐ Not available *(please tick)* or ☐ Date ☐

Platelets Transfused — No. of bags ☐ Type of bags *(please tick)* Apheresis ☐ Pooled platelets ☐ Paediatric ☐

Active Bleeding up to 24 hours before transfusion incl. Petechiae or mucosal bleeding ☐ Yes ☐ No

If yes, did bleeding cease within 6 hours of transfusion? ☐ Yes ☐ No ☐ Unable to determine

Surgery/Invasive Procedure 24 hours before, during, or after transfusion (refer to instructions sheet for definitions) ☐ Yes ☐ No

Patient location in hospital: Theatre ☐ ICU ☐ Ward ☐ Other ☐
If other, please state .....

Is the indication for Transfusion recorded in the medical record?*(please circle)* YES NO

Recorded Indication:
(Please tick)

- ☐ Prophylaxis bone marrow failure (Platelets <10)
- ☐ Prophylaxis bone marrow failure & risk factors (Platelets <20)
- ☐ Massive haemorrhage/transfusion & platelets <50
- ☐ Prophylaxis for surgery/invasive procedure (Platelets<50)
- ☐ Abnormal microvascular bleeding & platelets <100
- ☐ Documented platelet function disorder
- Other *(please specify)*.....

Risk Factors (if 'Yes', please specify details in NOTES)

Fever (> or equivalent to 38°C) ☐ Yes ☐ No

Laboratory coagulation abnormality (greater than 1.5 x upper limit reference range) ☐ Yes ☐ No

Anti-platelet drugs Eg Aspirin, ReoPro, Clopidogrel (Plavix) in the 5 days prior to transfusion ☐ Yes ☐ No
If yes, please state _____
(Refer to Appendix 1 for drug names)

Uraemia (creatinine is >200µmol/l) ☐ Yes ☐ No

Cardiopulmonary Bypass (longer than 2 hours or with deep hypothermic arrest or ECMO) ☐ Yes ☐ No

IV Antibiotics or antifungals ☐ Yes ☐ No

NOTES

*See website for further instructions and information. www.health.vic.gov.au/bloodmatters

Form Vers FINAL 2009-0424

State Government Victoria

Office Use only:

1. For this episode was sufficient data provided to make an assessment? Yes No
2. Was the transfusion episode aligned with the guidelines? Yes No NA
3. Was the dose effective? Yes No Unknown
4. What was the diagnosis criterion?
   - ☐ Prophylaxis bone marrow failure (Platelets <10)
   - ☐ Prophylaxis bone marrow failure & risk factors (Platelets <20)
   - ☐ Massive haemorrhage/transfusion & platelets <50
   - ☐ Prophylaxis for surgery/invasive procedure (Platelets<50)
   - ☐ Abnormal microvascular bleeding & platelets <100
   - ☐ Documented platelet function disorder
   - ☐ Other *(please specify)*.....

Appendix 2: Information provided to hospitals

Clinical Audit of Platelet Use

Background

Platelet transfusion is indicated for the prevention and treatment of haemorrhage in patients with thrombocytopenia or platelet function defects. Previous studies have shown a wide variation in clinical practice in the transfusion of platelets.

The platelet count is the primary trigger for the use of platelets, with the risk of bleeding and the extent of bleeding also used as indicators for platelet transfusion.

Note should be taken of the National Health and Medical Research Council and Australian and New Zealand Society of Blood Transfusion guidelines for transfusion of platelets (NH&MRC/ANZSBT, 2001).

The Blood Matters: better safer transfusion program wishes to work with hospitals to ensure that

a) blood components and products are used appropriately and effectively, and

b) alternative blood management strategies are used to limit the need for transfusion where clinically appropriate.

The Blood Matters Advisory Committee has identified the area of platelet use as an appropriate area for targeted clinical audit in order to determine current practice across the State.

Audit Aims

To improve the quality of care provided to patients by ensuring the appropriate use of platelet product in patients within hospitals. Medical record documentation relating to platelet transfusion should also be relevant and accurate.

Objectives

i. To determine if platelet use in a sample of hospitals is aligned to clinical practice standards developed from NH&MRC/ANZSBT guidelines.

ii. To determine contemporary patterns of use of platelets in hospitals.

Standards

Clinical practice standards have been developed from the national guidelines for the clinical use of platelets (2001).

Data Set for platelet Transfusion

Transfusion Committees (or their equivalent) are asked to take this opportunity to ensure that the required data for each platelet transfusion is documented in the clinical notes. According to NH&MRC/ANZSBT (2001) these are:

- indication for platelet transfusion
- amount of platelets transfused

- assessment of the effectiveness of the platelet transfusion

Methodology

The proposed methodology is for an audit of 30 platelet transfusion episodes.

Definition: *An episode will be defined as each time the participating blood bank issue one or more therapeutic doses of platelets to a patient. The same patient can only be entered into the database twice.*

The Transfusion Committee (or equivalent) should designate a member of staff to record the information requested on the proforma provided. The designated data collector in participating hospitals will review the patient case notes and using the audit proforma (Form 1: Clinical Audit of Platelet Use), collect the relevant data. It is suggested that a clinical sub-group identified by the Hospital Transfusion Committee (or equivalent) review their local data on platelet transfusion.

All data collection forms comply with the Privacy Acts.

Time Frame:

30 consecutive platelet transfusion episodes (or in low frequency users, all platelet transfusion episodes) between **1 January 2009 and 30 July 2009**. For hospitals that transfuse platelets very regularly, every third platelet transfusion may be audited, up to a maximum of 30 episodes.

A designated member of Hospital staff will undertake data collection and data entry. Further details for data collection and data entry are provided on the attached Audit Information Sheet.

The Blood Matters secretariat will co-ordinate the audit, taking responsibility for the distribution of audit collection tools, data entry and analysis, and will collaborate with the Blood Matters Advisory Committee in formulating the audit report. The Blood Matters Advisory Committee will disseminate results to the participating hospitals.

Audit reports are to be **returned (*online)* by 7 August 2009** to:

BLOOD MATTERS: better, safer transfusion program
Statewide Quality Branch, Department of Human Services
GPO Box 4057
MELBOURNE 3001

If further information is required please contact
- Karen Botting Blood Matters Project Manager on Tel: 9096 9037 or email: karen.botting@dhs.vic.gov.au
- or Lisa Stevenson, Transfusion Nurse Blood Matters on Tel: 9096 0476 or email: lisa.stevenson@dhs.vic.gov.au

AUDIT INFORMATION SHEET

This sheet contains definitions to assist with data collection and data entry.

Data Collection: recorded indications

The recorded indications are those documented in the medical record as the reason for the platelet transfusion.

1. **Fever (as a risk factor in bone marrow failure patients):** temperature equivalent to or greater than 38° C.
2. **Massive haemorrhage/transfusion**: one blood volume lost in 24 hour period or greater than 20 units transfused in a 24 hour period
3. **Surgery/invasive procedure**: Central or arterial line insertion or removal, broncho-alveolar lavage, lumbar puncture, liver biopsy, upper GI endoscopy, lapartomy/abdominal surgery (procedure is to be described in the 'Notes' section if not on this list).
4. **Abnormal microvascular bleeding & platelets**: complicated massive transfusion/DIC.
5. **Documented platelet function disorder:** transfusion is appropriate in hereditary and acquired platelet function defects (eg drug induced), after correcting anaemia and considering DDAVP and cryoprecipitate, except for Glanzman's Thrombasthenia where Factor VIIa is more appropriate.
6. **Other recorded indications:** may include High risk surgery eg neuro or ophthalmic.

Data Collection: other definitions

1. **Same day active bleeding:** (active bleeding up to 24 hours before transfusion) includes petechiae or mucosal bleeding
2. **Same day surgery/invasive procedure:** (surgery or procedure performed 24 hours before, during, or after transfusion) includes central or arterial line insertion or removal, broncho-alveolar lavage, lumbar puncture, liver biopsy, upper GI endoscopy, lapartomy/abdominal surgery (procedure is to be described in the 'Notes' section if not on this list).
3. **Bags of platelets:** one bag is equivalent to one bag of apheresis platelets or one bag of pooled platelets. If HLA platelets are used, this subcategory should be noted in the 'Notes' section.
4. **Anti-platelet Drugs:** Refer to Appendix 1

Data Entry

Please submit the data *online* to the Blood Matters Program by **7 August 2009.**

- Up to 30 audit forms are to be completed per hospital, numbered 1 to 30 in the 'Audit ID' field. These are to be 30 consecutive platelet transfusion episodes or for hospitals that transfuse platelets very regularly, every third platelet transfusion may be audited.
- The audit form is attached to the letter of invitation to your hospital and the form includes your 'Hospital Code'. Further copies of the audit form are available from the Blood Matters website at www.health.vic.gov.au/best/audit.htm
- Data is to be entered by each health service via the web at www.health.vic.gov.au/best/audit.htm. Instructions for entry are provided at this site from June 2009.

- Data is to be submitted online: you must enter you 'Hospital code' and 'Audit ID' number each time.
- For **queries** about data entry, please **contact Blood Matters on 03 9096 0476**.

Appendix 1: List of anticoagulant and antiplatelet drugs
Reproduced with permission from "A prospective observational study of blood product transfusion practices in Australian intensive care units", ANZICS, August 2008
Trade names are underlined with generic names in brackets or in bold.

Warfarin
- Coumadin
- Marevan

Clopidogrel
- Plavix
- Iscover

Aspirin
- Astrix 100
- Astrix tablets
- Cardiprin 100
- Cartia
- DBL aspirin
- Solprin

Glycoprotein IIb/IIIa inhibitors
- Aggrastat (Tirofiban)
- Integrilin (Eptifibatide)
- Reopro (Abciximab)

Ticlopidine
- Ticlopidine hexal
- Tilodene

Dipyridamole
- Persantin
- Persantin SR

NSAID
- Aclin (Sulindac), liquid
- Advil Capsules (Ibuprofen)
- Advil Tablets (Ibuprofen)
- Aleve (Naproxen sodium)
- Anaprox (Naproxen sodium)
- Arthrexin (Indomethacin)
- Arthrotec 50 (Diclofenac sodium; Misoprostol)
- Brufen (Ibuprofen)
- Bugesic (Ibuprofen)
- Bugesic Oral Suspension (Ibuprofen)
- Butalgin (Ibuprofen)
- Celebrex (Celecoxib)
- Chemists' Own Ibuprofen Pain & Fever Suspension (Ibuprofen)
- Chemists' Own Ibuprofen Tablets (Ibuprofen)
- Chemists' Own Period Pain Tablets (Naproxen sodium)
- Chemmart Diclofenac (Diclofenac sodium)
- Chemmart Meloxicam (Meloxicam)
- Chemmart Piroxicam Capsules (Piroxicam)
- Chemmart Piroxicam Dispersible Tablets (Piroxicam)
- Crysanal (Naproxen sodium)
- Diclohexal (Diclofenac sodium)
- Dimetapp Children's Ibuprofen Pain & Fever Relief Suspension (Ibuprofen)
- Dimetapp Infant's Ibuprofen Colour Free Pain & Fever Relief Suspension (Ibuprofen)
- Dinac (Diclofenac sodium)
- Dynastat (Parecoxib sodium)
- Eazydayz Tablets (Naproxen sodium)
- Feldene (Piroxicam)
- Femme-free (Naproxen)
- Fenac, Fenac 25 (Diclofenac sodium)
- GenRx Diclofenac (Diclofenac sodium)
- GenRx Meloxicam (Meloxicam)
- GenRx Piroxicam Capsules (Piroxicam)
- GenRx Piroxicam Dispersible Tablets (Piroxicam)
- Gold Cross Ibuprofen Tablets (Ibuprofen)
- Herron Blue Ibuprofen (Ibuprofen)
- Hexal Diclac Anti-inflammatory Tablets (Diclofenac sodium)
- Imflac (Diclofenac sodium)
- Indocid (Indomethacin)
- Inza (Naproxen)
- Meloxibell (Meloxicam)
- Meloxicam Ranbaxy (Meloxicam)
- Meloxicam Sandoz (Meloxicam)
- Meloxicam Winthrop (Meloxicam)
- Meloxicam-GA (Meloxicam)
- Mobic (Meloxicam)
- Mobilis (Piroxicam)
- Movalis (Meloxicam)
- Moxicam (Meloxicam)
- Naprogesic (Naproxen sodium)
- Naprosyn (Naproxen)
- Naprosyn SR (Naproxen)
- Nurofen (Ibuprofen)
- Nurofen Liquid Capsules (Ibuprofen)
- Nurofen Meltlets Lemon (Ibuprofen)
- Nurofen Migraine Pain (Ibuprofen lysine)
- Nurofen Plus (Codeine phosphate; Ibuprofen)
- Nurofen Tension Headache (Ibuprofen)
- Nurofen for Children (Ibuprofen)
- Nurofen for Children Infant Drops (Ibuprofen)
- Nurofen for Children Meltlets (Ibuprofen)
- Nurolasts (Naproxen sodium)
- Orudis (Ketoprofen)
- Oruvail SR (Ketoprofen)
- Panafen IB (Ibuprofen)
- Panafen Plus (Codeine phosphate; Ibuprofen)
- Pharmacor Meloxicam (Meloxicam)
- Ponstan (Mefenamic acid)
- ProVen (Ibuprofen)
- Proxen SR (Naproxen)
- Rafen (Ibuprofen)
- Surgam (Tiaprofenic acid)
- Terry White Chemists Diclofenac (Diclofenac sodium)
- Terry White Chemists Meloxicam (Meloxicam)
- Terry White Chemists Piroxicam Capsules (Piroxicam)
- Terry White Chemists Piroxicam Dispersible Tablets (Piroxicam)
- Toradol (Ketorolac trometamol)
- Tri-Profen (Ibuprofen)
- Voltaren (Diclofenac sodium)
- Voltaren Rapid 12.5 (Diclofenac potassium)
- Voltaren Rapid 25 (Diclofenac potassium)
- Voltaren Rapid 50 (Diclofenac potassium)
- Voltfast (Diclofenac potassium)

Others
- Organon (Danaparoid)
- Refludan (lLepirudin)
- Dindevan (Phenindione)
- Angiomax (Bivalirudin)

Appendix 3: Clinical practice guidelines

CLINICAL PRACTICE GUIDELINES

Appropriate Use of Platelets

Summary of NHMRC/ASBT guidelines

This summary is derived from the National Health and Medical Research Council (NHMRC)/Australasian 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 Aged Care, 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.

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

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

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

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 audit 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.

NHMRC
National Health & Medical Research Council

ASBT
AUSTRALASIAN SOCIETY OF BLOOD TRANSFUSION INC

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 platelets are given as prophylaxis when the platelet count is >20x10⁹/L); 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.

October 20

Contact Details

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

- NHMRC Website at: http: //www.nhmrc.gov.au, or
- ASBT Website at: http://www.asbt.org.au

Print copies of all documents can be obtained by emailing:

- *HEALTH ADVISORY CTTEE NHMRC@nhmrc.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 secretariat@asbt.org.au.

Appropriate Use of Platelets

Use of platelets is indicated for the prevention and treatment of haemorrhage in patients with thrombocytopenia or platelet function defects. The platelet count is the primary trigger for the use of platelets, with clinical risk factors for bleeding and the extent of bleeding also influencing the decision to transfuse.

Use of platelets is likely to be **appropriate as prophylaxis** for:

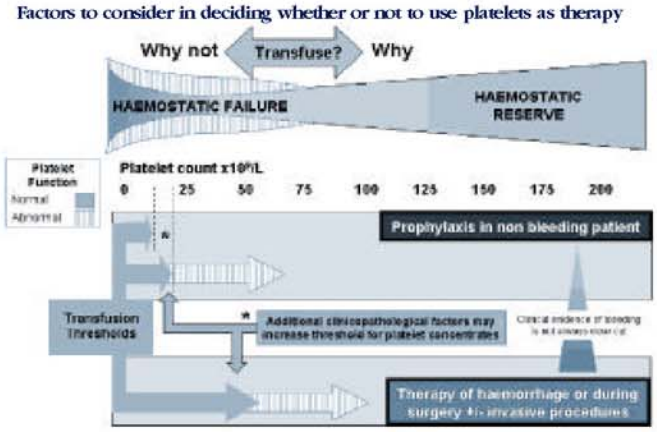
Indication*	Considerations
Bone marrow failure	At a platelet count of $<10x10^9$/L in the absence of risk factors and $<20x10^9$/L in the presence of risk factors (eg fever, antibiotics, evidence of systemic hemostatic failure).
Surgery/invasive procedure	To maintain platelet count at $>50x10^9$/L. For surgical procedures with high risk of bleeding (eg ocular or neurosurgery) it may be appropriate to maintain at $100x10^9$/L.
Platelet function disorders	May be appropriate in inherited or acquired disorders, depending on clinical features and setting. In this situation, platelet count is not a reliable indicator.

Use of platelets is likely to be **appropriate as therapy** for:

Indication*	Considerations
Bleeding	May be appropriate in any patient in whom thrombocytopenia is considered a major contributory factor.
Massive haemorrhage/ transfusion	Use should be confined to patients with thrombocytopenia and/or functional abnormalities who have significant bleeding from this cause. May be appropriate when the platelet count is $<50x10^9$/L ($<100x10^9$/L) in the presence of diffuse microvascular bleeding).

* The use of platelets for indications not listed in these tables is unlikely to be considered appropriate as prophylaxis or therapy. Consult the NHMRC/ASBT Guidleines for further details. Clinical and laboratory indications should be documented.

Factors to consider in deciding whether or not to use platelets as therapy



Contraindications

Use of platelets is not generally considered appropriate in the treatment of:

- immune-mediated platelet destruction
- thrombotic thrombocytopenic purpura
- haemolytic uraemic syndrome or
- drug-induced or cardiac bypass thrombocytopenia without haemorrhage.

Prescribing blood components: checklist for clinicians

Decisions should be based on the NHMRC/ASBT *Clinical Practice Guidelines for the Use of Blood Components*, taking individual patient needs into account. Before prescribing platelets, ask yourself the following questions.

1. What improvement in the patient's condition am I aiming to achieve?
2. Can I minimise blood loss to reduce the patient's need for transfusion?
3. Are there any other treatments I should give before making the decision to transfuse?
4. What are the specific clinical or laboratory indications for platelets for this patient?
5. What are the risks of transmitting infectious agents through the available blood products?*
6. Do the benefits of transfusion outweigh the risks for this particular patient?
7. What other options are there if no platelets are available in time?
8. Will a trained person monitor this patient and respond immediately if any acute transfusion reactions occur?
9. Have I recorded my decision to transfuse and reasons for transfusion on the patient's chart and any documentation used in the ordering or administering of blood components?
10. Has the patient been given a clear explanation of the potential risks and benefits of blood component therapy in his or her particular case?

* Note that the rates of non-infective complications are probably higher than those of infective complications.

Adapted from WHO (1998) *Transfusion Today* 38: 3–6.

ISBN 1864960531 October 2001

Appendix 4: Assessment of alignment with clinical practice guidelines

Appropriate use of platelets

Use of platelets is indicated for preventing and treating haemorrhage in patients with thrombocytopenia or platelet function defects. The platelet count is the primary trigger for the use of platelets, with clinical risk factors for bleeding and the extent of bleeding also influencing the decision to transfuse.

Use of platelets is likely to be appropriate as prophylaxis for the following.

Indication*	Considerations
Bone marrow failure	At a platelet count of < 10 x 10^9/L in the absence of risk factors and < 20 x 10^9/L in the presence of risk factors (e.g. fever, antibiotics, evidence of systemic haemostatic failure).
Surgery/invasive procedure	To maintain platelet count at > 50 x 10^9/L. For surgical procedures with high risk of bleeding (e.g. ocular or neurosurgery) it may be appropriate to maintain at 100 x 10^9/L.
Platelet function disorders	May be appropriate in inherited or acquired disorders, depending on clinical features and setting. In this situation, platelet count is not a reliable indicator.

Use of platelets is likely to be appropriate as therapy for the following.

Indication*	Considerations
Bleeding	At a platelet count of < 10 x 10^9/L in the absence of risk factors and < 20 x 10^9/L in the presence of risk factors (e.g. fever, antibiotics, evidence of systemic haemostatic failure).
Massive haemorrhage/transfusion	To maintain platelet count at > 50 x 10^9/L. For surgical procedures with high risk of bleeding (e.g. ocular or neurosurgery) it may be appropriate to maintain at 100 x 10^9/L.

* The use of platelets for indications not listed in these tables is unlikely to be considered appropriate as prophylaxis or therapy.

Source: National Health & Medical Research Council and Australian and New Zealand Society of Blood Transfusion 2001

(Appendix 4 cont'd)

Algorithm for alignment (for medical reviewer use)

Based on NH&MRC/ANZSBT guidelines (2001) and informed by the NZ Platelet Audit (February 2007)

	Diagnosis							
Platelet count	**Prophylaxis bone marrow failure**	**Prophylaxis bone marrow failure and risk factors[1]**	**Massive haemorrhage/ transfusion bleeding[2]**	**Prophylaxis for surgery/invasive procedure[3]**	**Abnormal microvascular bleeding[4]**	**Documented platelet function disorder[5]**	**Same day active bleeding[6]**	**High risk ocular or neurosurgical procedures**
< 10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
< 20		Yes	Yes	Yes	Yes	Yes	Yes	Yes
< 50			Yes	Yes	Yes	Yes	Yes	Yes
< 100					Yes	Yes		Yes
≥ 100						Yes		

Definitions

1. Fever (> 38oC), IV antibiotics or antifungals or mucosal bleeding or abnormal coagulation.
2. Blood volume replaced once within 24 hours or > 20 units transfused.
3. Central or arterial line insertion or removal, bronchoalveolar lavage, lumbar puncture, liver biopsy, upper GI endoscopy, laparotomy/abdominal surgery.
4. Complicated massive transfusion/disseminated intravascular coagulation (DIC). Complicated cardiopulmonary bypass. That is, lasting longer than two hours or with deep hypothermic arrest or extracorporeal membrane oxygenation (ECMO).
5. Regarding documented platelet disorders, transfusion is appropriate in hereditary and acquired platelet function defects (e.g. drug-induced), after correcting anaemia and considering desmopressin acetate (DDAVP) and cryoprecipitate, except for Glanzmann's disease (thrombasthenia) where factor VIIa is more appropriate.
6. With thrombocytopenia as a major contributory factor.

Not indicated

Uncomplicated immune thrombocytopenia (ITP)
Thrombotic thrombocytopenic purpura (TTP)/haemolytic uraemic syndrome (HUS).
Drug induced or cardiac bypass associated thrombocytopenia without haemorrhage
Heparin-induced thrombocytopenia (HIT)

Appendix 5: Draft guidelines for platelet use in neonates 2007

(Author: Dr Helen Savoia)

Transfusion of platelet components

Thrombocytopenia is the most common haemostatic abnormality in sick newborn infants. The immature coagulation system in neonates contributes to an increased bleeding risk. Platelet transfusions are indicated for the support of selected neonates with clinically significant quantitative or qualitative platelet disorders. Consideration should be given to the cause and natural history of the thrombocytopenia, as this may alter the type of platelet product given.

In the only reported randomised controlled study of platelet transfusion in preterm infants, Andrew et al. found no benefit (defined as the reduction of significant haemorrhage) in babies where moderate thrombocytopenia (50–150 x 10^9/L) was prevented by platelet transfusion compared with control babies.

Guidelines for platelet transfusion in the neonate acknowledge the lack of evidence on which to make recommendations and aim for a safe approach. Experience from alloimmune thrombocytopenia indicates that in a well-term neonate, the risk of significant haemorrhage as a result of thrombocytopenia is unlikely at counts above 30 x 10^9/L; however, for preterm infants, despite the lack of evidence, a higher threshold of 50 x 10^9/L is recommended.

Guidelines for platelet transfusion in neonates

Asymptomatic thrombocytopenia - Stable term or preterm: infant consider if platelet count < 20–30 x 10^9/L - Sick term or preterm: infant consider if platelet count < 30–50 x 10^9/L Symptomatic thrombocytopenia in any neonate - Major organ bleeding and platelet count < 100 x 10^9/L - Minor bleeding and platelet count < 50 x 10^9/L Thrombocytopenia and invasive procedures - Surgery: consider if platelet count < 50 x 10^9/L - Exchange transfusion: consider if platelet count < 50 x 10^9/L Thrombocytopenia and disseminated intravascular coagulation (DIC) - Consider if platelet count < 50 x 10^9/L

Alloimmune thrombocytopenia

Alloimmune thrombocytopenia (sometimes called neonatal alloimmune thrombocytopenia or 'NAIT') is a serious disease capable of causing significant morbidity or mortality from haemorrhage in-utero or during the perinatal period. Intracerebral haemorrhage (ICH) secondary to severe thrombocytopenia has been reported as early as 18 weeks' gestation. The level of thrombocytopenia that places the fetus at risk is not known, but ICH has rarely been reported in neonates with platelet counts greater than 30 x 109/L. Weekly or fortnightly platelet transfusion given in-utero have been used to reduce the risk of ICH; however, others recommend maternal intravenous immunoglobulin (IVIg) to raise the fetal platelet count. Appropriate antigen-negative platelets should be available to be given to a fetus undergoing any invasive procedure such as cordocentesis.

For the neonate with feto-maternal alloimmune thrombocytopenia (FMAIT), platelet transfusion is the treatment of choice and should be given to normalise the platelet count in an infant with ICH or to raise the platelet count to at least 50 x 109/L in infants without ICH. Platelets used for neonates with FMAIT should be negative for the implicated platelet-specific antigen.

Congenital infections

Neonates born with cytomegalovirus (CMV) infection, rubella, toxoplasmosis, syphilis or herpes simplex may have suppression of thrombopoiesis and/or splenomegaly with shortened platelet survival. Mild to moderate thrombocytopenia may be present. This usually does not require platelet support.

Neonates of mothers with immune thrombocytopenia (ITP)

Neonatal thrombocytopenia may be associated with past or current maternal ITP. The majority of infants are only mildly affected and the thrombocytopenia resolves spontaneously. Severe thrombocytopenia is reported to occur in approximately 4 per cent of neonates and the incidence of ICH is extremely low. Intravenous immunoglobulin and steroids are the treatments of choice where the thrombocytopenia is severe or bleeding is present.

Platelets for neonatal transfusion

- ABO and Rh(D) identical or compatible.
- Human platelet antigen (HPA) compatible in infants with alloimmune thrombocytopenia.
- Produced by standard techniques.
- Irradiated if appropriate.
- CMV negative or leukocyte reduced if appropriate.

A single platelet concentrate prepared from a unit of whole blood provides a suitable platelet dose for infants up to 10 kg (40–45 mL with 70–80 x 109 platelets). Platelets collected by apheresis can be issued in paediatric packs for neonatal use. A single pack provides a suitable platelet dose for infants up to 10 kg (~50 mL with 60–75 x 109 platelets).

Appendix 6: Draft guidelines for platelet transfusion in children

(Author: Dr Helen Savoia)

Guidelines for platelet transfusion in children

Platelet count < 10 x 10^9/L with failure of platelet production
Platelet count 10–20 x 10^9/L with failure of platelet production and additional risk factors
Platelet count < 20 x 10^9/L in the pre-engraftment phase in stem cell transplantation
Platelet count < 30 x 10^9/L in a patient with a brain tumour on chemotherapy
Active bleeding in association with a platelet qualitative defect
Unexplained excessive bleeding in a patient undergoing cardiopulmonary bypass
Platelet count < 50–100 x 10^9/L in a patient undergoing ECMO
Platelet count < 50 x 10^9/L in DIC or with abnormal coagulation and bleeding

Platelet transfusion in children with malignant disease

Children with leukaemia are the largest single group of patients receiving platelet transfusions. Platelet transfusion is used therapeutically in patients with bleeding and significant thrombocytopenia.

Prophylactic platelet transfusion is not routinely used during induction therapy for acute lymphoblastic leukaemia or for solid tumours (with the exception of brain tumours) unless: patients are symptomatic; there is active bleeding; it involves an invasive procedure; or there are additional risks such as fever.

Prophylactic platelet transfusion during induction chemotherapy for acute myeloid leukaemia using a threshold of 10 x 109/L and during the pre-engraftment phase of stem cell transplantation using a threshold of 20 x 109/L is widely practised.

A number of studies show that bleeding is more likely to arise in disease-induced than therapy-induced thrombocytopenia, and the presence of additional risk factors, such as sepsis, drugs that impair platelet function, abnormal haemostasis or invasive procedures, increase the risk of bleeding and a higher threshold is recommended. A platelet count above 30–50 x 109/L is generally acceptable for lumbar puncture, above 50 x 109/L for minor surgery and above 80–100 x 109/L for major surgery such as neurosurgery.

Platelet transfusion in stem cell transplantation

In the absence of evidence-based guidelines for children, the following clinical circumstances represent acceptable indications for platelet transfusion in stem cell recipients:

- prophylactic platelet transfusion during the pre-engraftment phase of stem cell transplantation using a threshold of 20 x 10^9/L. A higher threshold may be used in the presence of bleeding, severe mucositis, coagulopathy or concurrent anticoagulation.

ABO incompatibility between the patient and stem cell donor may be major, minor or both. In major incompatibility, the recipient has antibodies to the stem cell donor's red cells (e.g. group A donor and group O recipient); in minor incompatibility the stem cell preparation from the donor has antibodies to the recipient's red cells (e.g. anti-A in group O donor and group A recipient); in both major and minor incompatibility, the recipient's

plasma contains antibodies to the donor's cells and the donor plasma contains antibodies to the recipient's cells (e.g. group B recipient and group A donor).

Platelets for stem cell recipients

Where possible, a platelet product compatible with both donor and recipient should be used. At the Royal Children's Hospital the platelet product choice for each transplant recipient will be specified by their transplant physician and will be listed in the transplant protocol.

Platelet transfusion in children with congenital platelet disorders

There are several inherited platelet disorders that occasionally require platelet transfusions. Platelet transfusion has been shown to be of benefit in Bernard-Soulier syndrome and Glanzmann's thrombasthenia to cover surgery or a bleeding episode. Platelet transfusion can provoke the development of multi-specific HLA or platelet-specific antibodies and they should be used sparingly. Donor exposure should be limited through the use of apheresis platelets and the risk of alloimmunisation reduced through the use of leukocyte-reduced products.

Platelet transfusion in defects of platelet production

There are many rare causes of defects in platelet production such as thrombocytopenia with absent radii (TAR), Wiskott-Aldrich syndrome, Fanconi's anaemia, amegakaryocytic thrombocytopenia. Platelet transfusion should be used sparingly and reserved for clinical bleeding or invasive procedures since many patients with these conditions will require stem cell transplantation.

Platelet transfusion in immune thrombocytopenia

Transfused platelets are rapidly destroyed and should be reserved for cases of life-threatening bleeding.

Platelet transfusion in cardiopulmonary bypass and ECMO

Platelet transfusion may be warranted in a patient with unexplained excessive bleeding undergoing cardiopulmonary bypass. Patients undergoing extracorporeal membrane oxygenation (ECMO) are usually transfused to maintain a platelet count below 100 x 109/L.

Appendix 7: Proportion of platelet transfusion episodes aligned with clinical guidelines and meeting process indicators: 2009

Hospital	Count	* Proportion of platelet transfusion episodes aligned with guidelines	* Proportion of aligned platelet transfusion episodes with pre-transfusion platelet counts and medical record documentation for indication	* Proportion of aligned platelet transfusion episodes with pre- and post-transfusion platelet counts and medical record documentation for indication	Proportion of all platelet transfusions meeting process indicators		
					Pre-transfusion platelet count results	Post-transfusion platelet count results	Indication recorded in the medical record
A	30	80.0	50.0	46.7	93.3	83.3	60.0
B	30	83.3	80.0	56.7	100.0	76.7	96.7
C	22	81.8	72.7	72.7	100.0	95.5	86.4
D	30	70.0	60.0	53.3	100.0	90.0	76.7
E	25	76.0	76.0	72.0	96.0	88.0	88.0
G	29	93.1	89.7	86.2	96.6	96.6	100.0
H	30	73.3	56.7	53.3	100.0	90.0	73.3
I	25	24.0	0.0	0.0	100.0	92.0	4.0
J	19	73.7	57.9	52.6	100.0	94.7	84.2
K	30	80.0	66.7	60.0	100.0	93.3	80.0
L	29	58.6	37.9	37.9	100.0	100.0	55.2
M	28	96.4	89.3	89.3	100.0	100.0	89.3
N	27	51.9	48.1	44.4	100.0	96.3	70.4
O	30	60.0	46.7	43.3	96.7	96.7	73.3
P	30	50.0	43.3	36.7	100.0	93.3	60.0
Q	30	86.7	80.0	70.0	100.0	83.3	93.3
S	30	63.3	50.0	40.0	100.0	83.3	76.7
T	30	66.7	56.7	40.0	96.7	80.0	70.0
U	30	90.0	70.0	70.0	100.0	100.0	70.0
V	30	66.7	20.0	20.0	96.7	93.3	23.3
W	30	80.0	16.7	13.3	100.0	70.0	23.3
Y	13	61.5	61.5	38.5	100.0	69.2	100.0
Z	27	22.2	7.4	7.4	100.0	96.3	18.5
AA	19	15.8	10.5	0.0	100.0	78.9	31.6
BB	17	41.2	17.6	17.6	100.0	100.0	41.2
CC	9	66.7	66.7	66.7	100.0	100.0	100.0
Overall	**679**	**67.3**	**51.7**	**46.2**	**99.0**	**90.0**	**66.3**

Appendix 8: Definitions of hospital type

Classification definitions

The hospital classification used in this report is based on the peer groups as defined by the Australian Institute of Health and Welfare National Peer Group.

Principal referral and specialist hospitals	Principal referral hospitals are major city hospitals with more than 20,000 acute casemix-adjusted separations per year; regional hospitals have more than 16,000. Specialist hospitals are specialised acute women's and children's hospitals with more than 10,000 casemix-adjusted separations per year.
Large hospitals	Large hospitals are major city acute hospitals with more than 10,000 casemix-adjusted separations per year; regional acute hospitals have more than 8,000 and remote acute hospitals more than 5,000.
Medium hospitals	Medium hospitals are: - acute hospitals located in regional and major city areas treating between 2,000 and 10,000 acute casemix-adjusted separations per year or - acute hospitals in regional and major city areas treating between 2,000 and 5,000 acute casemix-adjusted separations per year, and acute hospitals treating fewer than 2,000 casemix-adjusted separations per year but with more than 2,000 separations per year.
Small acute hospitals	Small acute hospitals are: - regional acute hospitals (mainly small country town hospitals) treating fewer than 2,000 separations per year and with less than 40 per cent non-acute and outlier patient days of total patient days or - remote hospitals treating fewer than 5,000 acute casemix-adjusted separations but which are not multi-purpose and not small non-acute. Most have fewer than 2,000 separations per year.
Small non-acute hospitals and multi-purpose services	Small non-acute hospitals that treat fewer than 2,000 separations per year and with more than 40 per cent non-acute and outlier patient days of total patient days.

The definition of hospital classification remains consistent from year to year; however, a hospital may move between classifications due to changing patient admission rates/types. The federal Department of Health and Ageing only considers and classifies public hospitals; therefore, for the purpose of this report private hospitals are grouped separately.

Hospital code	Classification used for audit 2007*	Classification used for audit 2009†
A	Principal referral and specialist hospitals	Principal referral and specialist hospitals
B	Principal referral and specialist hospitals	Principal referral and specialist hospitals
C	Large hospitals	Principal referral and specialist hospitals
D	Principal referral and specialist hospitals	Principal referral and specialist hospitals
E	Private	Private
F	Principal referral and specialist hospitals	Principal referral and specialist hospitals
G	Large hospitals	Principal referral and specialist hospitals
H	Large hospitals	Principal referral and specialist hospitals
I	Private	Private
J	Large hospitals	Principal referral and specialist hospitals
K	Principal referral and specialist hospitals	Principal referral and specialist hospitals
L	Principal referral and specialist hospitals	Principal referral and specialist hospitals
M	Principal referral and specialist hospitals	Large hospitals
N	Private	Private
O	Private	Private
P	Principal referral and specialist hospitals	Principal referral and specialist hospitals
Q	Large hospitals	Principal referral and specialist hospitals
R	Private	Private
S	Principal referral and specialist hospitals	Principal referral and specialist hospitals
T	Principal referral and specialist hospitals	Principal referral and specialist hospitals
U	Principal referral and specialist hospitals	Principal referral and specialist hospitals
V	Principal referral and specialist hospitals	Principal referral and specialist hospitals
W	Principal referral and specialist hospitals	Principal referral and specialist hospitals
X	Private	Private
Y	Medium hospitals	Principal referral and specialist hospitals
Z	Private	Private
AA	Private	Private
BB	Medium hospitals	Large hospitals
CC	Principal referral and specialist hospitals	Large hospitals

*Australian Institute of Health and Welfare 2007

†Australian Institute of Health and Welfare 2009

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