Platelet Usage in Seven New Zealand Hospitals

Final report

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EXECUTIVE SUMMARY

BACKGROUND

The availability of platelets has allowed for more intensive surgical and medical therapy for patients. Correspondingly there has been an increased demand for platelets nationally and internationally. Together with increasing awareness of the complications of platelet transfusion such as Transfusion Related Acute Lung Injury (TRALI) and bacterial infection, the relevance of appropriateness of transfusion is becoming increasingly important.

AIM

A prospective audit of platelet usage in the seven main centres in New Zealand, covering almost 80% of New Zealand's use, was undertaken to assess the appropriateness of platelet transfusions as measured against the Australian and New Zealand Society of Blood Transfusion (ANZSBT) guidelines.

METHOD

Transfusion Nurse Specialists prospectively collected clinical, laboratory and transfusion data on 50 platelet transfusion episodes at each hospital. Additional episodes at Auckland Hospital were collected to ensure an even spread over all days of the week. An episode was defined as each time the participating blood bank issued one or more therapeutic doses of platelets to a patient. Patients were entered into the database multiple times as necessary. Two medical assessors, reviewed the data together to seek a consensus on the appropriateness of each episode.

RESULTS

388 episodes from 225 patients were captured. The mean number of episodes per patient was 1.7 (range: 1 – 8) with a mean of 1.9 (range: 1 – 10) adult therapeutic equivalent doses transfused per patient. 87% of the episodes were assessed as appropriately indicated, with some variation noted between hospitals and indications. The most frequent dose administered was one adult therapeutic dose per episode. Requests exceeding one adult therapeutic dose equated to 0-24% of hospitals' episodes. 84% of issues where more than one adult therapeutic dose was issued were appropriate, similar to the overall level of appropriateness. The audit did not specifically consider appropriateness of dose. 44% of patients were not bleeding at the time of transfusion. 68% of episodes transfused to non-bleeding patients were for marrow failure, and a further 9% were for procedures in patients with marrow failure.

COMMENT

The audit found that 87% of episodes were regarded as appropriate or probably appropriate by the reviewers, taking into account the ANZSBT guidelines and the clinical situation at the time of transfusion. This figure compares well to two published Australian studies which had levels of 79% and 88% for tertiary hospitals and an English audit with 81% of cases being appropriate.

44% of episodes were for platelets transfused to patients prophylactically. This compares favourably to an American university centre showing 74-78%. Of the prophylactic transfusion episodes in this audit, 14% were considered inappropriate. In the setting of prophylactic transfusion, guidelines may be particularly valuable.

Although not specifically sought in the audit, it appeared that Tranexamic Acid was not used as widely as the clinical situations suggested would be helpful. Tranexamic Acid has a significant role to play in minimising blood loss as well as platelet usage.

In summary, this audit has shown good adherence to guidelines and appropriate use of platelets, comparable with, or better than, other published reports. The increase in platelet utilisation is therefore unlikely to be due to inappropriate use.

INTRODUCTION

The role of platelet transfusions in modern health care has been of considerable benefit to patients. The availability of platelets has allowed for more intensive therapy for haematology and oncology patients as well as providing support for those patients undergoing high risk surgical procedures. Correspondingly there has been an increased demand for platelets nationally and internationally, which has created a challenge for many blood centres to provide an adequate supply for hospitals.[1] The demand for platelets doubled in the United States between 1980 to 1987 and the number of apheresis platelets transfused increased by 75% from 1989 to 1992.[2] In England, platelet usage has also increased, rising by 2.3% in 2001-2002 in comparison to the previous year.[3] The New Zealand Blood Service has also witnessed an increase in platelet demand with an 18% increase comparing the 2005/06 financial year with 2001/02.[4]

Ironically, bleeding patients do not receive the majority of platelets. It has been claimed that the majority of platelets are administered prophylactically and one large medical centre (University of Minnesota) reported that 74-78% of platelets were given in the absence of any significant bleed.[5,6]

Improvements in platelet collection and storage have made platelet transfusions safer, however there are still risks associated with their administration. These include bacterial and viral infections, febrile reactions, allergic reactions, circulatory overload, alloimmunisation problems and transfusion related acute lung injury. Added to this, platelet transfusions are a scarce resource and a gift by a donor, which needs to be respected. Platelets are also the most expensive blood component, currently costing $665.69 (plus GST) per adult therapeutic dose.

The decision to transfuse platelets should therefore always be a carefully considered one.

To guide clinical practice, the National Health and Medical Research Council (NHMRC)[7] and the Australia and New Zealand Society of Blood Transfusion (ANZSBT)[8] have published guidelines for the appropriate use of platelets.
In summary:

- The use of platelets is indicated for the prevention and treatment of haemorrhage in patients with thrombocytopenia or platelet function disorders. The platelet count is the primary trigger for the use of platelets, with other clinical risk factors for bleeding and the extent of bleeding also influencing the decision to transfuse.
- Bone Marrow Failure: Platelet Concentrate is indicated in patients when the platelet count is below 10 x 10^9/L in the absence of risk factors. In the presence of risk factors (e.g. fever, antibiotics, or evidence of haemostatic failure) transfusion may be required at a higher level.
- Surgery/Invasive Procedure: To maintain the platelet count at greater than 50 x 10^9/L. For surgical procedures with high risk of bleeding (e.g. ocular or neurosurgery) it may be appropriate to maintain the platelet count at 100 x 10^9/L.
- Platelet Function Disorders: May be appropriate in inherited or acquired disorders. In this situation, the platelet count is not a reliable indicator. For example, following extended cardiac by-pass surgery i.e. more than 2 hours duration or bypass with deep hypothermic arrest (both defined as complicated cardiopulmonary bypass in this audit).
- Bleeding: May be appropriate in any patient in whom thrombocytopenia is considered to be a major contributing factor.
- Massive haemorrhage/transfusion: Use should be confined to patients with thrombocytopenia/or functional abnormalities who have significant bleeding from this cause. The transfusion of Platelet Concentrates may be appropriate when the platelet count is less than 50 x 10^9/L. In the presence of diffuse microvascular bleeding (defined as complicated massive transfusion/DIC in this audit), transfusion may be appropriate when the platelet count is less than 100 x 10^9/L.

Regular laboratory monitoring, with a platelet count, activated partial thromboplastin time (APTT) and a fibrinogen estimation will normally identify patients at risk of haemostatic failure who will benefit from timely transfusion of appropriate components before this occurs.

NZBS provides platelets as either apheresis or pooled leucodepleted platelets. Each bag or unit is issued as either a neonatal therapeutic dose (approx. 50ml) or an adult therapeutic dose (apheresis: approx. 190ml pooled: approx. 310ml).

The aim of this audit was:

- To investigate the current usage of platelets in New Zealand by auditing platelet issues within the seven main centres (Auckland, Manukau, Hamilton, Palmerston North, Wellington, Christchurch, and Dunedin). In the 2005/06 financial year a total of 11,829 adult platelet dose equivalents were issued nationally. 77% were issued within these main centres.
- To assess the appropriateness of platelet transfusions as measured against the guidelines of the ANZSBT.

METHOD

All inpatients and outpatients who received a platelet transfusion while attending one of the seven participating hospitals, during the audit timeframe, were included.

An episode was defined as each time the participating blood bank issued to a patient one or more therapeutic doses of platelets. Patients were entered into the database multiple times as necessary. Complicated cardiopulmonary bypass was defined as bypass lasting more than two hours or with deep hypothermic arrest. Massive transfusion/DIC was defined as complicated if diffuse microvascular bleeding was present.

Platelets are referred to in terms of adult therapeutic dose equivalents. Neonatal platelet doses are equivalent to a quarter of an adult therapeutic dose.

Transfusion Nurses Specialists in the seven main centres prospectively collected 50 platelet transfusion episodes. Because Auckland Hospital uses large numbers of platelets, the nurse at Auckland Hospital collected an additional 36 episodes to ensure all days of the week, and all operating lists and clinics, were assessed.

Data collection for each episode included:

- **Patient demographics**: date of birth, gender, weight (if available), NHI number, Progesa number.
- **Laboratory data:** pre and post transfusion platelet counts with date and time, Hct, INR, APTT, platelet function.
- **Transfusion data:** date, time and number of red cells, fresh frozen plasma, platelets and/or cryoprecipitate units transfused in the previous 12 hours.
- **Clinical data:** patient's diagnosis, indication for the use of platelets, hospital, ward location, rate of blood loss, co-morbidities, requesting clinician.
- **Medications** that interferes with platelet function or increase the risk of bleeding e.g. aspirin, clopidogrel, persantin, heparin, warfarin.

The data was collected from the NZBS Progesa computer system, the local DHB laboratory information system and a review of clinical notes. The cases were discussed with relevant DHB staff where necessary. Data was collated in a single Microsoft Access® database.

Two medical assessors, New Zealand Blood Service Transfusion Medicine Specialists with ongoing experience in managing and giving advice on the treatment for patients with bleeding disorders, reviewed the data together to seek a consensus on the appropriateness of each episode.

RESULTS

The seven centres collected a total of 388 episodes prospectively. The data took seven months to capture. The data was collected in two phases. The first phase consisted of a pilot phase of ten episodes per site. These were collected in August 2005. After review of the pilot data, the audit recommenced in November 2005. As Auckland Hospital had the fastest turnover of platelets, further episodes were collected on different days of the week to ensure representation of the different activities that took place during the week. Data capture was completed by the end of March 2006.

All sites captured the target of 50 episodes with Wellington and Palmerston North capturing a further one episode each and Auckland capturing a total of 86 episodes.

Demographics

The median age of the 225 patients was 47 years (range (0 – 85), 62% of whom were male. The mean number of episodes per patient was 1.7 (range: 1 – 8) and the mean number of adult therapeutic equivalent doses transfused per patient was 1.9 (range: 1 – 10).

Appropriateness of use

87% of the episodes were assessed as appropriately indicated by two Transfusion Medicine Specialists (table 1). Some variation was noted between hospitals and between indications. No difference was noted between uncomplicated or complicated (lasting > 2 hours or with deep hypothermic arrest) cardiac bypass.

Table 1: *Appropriateness of transfusion by hospital and indication*

Indication	n	Auckland *(n=86)*	Christchurch *(n=50)*	Dunedin *(n=50)*	Middlemore *(n=50)*	Palmerston North *(n=51)*	Waikato *(n=50)*	Wellington *(n=51)*	Overall *(n=388)*
Bleeding	47	83%	100%	100%	100%	80%	93%	100%	91%
Complicated cardiopulmonary bypass	25	64%	100%	88%			100%		80%
Complicated massive transfusion/DIC	6					100%		100%	100%
High risk surgery	7	50%	100%	100%			100%	100%	86%
ITP	1					0%			0%
Marrow failure	43	71%	70%	100%		0%	100%	67%	72%
Marrow failure with risk factors	135	91%	100%	100%	90%	100%	100%	64%	93%
Massive transfusion or DIC	29	100%	50%	100%	100%	100%	100%	100%	97%
Neonate	9	100%	100%	100%		100%		67%	89%
Platelet function abnormalities	6			100%				100%	100%
Standard cardiopulmonary bypass	23	50%		60%			100%	80%	70%
Surgery / Invasive procedure	55	50%	100%	100%	76%	100%	100%	100%	84%
Other	2	100%			0%				50%
Overall	388	77%	92%	94%	86%	90%	98%	76%	87%

Dose of platelets used

The commonest dose used was one adult therapeutic dose per episode (table 2). Although there was some variation between the hospitals, with some using two adult dose transfusions in up to 24% of episodes and another never using more than one adult dose, this did not reach statistical significance ($p>0.05$). Where more than one adult therapeutic dose was issued, 84% of issues were appropriate, similar to the overall level of appropriateness. The weight of patients transfused more than one adult therapeutic dose was 74.2kg ±14.4 kg. The mean weight of adults receiving single therapeutic doses was 76.1 ±14.4 kg. The audit did not specifically look at appropriateness of dose.

Table 2: *Dose of platelets per episode used by hospital*

Hospital	No of episodes	1 neonatal dose	2 neonatal dose	1 adult dose	2 adult dose	4 adult dose	Mean adult dose equivalents per episode
		(n =4)	*(n =3)*	*(n =341)*	*(n =39)*	*(n =1)*	*(n=388)*
Auckland	86	3%	3%	79%	13%	1%	1.11
Christchurch	50	2%	0%	84%	14%	0%	1.12
Dunedin	50	0%	0%	94%	6%	0%	1.06
Middlemore	50	0%	0%	76%	24%	0%	1.24
Palmerston N.	51	0%	0%	100%	0%	0%	1.00
Waikato	50	0%	0%	94%	6%	0%	1.06
Wellington	51	0%	0%	94%	6%	0%	1.06
Overall	388	1%	1%	88%	10%	0%	1.10

Of the 24 episodes in children weighing less than 15kg, 4 episodes (17%) were for 2 adult therapeutic doses of platelets.

Components used prior to transfusion

The number of components transfused in the 12 hours prior to each episode were assessed (table 3). The ratio of platelet doses to red cell units and FFP units transfused appeared low in complicated massive transfusion/DIC (1:14 and 1:7), especially compared with bleeding as an indication (5:1 and 3:1). As noted in a previous audit, cryoprecipitate appeared to be relatively under-utilised.

Table 3: *No of components transfused in 12 hours prior to episode*

Indication	Red cells	FFP	Platelets	Cryoprecipitate
Bleeding	5.3	3.0	1.0	1.1
Complicated cardiopulmonary bypass	2.0	1.1	0.2	0.6
Complicated massive transfusion/DIC	9.8	5.0	0.7	1.0
High risk surgery	0.3	0.3	0.0	0.0
ITP	0.0	0.0	0.0	0.0
Marrow failure	0.2	0.0	0.0	0.0
Marrow failure with risk factors	0.2	0.0	0.1	0.0
Massive transfusion or DIC	10.6	6.3	0.7	1.1
Neonate	0.1	0.0	0.1	0.0
Platelet function abnormalities	2.7	0.5	0.2	0.5
Standard cardiopulmonary bypass	2.6	0.5	0.1	0.0
Surgery / Invasive procedure	2.9	1.0	0.1	0.1
Other	0.0	0.0	0.0	0.0

Bleeding at time of transfusion

44% of patients were not bleeding at the time of transfusion (table 4), with two thirds of these patients having marrow failure with/without risk factors. Some differences were noticeable between DHBs.

Table 4: *Bleeding in relation to transfusion of platelets by site*

Hospital	Fast (>1L/hr)	Slow (<1L/hr)	Not bleeding	No info available
Auckland	9%	30%	55%	6%
Christchurch	6%	24%	68%	2%
Dunedin	10%	46%	30%	14%
Middlemore	22%	24%	34%	20%
Palmerston North	8%	6%	59%	27%
Waikato	10%	48%	40%	2%
Wellington	12%	14%	14%	61%
Overall	11%	28%	44%	18%

Although most episodes transfused to non-bleeding patients were for marrow failure (table 5), a significant number of episodes were found in surgical indications. Some of these were for procedures in patients with marrow failure (e.g. insertion of a central line in a patient with leukaemia).

Table 5: *Bleeding in relation to transfusion of platelets by indication*

Diagnoses	n	Fast (>1L/hr)	Slow (<1L/hr)	Not bleeding	No info available*
Bleeding	47	64%	26%	11%	0%
Complicated cardiopulmonary bypass	25	36%	12%	20%	32%
Complicated massive transfusion/DIC	6	17%	33%	50%	0%
High risk surgery	7	29%	0%	29%	43%
ITP	1	100%	0%	0%	0%
Marrow failure	43	9%	0%	23%	67%
Marrow failure with risk factors	135	23%	0%	13%	64%
Massive transfusion or DIC	29	10%	45%	21%	24%
Neonate	9	0%	0%	56%	44%
Platelet function abnormalities	6	83%	0%	0%	17%
Standard cardiopulmonary bypass	23	35%	17%	22%	26%
Surgery / Invasive procedure	55	22%	15%	18%	45%
Other	2	50%	0%	0%	50%
Inappropriate	13%	10%	6%	14%	28%
No of episodes	388	42	107	170	69

** "No info available" refers to rate of bleeding and/or whether bleeding was present. Appropriateness was assessed on the rest of the clinical picture.*

Episodes where platelets were administered prophylactically that the reviewers considered inappropriate were more likely to come from Auckland Hospital, even accounting for Auckland having more episodes than other centres (table 6).

Table 6: *Inappropriate use of platelets in non-bleeding patients as a percentage of the hospital's patients with the indication (% inappropriate, number of episodes with indication)*

Indication	Auckland	Christchurch	Dunedin	Middlemore	Palmerston North	Waikato	Wellington
Complicated cardiopulmonary bypass	18% (11)	0% (2)	0% (8)			0% (4)	
Marrow failure	29% (7)	30% (10)	0% (8)		67% (3)	0% (3)	0% (12)
Marrow failure with risk factors	6% (33)	0% (25)	0% (5)	5% (21)	0% (21)	6% (16)	0% (14)
Massive transfusion or DIC	0% (2)	50% (2)	0% (2)	0% (5)	0% (14)	0% (2)	0% (2)
Standard cardiopulmonary bypass	50% (6)		20% (5)			0% (2)	0% (10)
Surgery / Invasive procedure	40% (10)	0% (7)	0% (7)	6% (17)	0% (3)	0% (8)	0% (3)

Appropriate vs. Inappropriate transfusions

Comparing appropriate vs. inappropriate transfusions for major clinical factors for each indication (table 7), showed that a transfusion was more likely to be inappropriate in the following situations: transfusing above the trigger recommended in the guidelines, the absence of a coagulopathy, less than four units of red cells transfused in the last 12 hours, not bleeding and not on anti-platelet medication.

One area of debate is whether platelet triggers in children with marrow failure should be higher than in adults. In this audit only 22% of patients with marrow failure and 72% with marrow failures and risk factors were transfused at or below the respective triggers of 10 and 20 x 10^9/L. Nevertheless, 67% and 100%, respectively, of these transfusions were considered appropriate.

Table 7: *Comparison of major clinical features vs. appropriateness of transfusion (Note that this table is a summary and does not take all aspects of each patient into account)*

Indication for transfusion	Appropriate	n	Below trigger for platelet transfusion	Coagulo-pathic *(INR.1.5, APTT>45 or Fib <1)*	More than 4u rbc in previous 12 hours	Bleeding	Anti-platelet meds *(aspirin, ticlopidine, clopidogrel)*
Bleeding	No	4	50%	0%	25%	75%	0%
Bleeding	Yes	43	86%	35%	28%	91%	35%
Complicated cardiopulmonary bypass	No	5	100%	40%	0%	40%	60%
Complicated cardiopulmonary bypass	Yes	20	70%	35%	20%	50%	50%
High risk surgery	No	1	0%	0%	0%	0%	0%
High risk surgery	Yes	6	83%	17%	0%	33%	17%
Marrow failure	No	12	8%	8%	0%	0%	0%
Marrow failure	Yes	31	71%	6%	0%	13%	3%
Marrow failure with risk factors	No	10	0%	0%	0%	0%	10%
Marrow failure with risk factors	Yes	125	88%	14%	0%	25%	1%
Massive transfusion or DIC	No	1	100%	100%	0%	0%	100%
Massive transfusion or DIC	Yes	28	61%	50%	71%	57%	25%
Neonate	No	1	100%	0%	0%	0%	0%
Neonate	Yes	8	100%	13%	0%	0%	13%
Standard cardiopulmonary bypass	No	7	0%	43%	0%	14%	57%
Standard cardiopulmonary bypass	Yes	16	0%	63%	19%	69%	69%
Surgery / Invasive procedure	No	9	22%	11%	22%	22%	56%
Surgery / Invasive procedure	Yes	46	57%	41%	22%	39%	7%

Platelet increments

Platelet increments were assessed for those episodes where a pre-transfusion and post-transfusion platelet count were available within 6 hours of the episode for patients weighing more than 15kg (table 7) and where the reviewers considered the indication appropriate or probably appropriate. The standard deviation is wide for these increments as many of these patients were actively consuming platelets. No patients with marrow failure without risk factors had the necessary pre and post platelet counts to assess increments in this more stable group. Assessing increments in patients under 15kg was not performed due to the small number of patients with the necessary platelet counts (n=2).

Table 8: *Platelet increments per appropriate adult therapeutic dose equivalent by indication*

Indication	Mean increment ± SD *($x10^9$/L)*	n
Bleeding	17.3 ± 41.8	22
Complicated cardiopulmonary bypass	52.4 ± 30.7	6
Complicated massive transfusion or DIC	24.3 ± 12.5	3
High risk surgery	42.5 ± 9.3	3
Marrow failure with risk factors	30.2 ± 24.4	6
Massive transfusion or DIC	20.5 ± 33.1	24
Platelet function abnormalities	32.5 ± 38.9	2
Standard cardiopulmonary bypass	29.8 ± 36.5	11
Surgery / Invasive procedure	18.4 ± 32.3	17
Overall	24.2 ±34.4	94

NZBS policy is to issue platelets as ABO compatible following the same set of rules that govern red cell transfusions. A small number of transfusion (n=10) required a group cross-over (group A platelets to a group O recipient). The mean increment for these transfusions was 13.9 ± 31.0 $x10^9$/L. The indication for these transfusions were Bleeding, Massive Transfusion/DIC, some complicated, and Surgery.

LIMITATIONS

It is accepted that an audit provides a snap shot of activity over a determined period, so the variation in time needed to collect the required number of episodes may be of consequence.

Blood banks have certain limits on issuing of platelets before medical consultation with a Haematologist or Transfusion Medicine Specialist is required. This oversight affects the use of platelets and may vary from site to site.

Incomplete data sets limited certain aspects of the analysis. Patient weights were infrequently documented and post transfusion platelet counts were frequently not taken within 6 hours of transfusion. Together, this excluded over half the episodes from the analysis of increments. Related to this, the audit did not look for thromboelastograph (TEG) results as an indicator of platelet function. This may have provided additional information about appropriateness of use.

There were seven Transfusion Nurse Specialists collecting data. This permitted a national audit to be performed, but an inherent problem with multiple collectors is that when an episode requires a comment, various interpretations can be placed on that comment. An attempt to reduce this from occurring was made with the format of the form used to collect data and regular telephone and face to face meetings to clarify problems raised during the audit period.

The Transfusion Medicine Specialist review was conducted based on the information provided by the audit. While key points were sought, the data is inevitably not as complete as a full review of each patient's clinical record. This introduces a level of assumption into the assessment of appropriateness. Potential for bias exists, as the two specialists were actively involved in the management of some of the audit episodes. When this was recognised, the specialist withdrew himself from the assessment of appropriateness. However, this did allow for more comprehensive discussion of the episode than would otherwise be possible.

The audit design included more episodes from Auckland than from other DHBs, reflecting that Auckland DHB is the largest consumer of platelets nationally. Although of itself, this introduces an element of skewing, it does partly correct the overrepresentation of lower use DHBs.

Lastly, this audit did not assess the clinical outcome other than the post-infusion platelet counts. While desirable, this would have added considerably to the complexity of the audit, beyond the resources available. Similarly, it was not possible to assess the morbidity or mortality prevented by episodes assessed as inappropriate. Assessments were therefore made in line with international best practice guidelines and clinical experience.

COMMENT

This audit looked at 388 episodes of platelet transfusion across seven of the hospitals that use the most platelets in the country. These hospitals use almost 80% of New Zealand's platelets[4].

The audit found that 87% of episodes were regarded as appropriate or probably appropriate by the reviewers. This assessment took into account the ANZSBT guidelines as well as the

more complex problems facing the clinician at the time of transfusion. This figure compares well to published Australian studies which had levels of 79% for major tertiary hospitals[9] and 88% in another tertiary hospital[10]. In an English audit, platelets were appropriately transfused in 81% of cases[11]. The relevance of appropriateness of transfusion is becoming increasingly important with increasing awareness of the complications of platelet transfusion, such as TRALI, bacterial infection and immunomodulation. In addition, due to the short shelf life of this component, transfusing appropriately is important to maintaining adequate supply of platelets.

It was reassuring to see that 89% of transfusions were with a single adult dose of platelets but of some concern that almost a quarter of transfusions at one hospital were of two adult doses. Platelets are provided as a full therapeutic dose and, while there will be times when more than one is needed, these should be relatively few. On clinical review, at least some of these double-doses appear unjustified, although this was not quantified in the audit.

44% of episodes were for platelets transfused to patients prophylactically. This compares favourably to an American university centre showing 74-78%[5,6] but, of the prophylactic transfusion episodes in this audit, 14% were nevertheless considered inappropriate. It is in the setting of prophylactic transfusion that guidelines become particularly valuable. In particular paediatric cardiac surgery appears to be giving platelets routinely and this practice is questioned.

The number of components used prior to the use of platelets was generally consistent with what was expected. However cryoprecipitate appeared relatively under-utilised in the Bleeding and Massive Transfusion/DIC indications and FFP was frequently used as 2 unit doses, instead of a weight-adjusted dose. Although not specifically captured in the audit, it appeared that Tranexamic Acid was not used as widely as the clinical situations, especially cardiopulmonary bypass and massive transfusion, suggested would be helpful. Tranexamic Acid has a significant role to play in minimising blood loss as well as platelet usage[12].

Mean platelet increment per adult therapeutic dose equivalent was 24 $x10^9$/L, consistent with expectations, although there were wide standard deviations around the increments. The increment for ABO incompatible platelet transfusions was noticeably less at 13.9 x 10^9/L. Although this is what was expected, given that platelets express small amounts of the ABO blood group on their surface, the wide confidence intervals mean that this figure is not statistically significantly different from ABO compatible transfusions.

In summary, this audit has shown good adherence to guidelines and appropriate use of platelets, comparable with, or better than, other published reports. The increase in platelet utilisation is therefore unlikely to be due to inappropriate use.

RECOMMENDATIONS

There appears to be a need to provide education to clinical staff regarding

- The correct dose of platelets
- The triggers for platelet transfusion in international guidelines
- The value of anti-fibrinolytics such as tranexamic acid as an adjunct in bleeding patients.

REFERENCES

1. Wandt H, Frank M, Ehninger G, Scheider C, Brack N, Daoud A et al. Safety and cost effectiveness of a 10 x 10^9/L trigger for prophylactic platelet transfusions compared with the traditional 20 x 10^9/L trigger: a prospective comparative trial in 105 patients with Acute Myeloid Leukaemia. Blood. 1998; 91: 3601-3606.
2. Wallace EL, Churchill WH, Surgenor DM, Cho G, McGurk S, Murphy L. Collection and transfusion of blood and blood components in the United States. Transfusion 1992; 35: 802-812.

3. British Committee for Standards in Haematology, Blood Transfusion Task Force. Guidelines for the use of platelet transfusions. British Journal of Haematology. 2003; 122: 10-23.
4. New Zealand Blood Service. Demand Management Project Reports January 2007.
5. McCullough J, Steeper TA, Connelly DP, Jackson B, Huntington S & Scott EP. Platelet utilisation in a university hospital. JAMA. 1988; 259: 2414-2418.
6. Greeno E, McCullough J, Weisdorf D. Platelet utilization and the transfusion trigger: a prospective analysis. Transfusion. 2007;47:201–205
7. Clinical Practice Guidelines on the use of Blood Components. NHMRC & ASBT 2001
8. ANZSBT guidelines http://www.anzsbt.org.au
9. Schofield WN, Rubin GL, Dean MG. Appropriateness of platelet, fresh frozen plasma and cryoprecipitate transfusion in New South Wales public hospitals. MJA. 2003; 178: 117-121.
10. Hui C-H, Williams I, Davis K. Clinical audit of the use of fresh-frozen plasma and platelets in a tertiary teaching hospital and the impact of a new transfusion request form. Intern Med J. 2004; 35: 283-288
11. Thomson A, Contreras M, Knowles S. Blood component treatment: a retrospective audit in five major London hospitals. J Clin Pathol. 1991; 44:734-737
12. Slaughter TF, Greenberg CS. Antifibrinolytic drugs and perioperative haemostasis. Am J Haem. 1997; 56: 32-36