New Zealand Blood Service

The gift of life

Irradiated Component Usage within New Zealand

Final Report

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EXECUTIVE SUMMARY

Background
Transfusion Associated Graft vs Host Disease (TA-GVHD) is a fatal complication of blood transfusion. Practically, there is no treatment for TA-GVHD. The disease is prevented by providing irradiated components to at-risk patients. These patients are treated by a diverse group of health professionals. The challenge is to ensure that such patients always receive irradiated blood components.

Aim
To ascertain if patients with an absolute indication for irradiated components (as per Australia & New Zealand Society of Blood Transfusion guidelines) received only irradiated components. To assess whether patients who have an irradiated components protocol in place have appropriate diagnoses.

Method
Transfusion Nurse Specialists at six main centres across New Zealand retrospectively collated lists of patients with absolute indications for irradiated components for 2004. The clinical data included the diagnosis and treatment dates. Sources included case mix analysts, paediatricians, haematologists, pharmacists and blood banks. The units transfused, and whether or not these were irradiated, were sourced from Progesa.

Results
484 patients were identified as having attended hospital in 2004 with an indication for irradiated components. 295 (61%) received transfusions. 4606 units in total were transfused of which 330 (7%) were not irradiated. 66 (22%) transfused patients received a mean of 4.8 non-irradiated units (range: 1-34). The diagnosis most strongly associated with patients receiving non-irradiated components was Hodgkin's Disease followed by purine analogue therapy and autologous stem cell harvests (22, 14 and 12 patients respectively). Of the 413 irradiated protocols in place, 70% were absolute indications and 24% were probable indications as per ANZSBT guidelines. Some neonatal units had standing policies to provide irradiated components to all patients. No cases of TA-GVHD were reported in 2004. Not all clinicians agree with all the ANZSBT guidelines with Hodgkin's Disease and Aplastic Anaemia on immunosuppressive therapy being the two most controversial indications. However only one DHB comprehensively addressed indications for irradiated components in its blood transfusion policy and only a few departments in the remaining DHBs had formal policies.

Conclusion
Nearly a quarter (22%) of patients with absolute indications for irradiated components received non-irradiated components. Where Progesa protocols were in place, indications were mainly appropriate and irradiated components were provided.

Recommendations

1. Although the ANZSBT indications for irradiated components are debated by some clinical staff, each hospital needs to make formal decisions regarding which indications must receive irradiated components and for how long.
2. Systems need to be reviewed to ensure that all patients who need irradiated components are notified to Blood Bank.
3. NZBS needs to review its systems to ensure that components such as HLA-matched platelets are irradiated and that protocols are put into Progesa when components such as red cells for exchange transfusion are issued.

BACKGROUND

Transfusion Associated Graft vs Host Disease (TA-GVHD) is a serious complication of blood transfusion which almost always results in death within weeks of occurrence. It arises when lymphocytes within a transfused unit engraft in the patient and reject the patient. Death follows principally as a result of bone marrow failure.

Although blood transfusions have become essential to hospitals since the 2nd World War, this serious adverse event of blood transfusion has only been widely recognised relatively recently. This may be due to the infrequency of the disease and the more common recent use of intensive immuno-suppressive therapies.

The first report of TA-GVHD occurred in infants receiving multiple transfusions of fresh components.[1] Later reports of TA-GVHD included patients who were immuno-suppressed following intensive chemotherapy for malignancies, and finally, there is evidence of immuno-competent patients who were HLA heterozygous, receiving components from homozygous donors and succumbing to TA-GVHD.[2,3]

Apart from immediate stem cell transplantation, for practical purposes, there is no successful treatment for TA-GVHD; therefore the aim is to prevent this disease. This can be achieved by identifying the risk groups and providing irradiated components to these patients. Irradiation prevents lymphocytes within the donation being able to replicate and cause TA-GVHD. Although all blood components in New Zealand are leucodepleted at source, this is not sufficient to prevent TA-GVHD.

Guidelines for the use of irradiated components have been published by several authoritative bodies, including the AABB[4] (formerly American Association of Blood Banks), the British Committee for Standards in Haematology[5] and the Australian and New Zealand Society of Blood Transfusion (ANZSBT)[6]. All three bodies have categorised the indications similarly as absolute, probable or controversial.

AIM

The principal aim of the audit was, to ascertain whether those patients whose clinical condition showed an absolute indication for irradiated components did receive such components.

A secondary aim is to identify those organisations that have a system in place whereby clinical staff can readily inform blood banks of their patient's special requirements. Further aims were to assess the level of exposure to non-irradiated components and the robustness of hospital systems in recognising patients at risk.

METHOD

Six transfusion nurse specialists from Auckland, Counties Manukau, Waikato, Capital & Coast, Canterbury and Otago DHBs undertook the audit. Patients were included in the audit if they attended the DHB during 2004 as an inpatient, or at a day-stay unit where transfusions take place, and had a diagnosis that met the absolute indications for irradiated components.

The diagnoses identified by the ANZSBT guidelines as absolute indications and periods during which irradiated components are required are:

- patients with Hodgkin's disease for life
- patients receiving purine analogues (Fludarabine, Cladrabine, Deoxycoformycin) for life
- allogeneic stem cell recipients for a minimum of 6 months post-transplant (starting from the date of conditioning) or till lymphocytes are $< 1 \times 10^9$ / L or until there is

evidence of GVHD or the patient is on prophylaxis for GVHD - whichever is the longest
- autologous stem cell recipients for a minimum of 3 months post autograft (if total body irradiation was not used in conditioning) or 6 months (if total body irradiation was used).
- patients scheduled to undergo autologous stem cell or marrow harvests - starting a week prior to and up till the completion of the harvest
- aplastic anaemia patients receiving immunosuppressive agents (eg antithymocyte globulin)
- patients with all congenital cellular immune deficiencies (listed in appendix 2) for life
- patients receiving intrauterine or exchange transfusions (provided that irradiation does not unduly delay transfusion) and subsequent top-up transfusions. Although no time limit is specified in either the ANZSBT or BCSH guidelines, this audit followed the UK practice of providing irradiated components up to 1 year old
- patients receiving granulocytes or HLA-matched transfusions (each component requires irradiation)
- patients receiving directed donations of any cellular components from any first or second degree blood relatives (each directed donation being irradiated)

The data was collected retrospectively and included Progesa number, NHI number, the diagnosis and the dates within 2004 when irradiated components were indicated. The audit was overseen by an NZBS Transfusion Medicine Specialist and the data was collated in a Microsoft Access database located on NZBS's internal network with restricted access.

The main sources for identifying patients from the DHBs were the case mix analysts. Each DHB's analyst involved was provided with a standard list of procedures and diagnosis (appendix 3). This ensured standardised collection for the majority of the data. Further information was sourced from hospital pharmacies, haematologists, oncologists and paediatricians to complement the case mix analyst data.

Some patients had more than one indication for irradiated components. Each indication was associated with a period when irradiated components were required. This is referred to as the critical period. Each indication with its associated critical period is referred to as an episode.

The units of cellular components (platelets, red cells and granulocytes) transfused to these patients anywhere in the country during the period when irradiated components were indicated, and whether or not the units were irradiated, was extracted from Progesa, NZBS's national Blood Management System.

The report concentrates on the DHB where the indication was identified, as it is the responsibility of the clinician recognising the indication to ensure that blood bank is notified. Information regarding the DHB where the unit was issued is presented in Appendix 1.

RESULTS

637 episodes (table 1) were captured involving a total of 484 patients. Several patients were included in more than one category due to multiple indications. The median age was 50 years (range: 6 months to 91 years). 9% (n = 46) of patients were paediatric (14 years and younger). 61% (n = 295) were male.

Table 1. *Number of episodes per indication audited.*

Indication	Episodes
Purine analogue treatment (fludarabine, cladrabine, deoxycoformycin)	185
Autologous stem cell harvest	126
Hodgkin's Disease	100
Autologous stem cell recipient	91
Allogeneic stem cell recipient	73
HLA-matched transfusion recipient	21
Congenital cellular immune deficiency	15
Aplastic anaemia on immuno-suppressive treatment	12
Intrauterine and/or neonatal exchange including post-exchange top-up transfusions	12
Granulocyte transfusion recipient	1
Total	**637**

61% (n=295) of patients were identified as receiving a transfusion in 2004 during their critical period. 22% (n=66) of the patients receiving a transfusion received one or more non-irradiated units. A mean of 4.8 non-irradiated units (range: 1 - 34) were transfused.

Table 2: *Diagnoses, patient numbers and irradiated vs non-irradiated units transfused by DHB*

DHB	Diagnoses	Unique patients	Total units transfused	Non irradiated units	Non irradiated units
Auckland	268	200	2088	152	7%
Canterbury	185	139	941	68	7%
Capital & Coast	77	62	648	59	9%
Counties Manukau	13	13	110	15	14%
Otago	23	23	123	9	7%
Waikato	74	56	696	27	4%
Total	640	493	4606	330	7%

A total of 4606 units were transfused during the critical periods for all the indications. 7.2% (*n* = 330) of the total number of units issued during the critical period were non-irradiated (table 2).

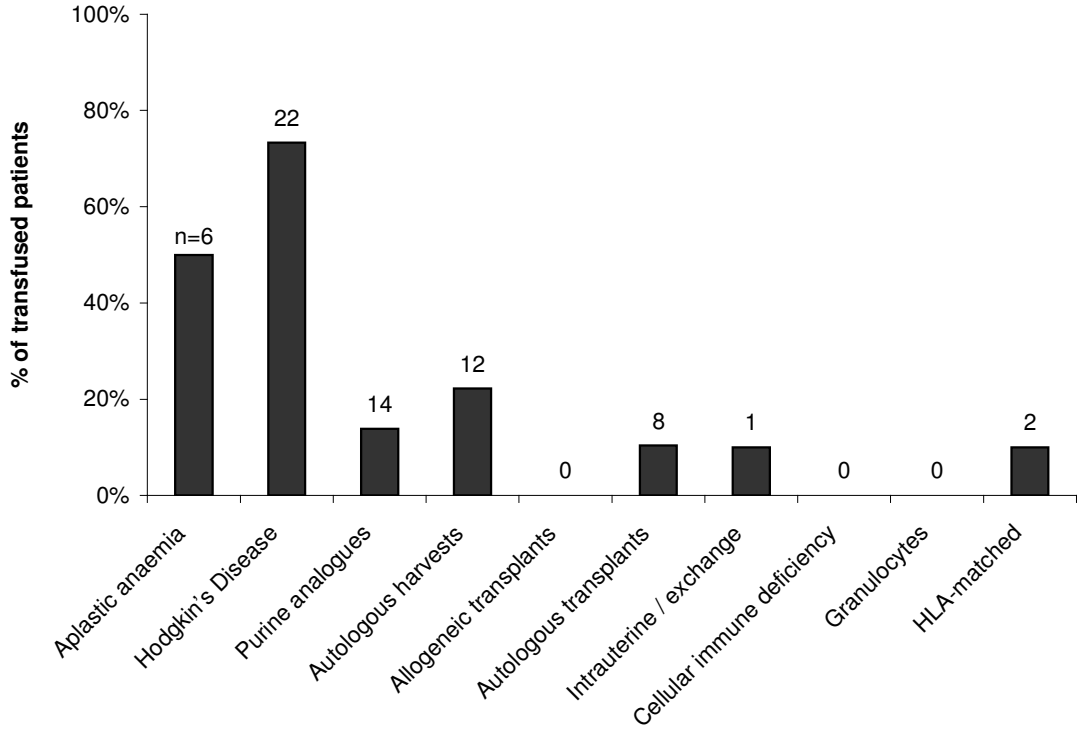

Figure 1. *Percentage of transfused patients receiving non-irradiated units by indication***.**

The percentage of patients receiving non-irradiated units (figure 1) varied by indication. This ranged from 0% for allogeneic transplant patients, congenital cellular immune deficiencies and granulocyte recipients to 73% for Hodgkin's Disease.

Specific Indications

All patients with Aplastic Anaemia (table 3) received blood components during the audited period, including a total of 77 non-irradiated blood components during the critical periods of their treatment. Patients received transfusions over periods ranging from 1 day to 7 months. The number of units transfused ranged from 2 to 34 units per patient. Half the transfused patients received non-irradiated components. Only three patients had a Progesa protocol and these patients received only irradiated components once the blood bank had been notified. Difficulties in identifying patients with Aplastic Anaemia are discussed in later in this report under Limitations.

Table 3: *Irradiated vs non-irradiated units in Aplastic Anaemia on immunosuppressive therapy*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	134	37	28%	7	7	4
Canterbury	17	6	35%	1	1	1
Capital & Coast	46	34	74%	2	2	1
Waikato	5	0	0%	2	2	0
Totals	**202**	**77**	**38%**	**12**	**12**	**6**

30% of Hodgkin's Disease patients identified during the audit (table 4), required a transfusion with almost three-quarters of transfused patients receiving a non-irradiated unit. 7% of patients (n=7) had a Progesa protocol, (6 from Canterbury, 1 from Auckland) with all patients receiving irradiated components following notification of such a requirement. Of note is that Auckland DHB Haematology Department have excluded Hodgkin's Disease from their list of indications for irradiated components. This is discussed further under Hospital Policies and Conclusions.

Table 4: *Irradiated vs non-irradiated units in Hodgkin's Disease*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	124	44	35%	47	13	9
Canterbury	125	55	44%	30	13	9
Capital & Coast	12	12	100%	10	1	1
Otago	7	7	100%	2	1	1
Waikato	18	15	83%	11	2	2
Total	**286**	**133**	**47%**	**100**	**30**	**22**

Purine Analogue recipients (table 5) were the single largest group of patients included in the audit. 183 patients (185 patient episodes) received a total of 2173 units. 8% (n=14) of patients received 57 non-irradiated units following purine analogue treatment. There were differences between DHBs ranging from full compliance for 2 DHBs to varying compliance for 4 DHBs. 41% (n=75) of the patients had a Progesa protocol. One DHB transfused 8% (n=1) of their patients with non-irradiated components. This hospital was not connected to Progesa in 2004. All patients who had a Progesa protocol received irradiated components following notification.

Table 5: *Irradiated vs non-irradiated units in Purine Analogue recipients*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	757	33	4%	73	35	9
Canterbury	353	7	2%	45	21	3
Capital & Coast	346	0	0%	14	12	0
Counties Manukau	110	15	14%	13	8	1
Otago	116	2	2%	19	9	1
Waikato	491	0	0%	21	16	0
Total	**2173**	**57**	**3%**	**185**	**101**	**14**

121 patients underwent 126 autologous stem cell harvest procedures (table 6). 10% (n=12) of patients, at 3 of 4 hospitals, were transfused a total of 21 non-irradiated units during the critical period. 56% (n=68) of patients had a Progesa protocol requiring irradiated components. All patients who had a Progesa protocol received irradiated components from the date of notification.

Table 6: *Irradiated vs non-irradiated units in Autologous Stem Cell/Bone Marrow Harvests*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	29	6	21%	39	12	3
Canterbury	94	0	0%	49	28	0
Capital & Coast	17	7	41%	16	7	4
Waikato	38	8	21%	17	7	5
Total	**178**	**21**	**12%**	**121**	**54**	**12**

73 allogeneic bone marrow transplants in 71 recipients (table 7) were included in the audit and involved 3 hospitals. All patients in this group had a protocol in Progesa and received only irradiated components.

Table 7: *Irradiated vs non-irradiated units in Allogeneic Transplant Recipients*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	647	0	0%	39	33	0
Canterbury	182	0	0%	21	15	0
Capital & Coast	129	0	0%	11	9	0
Total	**958**	**0**	**0%**	**71**	**57**	**0**

90 patients underwent 91 autologous stem cell transplants (table 8). 9% (n=8) received 36 non-irradiated components during the critical period. 69% (n=62) of patients had a protocol in Progesa requiring irradiated components. All patients who had a protocol received irradiated components from the date of notification.

Table 8: *Irradiated vs non-irradiated units in Autologous Stem Cell/Bone Marrow Recipients*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	238	27	11%	36	25	6
Canterbury	163	0	0%	23	22	0
Capital & Coast	54	5	9%	13	12	1
Waikato	135	4	3%	18	18	1
Total	**590**	**36**	**6%**	**90**	**77**	**8**

12 neonatal patients were identified as having received an intrauterine or exchange transfusion (table 9). Top-up transfusions were included in the data analysed. One patient received three non-irradiated units. This patient had received an irradiated intra-uterine transfusion but the subsequent three top-up transfusions were not irradiated. This hospital did not have a policy of universal irradiating all units for neonatal departments. All other centres have universal irradiation to neonatal departments. No patient in this group had a Progesa protocol.

Table 9: *Irradiated vs non-irradiated units in Intrauterine / Neonatal Exchange Transfusions & top-ups*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	4	3	75%	3	2	1
Canterbury	5	0	0%	3	2	0
Capital & Coast	5	0	0%	5	5	0
Waikato	3	0	0%	1	1	0
Total	**17**	**3**	**18%**	**12**	**10**	**1**

15 patients with congenital cellular immune deficiency were identified (table 10). 26% (n=4), all in Auckland, required transfusion (n=74 units) during the audit period and all patients received irradiated components, although none had a Progesa protocol.

Table 10: *Irradiated vs non-irradiated units in Congenital Cellular Immune Deficiency*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	74	0	0%	9	4	0
Canterbury	0	0	0%	3	0	0
Capital & Coast	0	0	0%	1	0	0
Otago	0	0	0%	2	0	0
Total	**0**	**0**	**0%**	**15**	**4**	**0**

1 granulocyte transfusion recipient was identified and this unit was irradiated.

There were 21 HLA matched patient episodes (table 11) involving 20 patients who received 127 HLA matched platelets. 2 patients received 3 non-irradiated matched units. A Progesa protocol is not required for HLA-matched platelets, as all these units should have been irradiated at source by NZBS.

Table 11: *Irradiated vs non-irradiated units in HLA Matched Platelet Recipients*

DHB	Units transfused	Units not irradiated	Units not irradiated %	Patients with diagnosis	Patients transfused	Patients receiving non-irradiated units
Auckland	80	2	3%	10	10	2
Canterbury	2	0	0%	3	3	0
Capital & Coast	39	1	3%	5	5	0
Waikato	6	0	0%	2	2	0
Total	**127**	**3**	**2%**	**20**	**20**	**2**

No cases of Transfusion-Associated Graft-vs-Host Disease were reported to NZBS for 2004.

PROTOCOLS

Protocols were recorded in Progesa for 341 patients with 409 indications identified for these patients (appendix 4). 70% (n=286) were absolute indications, 24% (98) were possible indications and 2% (10) were for indications with no evidence of benefit according to ANZSBT guidelines. In a further group of 4% (n=15), the indication was not listed in the guidelines. A proportion of the protocols described in the ANZSBT as having no evidence of benefit came from a paediatric haematology unit where it is protocol to request an irradiation protocol on all patients to prevent a patient with a definite indication from being missed.

HOSPITAL POLICIES

Because not all of the ANZSBT indications have universal acceptance, DHB policies were obtained by the six Transfusion Nurse Specialists. Only Canterbury and Capital & Coast DHBs listed indications for irradiated components in their DHB blood transfusion policies. Canterbury's list was very similar to the ANZSBT guidelines with the exception that premature and very low birth weight babies were an absolute indication, and purine analogue recipients were a discretionary indication. Stem cell harvests and granulocyte transfusions were excluded. Capital & Coast required irradiated components for exchange transfusion and listed premature infants weighing <1200g, leukaemia, haematological malignancies with lymphopenia and therapeutic antibodies against T-cells as possible indications for irradiated components.

Several hospital departments had local policies in place. Waikato and Wellington hospitals require irradiated components for all patients in neonatal units. Auckland hospital had a policy requiring irradiated components for all patients admitted to the paediatric haematology ward. Auckland adult haematology had a policy requiring irradiated components for bone marrow/stem cell transplants, aplastic anaemia patients, purine analogue recipients and HLA-matched component recipients but without time limits. Hodgkin's Disease, stem cell harvests and granulocyte recipients were excluded from the policy. Dunedin Hospital uses the Christchurch Haematology Manual, which uses the ANZSBT guidelines as indications, but this is not a policy document. The local Haematology/Oncology handbook lists only post bone marrow transplant, certain immune deficiencies and prolonged immunosuppression eg aplastic anaemia.

LIMITATIONS

There were six Transfusion Nurse Specialists collecting clinical data from the DHBs involved. NZBS Progesa Team members supplied transfusion details of each patient episode. This two stream approach permitted a national audit to be performed, and reduced the potential for observer bias. Regular telephone and face to face meetings between the Transfusion Nurse Specialists and the Medical Supervisor occurred to clarify problems raised during the audit.

Diverse approaches were required to obtain information for the audit as each hospital had their own electronic patient management systems.

There was also variation between hospitals in how patients are coded. For example if a department relies on the discharge letter written by junior medical staff to code a patient, this may not be as comprehensive as one written by senior medical staff. This may have been true for a patient booked for a bone marrow biopsy but coded as having received a transplant.

Initially more than 30 patients were identified as having had Aplastic Anaemia from a single hospital. On investigation it transpired that pancytopenia of any cause received

the same code as Aplastic Anaemia. A further example of coding errors was identified where a patient was booked for an autologous stem cell transplant, which was cancelled, but according to hospital coding records the patient underwent the procedure.

Some hospitals were unable to provide complete information and this required Transfusion Nurse Specialists to search through patient notes and contact consultants for more information. This may have provided more information for particular episodes but such a process cannot be standardised which weakens the audit.

As some small, typically rural, hospitals, with bed numbers less than 50, do not have access to Progesa, it is possible that patients with indications for irradiated components were transfused and not included in the audit. Transfusion records of patients at these hospitals were not included in the audit. Subsequent information has identified a single patient transfused at such an outlying hospital.

One factor confounding this audit was nine instances where units were irradiated, but were not correctly recorded as such in Progesa. This occurred in blood banks where the staff has ready access to an irradiator. The procedure regarding documenting irradiation was reviewed during 2005 separately to this audit.

CONCLUSION

This report has shown that there is significant non-compliance and inconsistency in providing irradiated components to at-risk patients in New Zealand hospitals. 22% of patients transfused cellular components during the critical period of their treatment received non-irradiated components. There were variations between patient diagnoses ranging from 47% to 100% of units irradiated.

Patients with aplastic anaemia who were immuno-compromised were more likely than any other group to receive a non-irradiated component. It is however acknowledged that this indication is not included in the British Committee for Standards in Haematology (BCSH) guidelines[5] and has been questioned by some haematologists. As only 25% of the patients had a request for irradiated components this may suggest that some clinicians are following the British guidelines for this indication. This is an area where more effective communication between clinicians and NZBS would be helpful in ensuring that those patients who do require irradiated components actually receive them.

The next most likely indication to receive a non-irradiated component was Hodgkin's Disease. 30% of patients with Hodgkin's Disease audited required a blood transfusion with 73% of transfused patients receiving at least one non-irradiated component. Numerically this was the largest group of patients receiving non-irradiated components (23 patients). This supports anecdotal evidence from some Transfusion Nurses that some clinicians do not agree with international recommendations that Hodgkin's Disease patients should have irradiated components and the clinicians only request irradiated components if the patient has another indication that puts them at risk, such as a stem cell transplant. Auckland DHB have formalised this by excluding Hodgkin's Disease from their Haematology Department's list of indications for irradiated components.

ANZSBT and BSCH guidelines[4,5,6] strongly recommend that irradiated components are required for patients undergoing either allogeneic or autologous stem cell transplants. All patients undergoing an allogeneic transplant received irradiated components suggesting that there is general awareness and systems in place to ensure that patients received irradiated components. However, with autologous recipients, 8 patients from 3 hospitals received non-irradiated components. Only one hospital

(Canterbury) provided irradiated components to all patients having both autologous harvests and transplants and all of Canterbury's patients had a Progesa protocol requesting irradiated components. Outside Christchurch, only 42% of patients had a Progesa protocol requiring irradiated components for autologous stem cell harvests or transplants, so it may be useful for other hospitals to look at their notification systems to ensure better compliance.

Similarly, the single largest group of patients, purine analogue recipients, displayed differences in compliance between hospitals. In this audit, nearly 55% of patients receiving purine analogues required blood components, making it important to ensure these patients are identified to blood banks. Two hospitals, Wellington and Waikato, had Progesa protocols on all these patients. However, overall, less than 59% of the audited patients had a documented request for irradiated components, despite a manufacturer's warning in the package insert recommending that recipients must receive irradiated components. Anecdotally, it appears some clinicians believe that components only need irradiation for the first six months after therapy with purine analogues.

The hospital that transfused 14% (n=1) of its purine analogue recipients with non-irradiated units did not have access to the NZBS Progesa registry at the time of the audit, although they did have an internal alerting system. Staff at this hospital were required to send written requests to NZBS for irradiated units for their patients but did not keep the records to show this for the audit. It appears that non-irradiated units were sent and the receiving staff may have assumed them to be irradiated. This is unlikely to happen in the future as this hospital is now connected to NZBS Progesa but highlights that irradiated units need to be clearly identifiable.

Some hospitals have policies in place where a particular department is sent only irradiated components, regardless of whether they have been requested or not. This ensures that all patients in that department receive the appropriate component. Neonatal intensive care units are an example of this, and the audit showed that those hospitals that have universal irradiation to these departments complied fully with the ANZSBT guidelines. One hospital, where this policy was not in place, had a patient who received a non-irradiated component.

The guidelines indicate that the group of patients diagnosed with a rare congenital cellular immune deficiency should receive irradiated components. The audit identified 15 patients with 26% (n=4) requiring 74 transfusions. Despite no evidence of Progesa protocols for any of these patients, all received irradiated components. All patients in this group were under 14 years of age and it is possible that there is a greater awareness of TA-GVHD in the blood banks for this indication. The unit where these patients were transfused did not require irradiation for all units as practised in other neonatal intensive care units.

127 HLA-matched platelet units were transfused during the audit period. It is the responsibility of NZBS to supply such units and irradiation is an integral part of the procedure, however, in 3 instances 2 patients received non-irradiated units. This suggests that the NZBS procedures will need to be reviewed to avoid this happening in the future.

The majority (70%) of irradiation protocols in place in Progesa was for absolute indications. 5% of protocols were for indications that were either not listed or were graded as 'no evidence' in the guidelines. (Appendix 4). Some of these were from a haematology unit where the practice is to request a Progesa protocol on all patients irrespective of indication.

Few DHBs include indications for irradiated components in their blood transfusion policies although more have local policies in specific departments. Although some of the indications in the ANZSBT guidelines are controversial, the lack of reference to a policy or set of guidelines is of concern.

The principal aim of the audit has been achieved by determining the extent of compliance. The groups of patients audited are complex, often treated by several groups of health professionals, in various settings, across DHB borders. Added to that complexity, the supply of blood is from an organisation separate from the DHBs. It therefore is not surprising to find a level of non-compliance throughout New Zealand.

The secondary aim, to identify which organisations have systems in place to ensure that patients receive the appropriate component, was, to a lesser extent, achieved. The audit identified that hospitals used a variety of paper based systems to notify their blood bank of requirements for irradiated components.

Canterbury was able to provide irradiated components to all patients who underwent allogeneic or autologous stem cell transplants and autologous stem cell harvesting. Similarly, Waikato and Wellington were able to provide irradiated components to all patients who had been treated with purine analogues. This suggests that there is a certain level of robustness in their notification systems. A detailed examination of the systems used by these hospitals may highlight methods to improve communication for patients at risk of TA-GVHD.

It should be noted that regardless of indication audited, and provided that the hospital had access to Progesa, all patients with a Progesa protocol requiring irradiated components received only irradiated components. This suggests that having national registries in the health industry can assist in providing a good service to the public.

RECOMMENDATIONS

1. Although the ANZSBT indications for irradiated components are debated by some clinical staff, each hospital needs to make formal decisions regarding which indications must receive irradiated components and for how long.
2. Systems need to be reviewed to ensure that all patients who need irradiated components are notified to Blood Bank.
3. NZBS needs to review its systems to ensure that components such as HLA-matched platelets are irradiated and that protocols are put into Progesa when components such as red cells for exchange transfusion are issued.

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APPENDICES

Appendix 1: *Irradiated vs non-irradiated units issued by issuing hospital*

Facility	Total	Non irradiated	Irradiated
Auckland Hospital	1092	141	951
Wellington Hospital	550	37	513
Christchurch Hospital	924	65	859
Christchurch Women's Hospital	4	0	4
Dunedin Hospital	97	9	88
Gisborne Hospital	2	0	2
Hastings Hospital	2	0	2
Masterton Hospital	22	21	1
Middlemore Hospital	110	15	95
National Women's Hospital	4	3	1
North Shore Hospital	40	1	39
Palmerston North Hospital	1	1	0
Rawene Hospital	4	4	0
Southland Hospital	29	0	29
Starship Hospital	1018	3	1015
Taupo Hospital	10	0	10
Tauranga Hospital	41	3	38
Waikato Hospital	634	27	607
Wairau Hospital	7	0	7
Whakatane Hospital	12	0	12
Whangarei Hospital	3	0	3
Total	**4606**	**330**	**4276**

Appendix 2: *Guidelines used in this audit for congenital immune deficiency states with predominant defect of cell mediated immunity*

Cellular immune deficiencies in which TA-GVHD has been reported	Cellular immune deficiencies in which TA-GVHD has NOT been reported (not included in this audit)
SCID	Adenosine deaminase deficiency
Di George's Syndrome (3rd and 4th arch/pouch syndrome)	MHC class I deficiency
Wiskott-Aldrich syndrome	MHC class II deficiency
Purine nucleoside phosphorylase deficiency	Leucocyte adhesion deficiency
Reticular dysgenesis	Omenn's syndrome (immunodeficiency with eosinophilia)
Cell mediated immunodeficiency not otherwise classified	Ataxia telangiectasia
	Chronic mucocutaneous candidiasis

Appendix 3: *List of procedures and diagnoses used by case-mix analysts to extract data*

Disorder	Codes	Code's Meaning
Hodgkin's Disease (including subtypes)	C81.0	Lymphocytic predominant Hodgkin's Disease
	C81.1	Nodular sclerosing Hodgkin's Disease
	C81.2	Mixed cellularity Hodgkin's Disease
	C81.3	Lymphocyte depleted Hodgkin's Disease
	C81.7	Other Hodgkin's Disease
	C81.9	Hodgkin's Disease, unspecified
Purine analogues	-	
Stem cell Transplants	13706-00	Allogeneic marrow/stem cell transplant
	13706-06	Allogeneic marrow/stem cell transplant
	13706-09	Allogeneic marrow/stem cell transplant
	13706-10	Allogeneic marrow/stem cell transplant
	13706-07	Autologous marrow/stem cell transplant
	13706-08	Autologous marrow/stem cell transplant
Stem cell harvests	13750-04	Stem cell harvest
	13750-05	Stem cell harvest
	13700-00	Bone marrow harvest
Aplastic anaemia	D61.3	Idiopathic Aplastic Anaemia
	D61.9	Aplastic Anaemia NOS
Intrauterine and Neonatal exchange transfusions	16609-00	Intrauterine fetal transfusion
	16612-00	Intrauterine fetal transfusion
	16615-00	Intrauterine fetal transfusion
	13306-00	Exchange transfusion
	92206-00	Exchange transfusion in infant
Congenital Cellular Immune Deficiencies	D81.0	SCID with reticular dysgenesis
	D81.1	SCID with low B & T cell numbers
	D81.2	SCID with low or normal B cell numbers
	D81.3	ADA deficiency
	D81.4	Nezelof's syndrome (immune deficiency due to absence of thymus)
	D81.5	PNP deficiency
	D81.6	MHC class I deficiency
	D81.7	MHC class II deficiency
	D81.8	Other combined immunodeficiencies
	D81.9	Combined immunodeficiency unspecified
	D82.0	Wiskott-Aldrich syndrome
	D82.1	Di George's Syndrome
	D82.2	Immunodeficiency with short-limbed stature
	D82.3	Immunodeficiency following hereditary defective response to EBV
	D84.0	Lymphocyte adhesion deficiency (LFA-1 defect)
	D82.8	Immunodeficiency associated with other specified major defect
	D82.9	Immunodeficiency associated with major defect, unspecified
	(see SCID)	Omenn's syndrome
	?	Ataxia telangiectasia

Appendix 4: *Irradiation protocols in Progesa by indication*

ANZSBT Grade	Indication	n
Absolute	Allogeneic and Autologous Bone Marrow/PBSC Transplant donor	3
	Allogeneic and Autologous Bone Marrow/PBSC Transplant recipient	145
	Aplastic anaemia receiving immunosuppressive therapy	8
	HLA matched single donor platelets	9
	Hodgkin's Disease	11
	Intrauterine and all subsequent transfusion and neonatal exchange transfusions	2
	Received purine analogues	108
Possible	Acute Leukaemia	48
	B cell malignancy receiving chemotherapy and/or radiotherapy leading to lymphopenia <0.5 x 109/L	18
	Chronic Myeloid Leukaemia	3
	Haemophilia	1
	High dose chemotherapy and/or irradiation sufficient to cause lymphopenia <0.5 x 109/L	17
	Receiving long term or high dose steroids as therapy for their malignancies	7
	T Cell malignancy	3
	Therapeutic antibodies against T cells	1
No evidence	Chemotherapy and/or irradiation not sufficient to cause lymphopenia <0.5 x 109/L	2
	Thalassaemia, sickle cell dissease, hereditary spherocytosis, Glanzman's thrombaesthenia, AIHA	8
Not listed in ANZSBT Guidelines	Other: end-stage renal disease	1
	Other: multiple cardiac/medical problems	1
	Other: neonatal thrombocytopenia	1
	Other: not stated	6
	Other: solid organ transplantation (liver, renal)	6