Contents

Prolonged responses to rituximab in patients with immune thrombocytopenia: Extended follow up of a randomized trial (041)

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Background:

Rituximab is commonly used to treat patients with immune thrombocytopenia (ITP). Approximately 60% of patients will achieve a platelet count response; however, the duration of response is uncertain and few clinical trials have reported results beyond 6 months.

Aims:

The aim of this study was to determine the duration of response to rituximab in non-splenectomised adult patients with ITP who were enrolled in placebo controlled trial after extended follow up.

Methods:

We followed patients who had received rituximab as part of the Canadian multicenter randomized trial of adjuvant rituximab or placebo for the treatment of ITP. Patients had primary ITP, were over 18 years of age, received 4 weekly infusion of rituximab (375mg/m2) and completed 6 month follow up on the main trial. Platelet counts, bleeding and clinical data were collected retrospectively for up to 3.5 years. Complete response (CR) and overall response (OR) were defined as the achievement of a platelet count >100 x 109/L and >30 x109/L with doubling from baseline respectively, without additional treatment. The aim was to determine duration of response at the end of follow up. The outcomes of patients who failed therapy in the original study were also evaluated.

Results:

After the main trial (initial 6 months) 12/32 patients in the rituximab group had a complete response. Of those, 9 patients (28.1%) maintained a complete response until the end of follow up (Median 27.4, IQR 16.2 – 35.4). There were 13/32 patients who achieved an overall response after rituximab in the main trial; of those, 10 (31.3%) maintained an overall response. In the placebo group, 4/26 patients achieved and maintained a complete response until the end of follow up. Additional therapies administered to patients who did not achieve a response to rituximab (n=10) included splenectomy (n=5), thrombopoietin receptor agonists (n=2) and immunosuppressive therapy (n=3). Response to additional therapy was reported in 8/10 patients (5 with CR and 3 with OR).

Conclusion:

Complete platelet count responses after rituximab are sustained in approximately 28% of ITP patients after 3.5 years of follow up. These data help inform long term platelet count outcomes after rituximab treatment.

Monoclonal antibodies can supress the immune response to foreign erythrocytes independent of Fcγ receptor mediated red blood cell clearance and B-cell inhibition (074)

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Polyclonal anti-D has been used to prevent RhD-negative mothers from becoming immunized against RhD positive erythrocytes during pregnancy and this mechanism has been referred as “antibody-mediated immune suppression” (AMIS). Although anti-D prophylaxis has been highly successful, the inhibitory mechanisms remain poorly understood. Two major theories behind AMIS involve the binding of IgG to activating or inhibitory Fcγ receptors which can induce either erythrocyte clearance or immune inhibition, respectively. In this work, we explored the absolute role of activating and inhibitory FcγR in the AMIS mechanism mediated by monoclonal antibodies using the HOD mouse model of red blood cell (RBC) immunization. HOD transgenic mice contain a RBC specific recombinant protein comprised of the hen egg lysozyme (HEL) in tandem sequence with ovalbumin and the human transmembrane Duffy antigen, and erythrocytes from HOD mice can stimulate an immune response to the HEL on the RBC. To assess the contribution of activating and inhibitory Fcγ receptors to AMIS, C57BL/6 vs Fcγ chain-/- or FcγRIIB-/- mice were used as recipients of HOD-RBC alone or together with anti-HEL or anti-Duffy monoclonal antibodies (i.e., AMIS) and the resulting immune response to the HEL antigen evaluated. We definitively establish that anti-HEL monoclonal antibodies suppress the antibody response to HOD RBCs in mice lacking the activating or inhibitory IgG binding receptors, as compared to wild-type mice. In addition, anti-Duffy monoclonal antibodies that have epitope specificity distinct from the humoral-immune target, also significantly reduced the antibody response to the HOD cells in mice deficient for these receptors. In conclusion, successful inhibition of in vivo antibody responses to HOD-RBCs by monoclonal IgG can occur independently of Fcγ receptor mediated red blood cell clearance or FcγRIIB-dependent B-cell inhibition. These results may have implications for the understanding of RhD prophylaxis by monoclonal antibodies as well as for the design of new recombinant therapeutics based on monoclonal antibodies to ultimately replace anti-D.

Use of Process Mapping to Accurately Benchmark Equivalent Red Cell Inventory Processes at Multiple Hospital Sites at a Distributed Transfusion Service in Atlantic Canada (058)

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Background: Conventional benchmarking involves comparing different centers and their key performance (KPIs) or quality indicators. These indicators classically involve performance describing variables such as discard or expiry rates, issuable stock index, turnaround times, and other aggregated characteristics. Most KPIs represent the cumulative effect of multiple process steps; however, no efforts have been made to compare those interim process steps to each other at different centers to gain a higher resolution understanding of the overall process. We describe a scalable and novel technique using process mapping to create and visualise red blood cell (PRBC) inventory handling benchmarks, at our institution.

Methods: PRBC state data from April 1, 2013 – March 31, 2014 was queried from the Capital Health Authority's laboratory information system (Halifax, NS). Data included blood group, location, time stamps, and activity states of all PRBC units at the four hospital transfusion sites (Halifax Infirmary [HI], Dartmouth General [DGH], Victoria General [VG], Hants Community [HC]).

Results: There were 13778 unique PRBC units during the time period. The mean case duration, representing the end-to-end receipt and disposition of a PRBC unit, was 10.9days. There were 4418 variants, with each variant representing a common process pathway for PRBC processing. Among the PRBC units pathways examined, there were three major PRBC handling steps regionally and outliers are identified: 1) Unconfirmed à available: all blood groups with mean of 1.1-2.2 hours, HC at 3.4 hrs, except Aneg at 10.2hrs; 2) Available à crossmatched: DGH Bneg at 14.5 days vs. HI at 7.6 days, HC Oneg/Opos at 12.6/14.2 days vs 1.0-4.9days regionally for O Pos primarily, A Pos at 11.2days vs 3.4-6.0days regionally; HI ABneg at 11.7days; 3) Available à transferred to HI: HC held all units except ABNeg and BNeg between 10.8-21.0days; DGH held Aneg, Bneg, and Oneg for 18.1, 19.0, and 15.8 days respectively, and up to 8.5 days for other blood groups. (Full tables and process maps not in abstract.)

Conclusion: We demonstrate the use of process mapping to discover and benchmark processes between our transfusion sites at high resolution. This first step in understanding is crucial to increase the efficiency of our PRBC handling practices. Furthermore, this process could also be used to benchmark institutions with each other.

How Long To Detain a Transfusee? Hemovigilance Data To Guide Post-Administration Observation Duration Policies. (023)

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Purpose: Longer retentions for pre-discharge review assume better capture of post-transfusion reactions while keeping patients close to expedient management. However, this safety is purchased at the expense of increased resources and reduced patient turnover. To better inform stakeholders on the risks of discharge at various post-transfusion cut-points, we examined when post-completion transfusion reactions occurred.

Methods: Between 1/Jan/2010 – 7/Jun/2014 (4.5 years), 1422 patient reaction events were logged at a single institution. Reactions were sorted according to onset time in relation to completion, with an examination of accrued proportions by cut-point. Reactions severity (overall) was also sorted by time-of-onset distribution.

Results: Of 1413 analyzable events, 454 patient-reaction-events [PRE] (48%) were reported from an outpatient transfusion setting. From the total, 367 patients (26%) suffered a PRE which curtailed the intended transfusion, while 98 (7%) provided insufficient information to determine whether the implicated product(s) had been fully infused. The remaining 948 PRE (67%) had documentation of completed infusions, with 674 (71%) having sufficient time-based data for analysis.

Of those who received 100% of the order, 66 (10%) exhibited their disturbances before completion. The vast majority of PRE were noted at completion, with 405 patients reacting 0 minutes after the completion time (60%). The remaining 203 PRE (30%) exhibited a range of post-completion onset times: mode, median and mean at 20, 42 and 23.2 minutes, respectively.

The median time to a delayed reaction was 35 minutes for minor reactions (124 patients), 45 minutes for moderate reactions (54 patients), 1 hour for severe reactions (17 patients), and 1h:9min for life-threatening/eventually fatal reactions (8 patients). Post-transfusion discharge at the mode of 20 minutes would discover ¼ of delayed PRE; 45 minutes would discover ½ (and most mild to moderate PRE events); 1 hour would discover >60% of (and most severe) PRE; 1h:30min would discover ¾ of PRE (and PRE associated with fatal outcomes); 2h would discover 80%; and 3h would discover 86%.

Conclusions: The published standard of 1h in the aaBB Technical Manual appears statistically well-grounded. It is necessary to balance precautionary gains with costs and patient preferences.

RHD genotyping for prenatal patients with a serologic weak D phenotype (027)

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Introduction

In 2014, the College of American Pathologists (CAP) Transfusion Medicine Resource Committee (TMRC) recommended genotyping of prenatal patients with a discordant and/or serologic weak D phenotype. Patients found to be weak D types 1, 2, or 3 are treated as D+, avoiding Rh immune globulin. This is already the policy for CBS prenatal programs in western Canada. In Ontario and Nova Scotia, samples are being sent to CBS from selected hospitals for D genotyping. We compared results from Ontario and Nova Scotia with those obtained in Alberta and anticipated by TMRC.

Design and Methods

The number of pregnancies per province was taken from Statistics Canada. Results of the Alberta prenatal testing laboratory (2013) and genotyping cases from Ontario and Nova Scotia (2014) were compiled. US data on percentage of samples predicted to require genotyping and expected to be weak D type 1, 2, or 3 was taken from the Transfusion manuscript by Sandler.

Results

In Alberta, 54 samples were sent for genotyping out of 54,211 pregnancies (0.1% of all pregnancies, 0.69% of D- pregnancies). In Ontario, 67 samples were received out of 141,224 pregnancies (0.047% of all pregnancies, 0.33% of D- pregnancies). In Nova Scotia, 44 samples were received out of 8,675 pregnancies (0.51% of all pregnancies, 3.5% of D- pregnancies). 65% (Alberta) and 59% (Ontario and Atlantic) of samples genotyped were weak D type 1, 2, or 3.

Conclusions

Adoption of genotyping for weak D is likely nearly complete in Nova Scotia, but low in Ontario. Sandler et al predict that 0.44% of pregnancies, or 3% of D- pregnancies, would require genotyping and 80% of these would be weak D type 1, 2, or 3. Both the percentage of pregnancies requiring genotyping and the percentage of genotyped samples that are weak D type 1, 2 or 3 may be overestimated by Sandler. Likely many of these samples are being typed as D+ in current serologic algorithms. The different racial composition in Canada vs the US may contribute to differences. The vast majority of samples sent for genotyping demonstrate a variant, in some cases only found on sequencing.

IDENTIFICATION OF RHCE VARIANTS IN OUR PATIENT & DONOR POPULATION (032)

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PURPOSE: To determine the RHCE variants present in frequently transfused patients and in our donor population. Variants are predominantly associated with altered C and e antigens.

METHOD: Blood group genotyping was performed from March 2014 to February 2015 using the Progenika IDcoreXT assay which interrogates common RHCE variants associated with production of Rh alloantibodies. Samples from approximately 300 patients with sickle cell disease, thalassemia or with other chronic transfusion needs referred to the National Immunohematology Reference Laboratory (NIRL) and approximately 250 largely randomly selected donors were tested.

RESULTS: 21 patients had at least one variant allele: 12 would not express variant antigens due to the presence of 1 normal allele paired with the variant allele; 9 would express variant Rh antigens, as they were homozygous for a single variant allele or heterozygous with 2 variant alleles. Patient group variants included RHCE: ce(733G), ceAR, ce(733G,1006T), ce(712G) and the hybrid D-CE-D gene RHD*r'S-RHCE*ce(733G,1006T). 12 donors had at least one variant allele: 9 would not cause variant RhCE antigen expression; 3 would. Donor group variants included RHCE: ce(733G), ceAR and ce(733G,1006T).

CONCLUSION: The identified RHCE variants are common in the African-Canadian population. Blood group genotyping may reveal clinically relevant variants not identified by phenotyping alone. Some of these variants are commonly inherited with variant D alleles encoding for a partial D. Increased recruitment and genotyping of African-Canadian donors may facilitate transfusion support for these patients.

Various Forms of Therapeutic Plasma Photochemically Treated for Pathogen Inactivation (044)

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Background: A photochemical treatment process (PCT) utilizing amotosalen and UVA light (INTERCEPT™ Blood System) has been developed for inactivation of viruses, bacteria, parasites, and leukocytes that can contaminate blood components intended for transfusion. This proactive approach has been shown to inactivate high titers of a broad spectrum of pathogens in blood components, and this process is in routine use in over 100 centers in 20 countries. We performed a literature review on plasma products pathogen inactivated by INTERCEPT to determine the compatibility of the process with a variety of source materials.

Methods: Publications reporting coagulation function of 6 types of plasma were identified: fresh frozen plasma or plasma frozen within 24 hours derived either from apheresis or whole blood (from fresh or previously frozen plasma), liquid, freeze dried and cryo-depleted plasma. The reported values for a selection of key plasma proteins that establish plasma quality were collated: Factor VIII, Fibrinogen, Protein C, Protein S, alpha 2-antiplasmin and thrombin generation (ETP) tested with 5 pM tissue factor (TF).

Results: The reported values for the 6 selected plasma quality parameters in the various forms of INTERCEPT plasma products were obtained from 7 publications. Factor VIII and Fibrinogen were maintained within reference range (0.5-1.5 IU/mL and 2-4 g/L, respectively) for all types of plasma except in cryo-depleted as expected (however, the concentration was not different from control, non-treated cryo-depleted plasma). Factor VIII is reduced in liquid stored plasma below reference. Protein C, Protein S and alpha 2-antiplasmin values were also maintained within reference ranges (0.7-1.4 IU/mL, 0.5-1.4 IU/mL, and 0.8-1.2 IU/mL, respectively). Importantly, the thrombin generation capacity (range 1226-2438 nM*min) of the different plasma products (not tested in cryo-depleted plasma) was retained or minimally altered after treatment.

Conclusion: The INTERCEPT pathogen inactivation process can be successfully applied to plasma products from various sources or forms, frozen, derived from whole blood or apheresis, liquid, freeze-dried or cryo-depleted. Critical markers of plasma coagulation function are retained at physiological level and the thrombin generation capacity of plasma products is not adversely affected.

References: Coene et al. Transfusion 2014, Hacquard et al. Vox Sang 2012, Gorlin et al. Transfusion 2014, Le et al. Transfusion 2014, Knutson et al. Manuscript in preparation, Martinaud et al. Anesthesiology 2012, Yarranton et al. Transfusion 2005.

Transfusion practice in acute upper gastrointestinal bleeding: a large retrospective review. (086)

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Introduction: Acute upper gastrointestinal bleeding (AUGIB) is a condition for which red blood cell transfusions are often ordered, commonly based on hemoglobin (Hb) value. Transfusions are associated with worse outcomes in AUGIB and restrictive thresholds lead to equal or better outcomes in various acute clinical scenarios. A prospective randomized controlled trial showed that restrictive transfusion strategy reduces 6-week mortality in AUGIB when compared to a more liberal threshold. The objective of this study was to determine the history, clinical course, transfusion thresholds, and outcomes of patients with AUGIB at St. Michael's Hospital, a tertiary referral centre for gastrointestinal bleeding in the Greater Toronto Area.

Design and Methods: This is a retrospective single review of AUGIB cases at a single centre. Patients who presented with AUGIB between April 1st, 2010 and May 31st, 2013 were assessed for in hospital mortality, transfusion rate, pre transfusion Hb trigger for RBC transfusion, activation of massive transfusion protocol (MTP), endoscopy (diagnosis, intervention, time to endoscopy, if applicable). Demographic and clinical data were also captured.

Results: During the study period, 703 patients with AUGIB were assessed at SMH. 621 (88.3%) had non-variceal bleeding and 82 (11.7%) had variceal bleeding. 563 (80.1%) were admitted to the hospital and 310 (44.1%) were transfused with red blood cells. Pre transfusion Hb was 74 g/L (29 to 154 g/L). 36.4% of transfused patients had pre transfusion Hb <70g/L and 63.6% had pre transfusion Hb ≥70 g/L. 7 patients (1.0%) had a MTP activated. 521 patients (74.1%) underwent endoscopy and median time from AUGIB diagnosis to endoscopy was 1 day (0 to 28 days). Median hospital length of stay was 4 days (1 to 93 days). Overall in-hospital mortality was 3.3%.

Conclusion: AUGIB is a common condition and is associated with significant morbidity but low mortality. Massive hemorrhage due to AUGIB is rare and transfusion practice is very heterogenous. Implementation of restrictive transfusion strategy probably will prevent unnecessary red blood cell transfusions at St. Michael's Hospital.

Evaluating the psychological impact of three different letters notifying donors of exclusion following false positive screening test results (010)

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Introduction / Objective

This study evaluated the psychological impact of notifying donors of false positive screening test results and resulting exclusion from blood donation. Minimising the negative impact of such a notification is important for donor retention. Three different notification letters were compared: the first informed donors of a permanent exclusion, the second of a temporary exclusion, and the third of a temporary exclusion with wording actively attempting to minimise recipients' level of psychological distress.

Design and Methods / Process

Three donor groups, having received one of the three letters, completed a questionnaire using five-point Likert scales. Four constructs were evaluated: perceived quality of communication pertaining to tests results, psychological distress levels, attitude towards blood donation and desire to donate blood. Groups were paired for gender, age and virological marker, to eliminate potential bias and isolate the specific impact of communicating the test results. Constructs' internal consistency was ascertained using Cronbach's alpha. Groups were compared using ANOVAs. The project was reviewed and approved by an ethical review board.

Results / Conclusions

Results show that desire to donate blood is significantly lower for donors who received the second (mean ± SD: 4.28 ± 0.82) and third letters (3.96 ± 1.21) than for those who received the first (4.53 ± 0.96) ($F = 6.45$, $p = 0.0023$). Perceived quality of communication is significantly better with the second (3.02 ± 0.74) and third (3.12 ± 0.76) letters than with the first (2.65 ± 0.82)($F = 5.99$, $p = 0.0035$). There is no significant difference between the second and third letters for these two constructs and no significant difference between the three letters for psychological distress levels or attitude towards blood donation.

Results suggest that letters can only be fine-tuned to a certain point in order to minimize the negative impact of notifying donors of false positive test results. Even with careful wording and making the exclusion temporary, the positive impact on donors' psychological distress levels, attitude and willingness to donate blood again in the future has been minimal in our experience. To further minimise the impact of notification, it may be necessary to use a communication medium other than a simple letter.

Donor Travel Survey (019)

Sheila O'Brien Ph.D., Canadian Blood Services; Lori Osmond, Canadian Blood Services, Mindy Goldman MD., Canadian Blood Services; Margaret A. Fearon MD., Canadian Blood Services

BACKGROUND Up-to-date travel data was collected to help CBS understand the travel habits of their donors and assess impact of implementing strategies to address emerging pathogens such as short term deferral after tropical travel.

METHODS In August 2014, 17,728 whole blood donors were sent a link to an on-line survey about their travel outside Canada in the last 12 months. 8,908 donors completed the questionnaire (50.5%). Donors were also asked how soon they returned to donate after their most recent travel. We sampled donors who had donated recently. Therefore, the results exclude malaria risk travel, due to the 12 month deferral period. Weighted percentages of the number of donors travelling to various destinations were calculated from the survey sample. The projected number of donors with travel to each region in 2014 was estimated as the product of the weighted percentage and the number of whole blood donors in 2014.

RESULTS 59.5% of donors travelled outside Canada in the last 12 months. The most common destination for Canadian travellers was the United States, to which 200,221 donors travelled (48%). Other common destinations were Europe, to which 40,746 donors (9.8%) travelled, the Caribbean to which 38,967 donors (9.3%) travelled, and Mexico to which 29,218 donors (7.1%) travelled. Donors may have traveled to more than one region. If a new deferral criterion were to be implemented for Caribbean travel, it would likely be a 14 day or 28 day deferral. Of donors with Caribbean travel, a projected 2,000 donors per year (5.1%) return to donate within 14 days of travel. An additional 4,500 donors (11.7%) return within 28 days of travel. For any travel outside Canada and the US about 8,000 donors (8.5%) return within 14 days. An additional 24,400 donors (16%) return within 28 days.

CONCLUSION More than half of donors had international travel. The impact of 14 or 28 day deferral could be substantial. For the purposes of this study, seasonal patterns were not assessed. There may be more donors impacted at particular times of the year especially in the winter when travel to sun destinations is most popular.

Iron Deficiency in Apheresis Donors (020)

Sheila O'Brien Ph.D., Canadian Blood Services; Samra Uzicanin, Canadian Blood Services; Vito Scalia, Canadian Blood Services, Mindy Goldman MD., Canadian Blood Services

INTRODUCTION: The effect of regular apheresis on donor iron stores has not been well characterized. For example, the combination of blood taken for donor testing and blood lost in the process of plateletpheresis can result in the annual loss equivalent of 4-5 units of whole blood in donors donating at the maximum frequency.

METHODS: Donors were randomly selected from clinics performing apheresis. All were repeat donors: 39 (37 males, 2 females) platelet donors and 71 (57 males, 14 females) plasma donors. Ferritin levels were compared to those of whole blood donors in the study. Donor age and donation history (whole blood and apheresis) were obtained from the National Epidemiology Donor Database (NEDD). Iron stores were assessed by measuring ferritin levels on donor plasma retention samples using Architect Plus i1000SR analyzer (Abbott Laboratories, IL, USA).

RESULTS: 72% (79/110) of the donors were males ≥40, typically representative of the apheresis donor pool. Among males, low ferritin (<25 µg/L) was found in 19% (7/37) of platelet and 35% (20/57) of plasma donors, compared to 38% (851/2213) of male repeat whole blood donors. Among females, low ferritin was found in 50% (1/2) of platelet and 79% (11/14) of plasma donors, compared to 60% (1019/1696) of female repeat whole blood donors. Donors can donate platelets every 2 weeks and plasma once a week. The average donation frequency per year was: platelet - 11 for males and 7 for females; plasma - 25 for males and 17 for females. There was a correlation between frequency of plasma donation and iron deficiency, with 70% (14/20) of males with low ferritin donating ≥25 times/year and 55% (6/11) of females with low ferritin donating ≥17 times/year. 10% (11/110) of donors made at least 1 whole blood donation in the past 12 months, however only 4% (1/27) of male and 8% (1/12) of female low ferritin donors had done so.

CONCLUSIONS: Iron deficiency is fairly common in frequent apheresis donors. These donors should receive similar education to whole blood donors about the possibility of iron deficiency.

On the Brink - Testing Ontario's Plan for Blood Shortages (029)

Deborah Lauzon, Ontario Regional Blood Coordinating Network, Wendy Owens Ontario Regional Blood Coordinating Network, Denyse Tremblay Canadian Blood Services, Ahmed Coovadia Canadian Blood Services

Background: In 2004, three opportunities presented to test Ontario's blood shortage management plan. On February 3/4, a simulation exercise for a provincial shortage of platelets was held. In September and October, Canadian Blood Services (CBS) issued a 'Green Advisory' to hospitals across the country due to low inventory. Finally in late December, as a result of a potential labour disruption at CBS, Ontario's plan was initiated. Method: The Ontario Emergency Blood Management Committee (OEBMC) met and implemented the plan for both the simulation scenario and the CBS labour situation. A survey was issued to gather information on the simulation. No formal meetings were held for the 'Green Advisory'. A debrief was held for each of these three events to make recommendations for improvement. The simulation exercise presented an opportunity to test several aspects of the plan. The potential CBS labour disruption presented an opportunity to test out a 'real life' situation to activate the plan. Results: Approximately 61% of Ontario's hospitals with a transfusion service participated in the simulation exercise. 26% of hospitals in Ontario stock platelets and were able to provide feedback on how platelet stock would be managed during an Amber and Red phase. Recommendations from the exercise included development of a clinical guidance document to help ensure consistency across the province. During the meetings related to the potential CBS labour disruption, a guidance document was quickly developed to provide standardized best practice. Through the exercise and possible labour disruption, communication between the Ministry of Health and Long-Term Care (MOHLTC), hospitals and CBS occurred frequently. During the 'Green Advisory' there was very little formal communication although it provided an opportunity for hospitals to report inventory levels into the new CBS web based tool and for CBS to report the level of inventory available on hospital shelves. Conclusion: Although simulation exercises are necessary to ensure ongoing review and improvement of contingency plans, the most progress and learning results from real life situations where stakeholders exhibit a much higher level of commitment, sense of urgency and willingness to contribute. Debrief discussions provide an important opportunity to document lessons learned to help ensure the level of preparedness continues to improve.
Acknowledgments: Members of the Ontario Emergency Blood Management Committee.

Discordant Results between RhD Serological Testing and Targeted Sequence Genotyping (013)

Chantale Pambrun MD., IWK Health Centre, Dalhousie University

Introduction:

A weakened RhD serology testing algorithm was implemented in February 2013 at the IWK Health Centre in Halifax. New or rare genetic variants or variant combinations that are not part of the Blood Group Genotyping (BGG) reference database provided by Progenika Inc., will not be detected by the BLOODChip services performed on the ID CORE XT. These events are expected to occur less than 0.1% of the time in the general population according to the assay limitation section of the BGG report.

Process:

Discordant serologic and genotype findings were reviewed for a twenty-four month period since implementation of the algorithm. As per the IWK Health Centre RhD testing algorithm, weakened serology or discrepant results between two D antiseras, prompts a referral to the National Immunohematology Reference Laboratory (NIRL) for genotyping, if the patient is pregnant. RHD genotyping is performed at Progenika Inc. on an ID CORE XT bead-array (PCR and hybridization based assay). Quality assurance was performed by Progenika Inc. by standard Sanger sequencing in cases of discordant findings between serology and the ID CORE XT results.

Results:

93 serologically weakened RhD samples were detected from the 17,711 patients tested (0.5%).

74 specimens were sent to NIRL for ID CORE XT gene testing on pregnant patients.

Discordant results were found in 13 specimens (18%).

All 13 samples had RHD gene Sanger sequencing performed with a variant RhD detected.

Conclusion:

Our findings highlight the known limitations of the genotyping platforms and the need to keep serological testing as the gold standard. The reported rate of new or rare genetic variants or variant combinations by Progenika Inc. of less than 0.1%, is in keeping with our findings of 0.07% among all patients tested. The incidence however is much higher among patients with a weakened anti-D serology result; 18% from our data. It is important to keep in mind the assay limitation when making patient management decisions. Our current process is to treat all patients with an RhD discordant result between serology and genotyping as RhD negative.

Acknowledgements:

National Immunohematology Reference Laboratory.

Progenika Inc.

Characterization of the hematopoietic enhancing activity of medium conditioned with osteoblasts (026)

Nicolas Pineault PhD, Center for Innovation, Canadian Blood Services: Gwendoline Bugnot MSc, Canadian Blood Services: Roya Pasha MSc, Canadian Blood Services: Ahmad Abu-Khader PhD, Canadian Blood Services.

Cord blood (CB) transplantation is associated with significant delays in platelet and neutrophil engraftment. Ex vivo expansion of CB hematopoietic stem and progenitor cells in culture prior to transplantation has recently been shown to accelerate neutrophil engraftment in patients, while platelet engraftment remains significantly delayed. Previously, we showed that medium conditioned for 6 days with osteoblasts (OST) derived from mesenchymal stromal cells (MSC) supported greater progenitor expansions, and that CB CD34+ cells expanded in MSC-derived-OST conditioned medium (M-OST CM) supported a more robust engraftment of platelets in immunodeficient mice. The mechanisms responsible for the improved expansion and increased thrombopoietic activity provided by M-OST CM remain to be elucidated. In the present study we set out to i) identify the conditioning time required to maintain the HEA, ii) to characterize the hematopoietic enhancing activity (HEA) of M-OST CM and, iii) to test the stability at of M-OST CM stored at -80C.

M-OST CMs induced superior expansion of total nucleated cells (TNC, mean of 1.7-fold, $p<0.05$), CD34+ cells (1.5-fold) and CD14+ cells (62-fold, $p<0.05$) vs. control independently on the length of conditioning (1, 2, 3 or 6 days). Media conditioned for 1 day reproduced 99% and 80% of the HEA of M-OST CM on CD34+ and on CD14+ cells, respectively. Interestingly, the HEAs of M-OST CM on the expansion of TNC and CD34+ cells were highly sensitive to filtration (0.2 µM), while others such as the HEA on monocytic CD14+ cells (+16-fold vs control, $p<0.01$) were not. Surprisingly, addition of thawed non-cryoprotected M-OST partially restored in a dose-dependent manner the lost HEAs of M-OST CM. The stability of M-OST CM stored at -80C is under investigation but preliminary results suggest that the HEAs could be retained for several months.

In summary, our results suggest that physically divergent elements are responsible for the HEAs of M-OST CM on TNC, CD34+ cells and CD14+ cells. The HEA on TNC and CD34+ cell expansion lost to filtration are likely mediated by large protein complexes or cellular elements. Conversely, other activities such as the HEA on CD14+ cells are clearly mediated by soluble agonists.

Evaluation of alternative skin disinfection methods for donors allergic to chlorhexidine (011)

Sandra Ramirez-Arcos* PhD, Yuntong Kou MSc, Mariam Taha MSc, and Mindy Goldman MD, Canadian Blood Services

Introduction: Donor skin disinfection is important to ensure the safety of blood components. Currently, Canadian Blood Services uses the Chloraprep swabstick (2% chlorhexidine and 70% isopropanol) as the primary donor skin disinfection method. For donors sensitive to chlorhexidine, a two-step method (70% isopropyl alcohol scrub sponge followed by an ampoule of 2% iodine tincture) is used. As the alternative two-step method will soon be discontinued, this study was aimed at evaluating alternatives for skin disinfection of donors who are sensitive to chlorhexidine.

Design and Methods: Phase 1: Chloraprep and Loris 10% povidone-iodine swabstick were compared. Phase 2: Chloraprep and a two-step method [Applicare 10% povidone-iodine swabstick followed by Dynarex 70% isopropanol swabstick] were compared. 127 and 134 study subjects were included in each Phase, respectively, to detect a 10% difference in efficiency (80% power, significance level 5%). Contact-plate cultures were done on the anticubital fossa on each arm of the subjects before and after disinfection. Plates were incubated overnight at 37oC followed by colony counting. A comparison was made of the log10 reduction in colony counts on both arms of the same subject.

Results and Conclusions: Phase 1 showed that the Loris 10% povidone-iodine swabstick was significantly less efficient than Chloraprep. The disinfection efficacy of Loris was variable and its application caused ergonomic concerns to the phlebotomists and skin irritations to a small number of subjects. By contrast, Phase 2 showed that the two-step method was as efficient as Chloraprep with both methods achieving a 0-2 log10 reduction in colony counts in 93% of study subjects and a 3 log10 count reduction in 7% of study subjects. The two-step method also had better acceptability by the phlebotomists and study subjects. Therefore, this method will be implemented to disinfect the skin of donors with sensitivity to chlorhexidine at Canadian Blood Services.

Acknowledgements: The authors thank staff involved in the coordination of skin disinfection kit shipments and recruiting volunteer subjects. We are grateful with the nurses responsible for application of the disinfectants, research personnel for colony counting, and Dr. Qi-Long Yi for statistical analyses.

Identical bleeding reduction in coagulopathic mice transfused with four coagulation factors or plasma (030)

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Introduction and Aims:

Prothrombin complex concentrates (PCCs) are plasma protein products enriched in coagulation factors II, VII, IX, X, and proteins C and S. PCCs are indicated for urgent warfarin reversal, but may also be useful in other clinical settings. Previously, we established a mouse model called Blood Exchange-induced Coagulopathy Approach (BECA) in which all plasma protein concentrations were reduced 5-fold. BECA mice, following four rounds of exchange of whole blood for washed red blood cells in colloid solution, demonstrate a bleeding tendency that is reduced by plasma transfusion. Our objectives were to compare the efficacy of commercial or modified PCC administration to plasma transfusion for hemostatic control in BECA mice.

Design and Methods: We conducted dose response studies in groups of 10-15 BECA mice. Anesthetized BECA mice were rendered coagulopathic by blood exchange, injected with 12 ml/kg body weight plasma or plasma proteins or controls, and subjected to standardized tail transection. Bleeding time and the volume of blood lost in the 15 minutes following injury was determined. All values are means ± one standard deviation.

Results: Blood losses were reduced 4-fold, from 268 ± 130 µl in mice receiving 5% Human Albumin Solution (HAS), to 67 ± 50 µl following normal murine pooled plasma (NMPP) transfusion ($p<0.001$). Commercial PCC (14.3 IU/kg) elicited a statistically identical reduction in blood loss to NMPP (74 ± 40 µl), as did a 7.15 IU/kg dose (110 ± 100 µl) while a 3.65 IU/kg dose was ineffective (240 ± 120 µl). Bleeding times paralleled blood losses for the different agents: HAS, 14.4 ± 1.3 min; NMPP, 6.6 ± 3.0 min ($p<0.001$); and 14.3 IU PCC, 6.1 ± 4.0 min ($p<0.001$). Minimal PCCs comprised of purified human coagulation factors II, VII, IX, and X at their normal (100, 0.5, 5, and 10 mg/L) (mPCC-1X), double (mPCC-2X), or triple (mPCC-3X) plasma concentrations were also assessed. mPCC-3X reduced blood loss indistinguishably from NMPP (49 ± 20 µl), as did mPCC-2X (94 ± 60 µl), while mPCC-1X was less effective (152 ± 65 µl, $p <0.05$ vs. NMPP). Bleeding times for mPCC-3X-treated mice were 3.9 ± 2.0 min ($p<0.001$ versus HAS) and did not differ significantly from NMPP-treated mice (6.6 ± 3.0 min).

Conclusions: Our results show that PCCs, at the same dose recommended for warfarin reversal in patients, restore hemostasis in pan factor-deficient BECA mice; moreover, the same effect is seen with mixtures of only four purified coagulation factors. Future experiments will further define the minimal requirement for hemostatically effective mPCC composition, and assess PCC/mPCC in a liver laceration model. At appropriate doses, four specific coagulation factors effectively substitute for plasma transfusion in coagulopathic mice. Further investigation and translation of these findings could lead to more effective utilization of plasma protein products in bleeding patients.

Interventions to Reduce Blood Loss from Laboratory Testing in Critically Ill Patients and Impact on Transfusion: A Systematic Review (040)

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Introduction: Blood loss for laboratory testing contributes to anemia, which is a common complication of critical illness and is associated with poor outcomes. Reduction of diagnostic phlebotomy volume may reduce transfusions and improve clinical outcomes in critically ill patients.

Objective: To identify strategies for reducing blood loss from diagnostic phlebotomy and assess their impact on volume of blood loss, transfusion and clinical outcomes.

Methods: Systematic review of published English-language studies using standard methodology.

Results: A search (Medline and Embase) yielded 3045 studies. After review by 2 independent assessors, 7 studies including 3 randomized controlled trials and 4 controlled cohort studies were included. Interventions included indwelling catheter devices that reduce discarded blood (n=4), small-volume blood collection tubes (n=2) and avoidance of arterial catheters (n=1). All 3 RCTs reported reduced daily phlebotomy volumes using arterial catheter blood conservation devices compared to standard practice (mean/day 35 vs 69 mL, $p<0.01$; median/day 8 vs 40 mL, $p<0.001$; median/day 63 vs 133 mL, $p=0.001$). Two RCTs reported transfusion data, 1 of which showed a statistically significant decrease in transfusions with the arterial catheter device intervention vs. control (21% vs. 38%, $p=0.01$). In 2 of 3 cohort studies interventions reduced phlebotomy volumes compared to standard practice (mean/day 63.6 vs 114.7 mL, $p<0.001$; median/day 5.1 vs 19.9 mL, $p<0.001$; mean/day 32.2 vs 55.6 mL, p-value not specified, respectively). ICU length of stay was not different between groups.

Conclusion: Diagnostic phlebotomy volume reduction techniques appear to reduce blood loss and may reduce transfusion rates in critically ill patients. High methodological quality randomized studies evaluating patient-important clinical outcomes are needed to evaluate the efficacy and possible harms associated with interventions that reduce blood loss for laboratory testing.

Production of infectious dengue virus by platelets (076)

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Introduction: Dengue virus (DENV) is the most prevalent arbovirus on the globe, annually infecting ~400 million people. Half of these are asymptomatic, yet have relatively high virus titers. Therefore, it is not surprising that endemic regions have reported transfusion transmission. Once thought to be restricted to the tropics, DENV has extended outside this traditional zone due to air travel and climate change. DENV is consequently a significant risk to blood systems globally and in Canada is flagged as an "emerging pathogen". Objective: Since thrombocytopenia is a hallmark of DENV disease, we have been studying interactions between DENV and platelets, and reported previously that platelets replicate the DENV RNA genome. The current work extends these studies by exploring whether platelets produce infectious DENV progeny, and the identity of related platelet receptors. Methods: Using highly purified DENV serotype 2, the titer consistent with an asymptomatic donor (~105 infectious units/mL) was spiked into donor-derived, leukoreduced platelet concentrates (PCs) produced at the Canadian Blood Services-affiliated, Network Centre for Applied Development or purified platelets. The platelets were stored according to SOP. Infectious DENV or DENV RNA was detected using cytolytic plaque assays or quantitative rtPCR (qPCR), respectively. The latter was also used to measure virus-binding after 1 hour. Results: Viable DENV underwent spontaneous logarithmic decay in PCs with ~4% of the initial infectious DENV detected at day 7. The presence of DENV was confirmed by qPCR, which showed as much as a 10-fold peak in DENV RNA genome replication after 4-6 days. Although the infectivity of DENV intrinsically declines, this was moderated by platelet-mediated generation of viable progeny as demonstrated by enhanced decay in the presence of a transcription inhibitor (cycloheximide). Purified platelets yielded similar results and excluded the possible contribution of other cells in PCs. Competitive inhibition studies using purified platelets revealed DC-SIGN and heparan sulfate proteoglycan function as co-receptors. Conclusions: For the first time, we demonstrate that the platelet translational machinery is involved in viable DENV production. This suggests that PCs derived from asymptomatic donors may harbor and enhance dengue virus during storage, highlighting the need for universal pathogen inactivation implementation.

An Overview of Donath Landsteiner Testing in Canada: Implications for Testing (039)

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Introduction: Paroxysmal Cold Hemoglobinuria (PCH) is a rare form of autoimmune hemolytic anemia caused by a biphasic IgG autoantibody typically with blood antigen P specificity. These antibodies are detected using the Donath-Landsteiner (DL) test. Current estimates of disease frequency are lacking and the diagnostic usefulness of DL testing is not known. The aims of this study were: 1) to describe DL ordering practices over the past decade in Canadian hospital laboratories; 2) to determine the number of positive DL test in adults and children; and 3) to evaluate the likelihood of PCH among adult patients with a positive DL test.

Methods: This study included: a national survey of hospital laboratories that performed DL testing in Canada; a retrospective single-centre review of DL testing procedures; and, adjudication of all positive DL tests in adults by 4 independent transfusion medicine experts. Data were analysed using SPSS version 20 using descriptive statistics. Research Ethics Board approval was obtained.

Results: 14/18 laboratories contacted completed the survey; response rate was 78%. Laboratory practices varied across sites for approval required to order and process DL testing. 52 DL tests were ordered across 14 centres during 2012-2013 (range 0-11 tests per year). Over 124 cumulative years reported, DL tests were positive in 3 adults and 14 children. 5 centres did not report any positive DL tests over 80 cumulative years of testing. At one large academic centre, 34 samples from 27 patients were sent for DL testing from 2006-2013: 1 sample was positive; 16 were negative; 4 were inconclusive due to hemolysis, presence of cold agglutinin or limited sample; and, 13 were not done due to improper collection, handling or hemolysis. Adjudication of the 3 positive adult cases resulted in no concordance by experts as to the likelihood of PCH as the clinical diagnosis.

Conclusions: PCH is rare, especially in adults. Experts reviewing the 3 positive DL cases reported over 124 cumulative years of testing could not agree on whether these cases represented a diagnosis of PCH. These observations raise questions about the utility of DL testing in adults and clinical correlations.

Acknowledgments: The authors gratefully acknowledge contributions from the 14 sites participating in this study. As well, we thank the McMaster Transfusion Research Centre for supporting this research.

Patterns of Practice and Cost of Therapy of Immune Thrombocytopenia since the Introduction of Thrombopoietin Receptor Agonists. (070)

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Background: Thrombopoietin receptor agonists are a relatively new class of medications for patients with chronic immune thrombocytopenia (ITP). How these agents have impacted practice patterns, especially the use of intravenous immune globulin (IVIG), has not been evaluated outside of clinical trials. Cost implications have not been assessed.

Methods: We performed a retrospective cohort study of patients with ITP who were treated with romiplostim since its introduction into clinical practice in four centres in Canada. Patients were 18 years of age or older, had primary or secondary ITP and were followed for one year before, and until the end of follow up after romiplostim administration. The objectives of this study were to compare the use of IVIG before and after romiplostim and to assess overall cost of treatment.

Results: Twenty-nine patients with ITP received romiplostim during the study period. Median age was 54 years (interquartile range [IQR] 45–63) and patients had received a median of 2 prior ITP treatments (IQR 1-4) including splenectomy (n=7). Median platelet count was 23 x109 (IQR 12 x109- 58 x109) before and 124 x109(IQR 79 x109-182 x109) after romiplostim. Median duration of romiplostim treatment was 3.7 months (110 days). Before romiplostim, median IVIG usage per patient was 2 infusions per year; after romiplostim, median IVIG usage was 0.7 infusions per year. For patients who received weekly romiplostim for at least 1 month (n= 19), median IVIG usage was 3 infusions per year before, and 0.7 infusions per year after romiplostim. Nineteen (66%) patients discontinued romiplostim during the observation period once platelet counts improved, because of adverse events or lack of effect. Overall cost of management was similar before and after romiplostim considering concomitant treatments, clinic time, nursing resources and hospitalizations ($3,701 Canadian dollars per patient-month before, and $3,866 per patient-month after).

Conclusions: Romiplostim was associated with higher platelet counts and less IVIG use in routine clinical practice. Romiplostim was not continued indefinitely in most patients. In this preliminary cost analysis, romiplostim was not associated with a significant difference in overall health care expenditure.

Introduction of a Closed-System Cell Processor for Red Blood Cell Washing: Post-Implementation Monitoring of Safety and Efficacy (091)

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BACKGROUND: After introduction of a closed system cell processor, the effect of extended outdate on safety, efficacy and utilization of washed red cell concentrates (RCCs) was assessed.

STUDY DESIGN AND METHODS: This study was a pre-/post-implementation observational study. Efficacy data were collected from sequentially transfused washed RCCs received as prophylactic therapy by β-thalassemia patients during a 3-month period before and after implementation of a Haemonetics ACP-215 closed system processor. Pre-implementation, an open system (TerumoBCT COBE 2991) was used to wash RCC. The primary endpoint for efficacy was a change in post-transfusion hemoglobin concentration corrected for the duration between transfusions. The primary endpoint for safety was the frequency of adverse transfusion reactions in all washed RCCs provided by Canadian Blood Services to the transfusion service for 12 months before and after implementation.

RESULTS: Data were analyzed from over 300 RCCs transfused to 31 recipients pre-implementation and 29 recipients post-implementation. The number of units transfused per episode reduced significantly post-implementation, from a mean of 3.5 units to a mean of 3.1 units ($p < 0.001$). The corrected change in hemoglobin concentration was not significantly different before and after implementation. Adverse transfusion reactions occurred in 0.15 % of transfusions both before and after implementation.

CONCLUSION: Safety and efficacy of washed RCCs were not affected after introduction of a closed system cell processor. The ACP-215 allowed for an extended expiry time, improving inventory management and overall utilization of washed RCCs. Transfusion of fewer RCCs/episode reduced exposure of recipients to allogeneic blood products while maintaining efficacy.

Small Molecule Ice Recrystallization Inhibitors Enable Freezing of Human Red Blood Cells with Reduced Glycerol Concentrations (092)

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Background: In North America, red blood cells (RBCs) are cryopreserved in a clinical setting using high glycerol concentrations (40% w/v) with slow cooling rates (1 degC/min) prior to storage at -80 degC, while European protocols use reduced glycerol concentrations with rapid freezing rates. After thawing and prior to transfusion, glycerol must be removed to avoid intravascular hemolysis. This is a time consuming process requiring specialized equipment. Consequently, improvements in the RBC cryopreservation process are urgently required. Small molecule ice recrystallization inhibitors (IRIs) have the ability to prevent ice recrystallization, a process that contributes to cellular injury and decreased cell viability after cryopreservation. Study Design and Methods: Small-molecule, glycosidic compounds where synthesized and their ice recrystallization activity was assessed using a "splat cooling" assay. The ability of the lead IRI active compounds to function as RBC cryoprotectants was assessed in the presence and absence of glycerol. The freezing of human RBCs was carried out using a two-step graded freezing protocol and post-thaw recovery and hemolysis were assessed. Cryomicroscopy using a Linkam FDCS cryostage on a Nikon 80i microscope was used to examine the effect of the IRIs on ice crystal structure during slow freezing. Results: Herein, we report that addition of 110 mM para-methoxyphenyl glucose or 30 mM para-bromophenyl glucose to a 15% glycerol solution increases post-thaw RBC integrity by 30-50% using slow cooling rates and emphasize the potential of small molecule IRIs for the preservation of cells. Cryomicroscopy shows that the structure of ice during the freezing process with RBCs is dramatically different when IRI compounds are present. By examining large libraries of IRI compounds, we have identified key structural features important for the IRI activity of phenolic-glycosides. Conclusions: This is the first example of a small molecule inhibitor of ice recrystallization being used to effectively cryopreserve RBCs with reduced amounts of glycerol and slow freezing rates. These results have tremendous potential for improving the cryopreservation of RBCs as post-thaw deglycerolization processing times would be greatly reduced with low glycerol concentrations.

THE SUCCESS STORY OF A LIS IMPLEMENTATION: WHEN LIS AND LISS MEET (062)

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Aim: Hema-Quebec Reference Laboratory performs serological investigations of complex cases for more than 1,300 patients per year and more than 500 genotypings per year. Before June 2014, all the results from these activities and the follow up were done by paper work, with the inherent high risk for file loss and errors such a system engenders. In 2011, a Laboratory Information System (LIS) was introduced to improve the security and efficiency of our laboratory activities starting with Cord Blood Bank (phase 1) and HLA/Platelet Laboratories and Stem Cell Donor Registry (phase 2), the Tissue Bank (phase 3) and finally incorporating the Maternal Milk Bank and the Reference Laboratory (phase 4) into this system.

Methods: Inlog (Haemonetics) was selected to adapt software modules to meet our needs. Three modules were developed: EdgeLab to present the results of the patient and stem cells donor analyses; EdgeCell, the databank information system for donor and for the processing and distribution activities of our various banks; and EdgeLink which integrated these two modules to make it possible to transfer information and results between our different laboratories. Most of the laboratory instruments have been interfaced and the majority of the laboratory forms have been incorporated into the system to reduce paper records and transcription errors. Rowny Systems Inc. (dba Antigen Plus) was also chosen to manage in-house and commercial RBC panels and also rare RBC and antisera inventory.

Results: EdgeLab and Antigen Plus modules were up and running on June 2014. Touch screens, articulated arms and barcode readers were installed at each work station to favor ergonomics and to optimize available space.

After implementation, we observed notable reductions in paper work and in nominal identifiers errors. Streamlined workflow resulted in a decreased of 10.4% in transmission time of the result report.

Conclusions: Héma-Québec is already seeing the benefits of a LIS. It offers better control of our various operations and reduction in turnaround times and improves communication and follow up on ongoing tests between our laboratories. Therefore, time frame of report transmissions has been reduced. LIS also allows users and managers to consult patient file and results via remote access.

HYBRID RHCE GENE IN AN AFRICAN PATIENT (068)

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Introduction: Many variants of RHD and RHCE genes have been described, and are particularly common among the Black population. Over the years, Héma-Québec's Immunohematology Reference Laboratory (HQ IRL) performed four serological investigations of a polytransfused African American woman G1P0 who suffers from sickle cell disease and underwent a hip replacement surgery. In addition to multiple alloantibodies, a phenotype-genotype discrepancy in the MNS blood group system, an RHD pseudogene and a possible RHCE hybrid gene were found.

Design and Methods: Samples were analyzed by HQ IRL according to approved techniques. RHCE mRNA was sequenced, DNA PCR-SSP RHD*/RHD*ψ was performed and GYPB mRNA sequencing were also performed. Samples from the first study were also sent to NYBC IRL to assist HQ IRL in resolving antibody identification.

Results/ Conclusions:

Serology: On the last sample: DAT was negative in gel and tube. The patient was recently transfused and reacted against all screening and identification RBCs in LISS gel and papain gel. Autocontrol gave negative results in both media. Eluate was found positive with all panel cells. Antibody against high-frequency antigen was suspected and alloadsorptions were performed on R1R1, R2R2, rr and Fy(a-b-) RBCs. In addition to the previously identified anti-Kn and anti-Fya, an anti-Fy3, an anti-E, an anti-C, and an auto-anti-e were identified. Anti-Lua was identified in a previous study. Anti-K and anti-Cw were left unexcluded.

Genotyping: GYPB mRNA sequencing results indicated GYPB*03/GYP*04, MNS*05 alleles (S+, s+, U+). Additional polymorphisms were found in GYPB: heterozygous 143 C>T (Thr48Met) and homozygous (251 C>G Thr84Ser)

RHCE mRNA and RHD DNA results gave: D+, **C+, c+, E-, e+

RHD-01/RHD-04N.01 (RHD ψ), *RHCE*Ce/RHCE*ce48C, 1170T, 1193A. The C phenotype is hard to predict as the variant has not been described in the literature. It could be the result of a hybrid gene. Polymorphisms 48G>C (Trp16Cys), 1170C>T (silence) and 1193T>A (Val398Glu) together have not been reported. Lack of the high prevalence Knops antigen, KCAM, was also identified by NYBC IRL.

Samples from the father were requested. HDFN is possible and a follow up every 4 weeks is suggested.

Canadian Blood Services' response to four recent public health advisories of potential hepatitis A virus exposure (084)

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Introduction - Hepatitis A virus causes short term human infection, typically following fecal-oral exposure. The virus is also potentially transfusion-transmissible from donations collected during a transient, 1-2 week viremic period that precedes onset of clinical illness. Four advisories of potential point-source hepatitis A exposure risk issued between Jan-March 2015 by local public health authorities in Ontario and British Columbia, prompted Canadian Blood Services to assess and manage the associated risk to blood safety. We summarize these incidents and risk mitigation measures to protect the blood supply.

Methods – A literature search/environmental scan was undertaken of blood operators' response to public health-identified community point-sources of potential hepatitis A exposure. Qualitative risk assessment of blood safety implications of 4 recent public health advisories was reviewed by Canadian Blood Services medical staff; consultation with blood donor clinic services staff also informed appropriate risk management procedures for each incident.

Results/Conclusions – Two incidents involved acute hepatitis A infection in a restaurant food handler; one involved an acutely infected cashier at a large food store, and a fourth involved an infected elementary school student after returning from a hepatitis A-endemic country. No associated hepatitis A cluster or widespread community transmission was subsequently reported with any incident and in only one instance was there an epidemiologically linked secondary case. There are no published guidelines to guide blood operators' response measures to such incidents. Response measures were tailored to each circumstance: signage placed at local clinic entrances informed donors of the potential blood safety risk associated with these exposures; unit recalls were undertaken if donors self-identified having an at-risk exposure and had donated in the weeks after; and, exposed donors were deferred 56 days after last exposure, a time frame beyond the 50 day outer incubation period for hepatitis A infection. For the school setting, school staff, some of whom may also have been blood donors, was informed through school communications. No suspected transfusion-transmitted hepatitis A infection associated with these incidents has been reported to-date. The blood safety risk associated with community point-sources of potential hepatitis A exposure is likely very low but tailored, precautionary risk mitigation measures are appropriate.

Modelling Inventory Exchanges in a National Blood System (066)

Matthew Hardy, Canadian Blood Services

Background: Canadian Blood Services produces and distributes approximately 850,000 units of red blood cells (RBC) annually through nine production and distribution facilities and one distribution-only hub. Each distribution site (DS) services a specific geographic region and is the sole supplier of blood products for hospitals in its area. While regions strive to be self-sufficient in blood products, blood is considered to be a national asset and thus 5 to 10% of blood is transferred between sites. Transfers may be planned to make up for known mismatches between collections and demand, or they may happen on an ad-hoc basis to move units with a rare phenotype to meet patient demand or to rebalance inventory across the network. The total cost of site-to-site transfers is in excess of $1M ($CAN) per annum.

Problem Statement: In this paper, we report on a simulation-based method to evaluate site-to-site blood transfers within the Canadian Blood Services network of distribution facilities. The purpose of the study is to evaluate operational polices for inventory transfers between DS sites and thus identify practices yielding low levels of shortages without undue transportation costs.

Methods: A simulation approach was adopted to model site-to-site transfers in the Canadian Blood Services network. A custom simulation model written in VB.Net was developed from an existing generic simulation framework. The framework was adapted to allow for the simulation of multiple DS within a single model instance. Once a national model was built, verified, and validated, a set of experiments was carried out to test different transfer policies.

Results: Inventory import/export thresholds were varied and the volume of products shipped between DS according to standing orders was systematically altered. Thresholds were varied from 0 to 4 days on hand (DOH) for import (demand) limits and 0 to -4 in for export (supply) limits; standing orders were discounted from 0 to 1 in increments of 0.25.

Results indicated that import thresholds, export thresholds, and standing orders all significantly affect product availability and transport cost. However, results also indicated significant two-way interactions between the factors. Thus, to obtain policy recommendations, a range of relative weightings between a unit shortage and the cost of transporting one unit one kilometer was systematically tested. The results show that three different policies would be considered optimal, given the range of relative weights of a shortage compared to the cost of transporting a unit of RBC. Shortages, in all scenarios, were extremely rare (<1unit/day). Statistically lower shortage rates were found, when shortages were weighted heavily compared to the cost of transporting a unit. Transport cost, as measured by total distance, showed mixed results. In general, increasing product availability implies a greater transportation cost, as might be expected. However, with a mid-range weighting of shortages (1.0E+06), model results suggested that a lower shortage rate could be accompanied by a transportation cost that was not statistically different from that of the base case.

Conclusions: We conclude that it is possible to use simulation methods to identify site-to-site transfer policies that yield improvements to operational performance parameters without increase transportation costs.

Gold-Silver Alloy Nanoparticles for DNA Sensing and as Contrast Agents for Cell Tagging Applications. (095)

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Introduction. Noble nanoparticles are attracting much attention in past decades because of their interesting photophysical properties. For example, silver and gold nanoparticles (NPs) can interact with light and generate localized surface plasmons resonance (LSPR). LSPR is a collective oscillation of conduction electrons within the metal. The LSPR frequency depends on the size, shape and composition of the NP. Nanoparticle architectures can be adjusted to maximize light-particle interactions for the development of sensitive biosensors, super luminescent contrast agents or highly efficient drug delivery systems with plasmonic enhanced capabilities. Objective. The principal objective of this work is to democratize the use of nanotechnologies for biosensing and cell tagging applications and to expose a new detection strategy for multiplex analysis exploiting luminescence and extinction properties of fluorescent core-shell nanoparticles. Methods. Using a patented seed growth approach, gold(x)/silver(1-x) alloy nanoparticles (Au(x)Ag(1-x) NPs) with narrow size distribution were prepared. Au(x)Ag(1-x) NPs were designed to meet the experimental needs of specific biological applications in terms of plasmonic properties. Fluorophore molecules were covalently incorporated in a 10-50 nm thick silica shell using a silica precursor (tetraethyl orthosilicate) and dye-silane coupling agents (aminopropyltriethoxysilane) to form fluorescent alloy-core and silica-shell nanoparticles (Au(x)Ag(x-1)@SiO2 NPs). The versatility of silica chemistry was exploited to functionalize targeting biomolecules (antibodies, oligonucleotides and aptamers) at the surface of Au(x)Ag(x-1)@SiO2 NPs. Results. Silver-core silica-shell NPs were designed to perform PCR-free blood genotyping applications by flow cytometry. Starting with only 1ml of blood, 9 patients were typed for the Dombrock group in less than 1 hour. Finally, Au(x)Ag(x-1)@SiO2 NPs were resolved by fluorescence and backscattering microscopy using hyperspectral imaging technology; demonstration of a new strategy for High Content Screening (HCS) and multiplex analysis based on multiplatform detection. Conclusion. Nanotechnologies offer new development opportunities for sensing applications and they should be considered as new effective tools for blood and cell characterization.

DECREASING OUTDATING PLASMA PROTEIN PRODUCT DISCARDS IN NOVA SCOTIA (065)

Susan Cairns BN, RN; Marina Hamilton RN, MScN

Introduction/Objective

The Nova Scotia Provincial Blood Coordinating Program (NSPBCP) realized Plasma Protein Products (PPPs) were outdating in Nova Scotia hospitals and wanted to avoid the discarding of these expensive and potentially scarce blood products.

Design and Methods/Process

The NSPBCP developed a reporting form for hospital blood transfusion services to submit PPP inventory outdating within 6 months. The completed form was faxed to the NSPBCP monthly. The NSPBCP utilization transfusion practice coordinator collated the data provided and then facilitated the redistribution of the PPPs identified to be at risk of outdating. The blood transfusion service also started to report the discards of PPPs to the NSPBCP.

Results/Conclusion

From January 1, 2012 to December 31, 2014, hospitals within Nova Scotia redistributed 808 vials of PPPs with a cost avoidance of $940,000.00. In order to automate the reporting process for PPP inventory nearing the manufacture outdate, the NSPBCP developed a PPP DASHBOARD allowing hospitals to view the available PPPs in Nova Scotia.

Acknowledgements

The NSPBCP recognizes the blood transfusion service laboratory technicians for their commitment and diligence in preventing PPP outdate discards.

Use of Heatmapping to Visualise After-hours Red Cell Transfusion at a Teaching Centre in Eastern Canada (057)

Irene Sadek, Dalhousie University and Capital District Health Authority, Halifax., Stephanie Watson, Capital District Health Authority, Halifax., Andrew Kumar-Misir, Capital District Health Authority, Halifax., Joan Macleod, Capital District Health Authority, Halifax., Calvino Cheng, Dalhousie University and Capital District Health Authority, Halifax.

Background: Transfusion of products after-hours is theoretically more risky, as there are fewer staff available to supervise blood product administration, and patient support during an adverse event may be compromised due to fewer staff. We characterize the extent of after-hours red cell (PRBC) transfusion at an institutional scale, and use a heatmapping method to visualise the data.

Methods: PRBC transfusion data from January 1, 2013- December 31, 2014 was queried from the Capital Health Authority's laboratory information system (Halifax, NS). Data included blood group, location and time stamp data for transfusion start times of all PRBC units. 8-5PM was defined as a workday. Visualisation was performed using Microsoft Excel 2010.

Results: There were 27163 units transfused, with 9272 (34.134%) transfused outside of working hours. There were 99 unique ward locations, a range between 1-3443 units (mean=271.81 units) per ward. There were 27 wards with 50% or greater units started after-hours, primarily intensive care and emergency medicine units, with 38.861% wards institutionally. The 20 clinical services without any after hours transfusions were primarily outpatient. Heatmapping identified a subset of wards that transfused afterhours and were not outpatient locations. This may be due to patient circumstances, but may also relate to ward culture.

Conclusion: At our institution, at least 1/3 of PRBC unit transfusions are started outside of working hours. This included transfusion locations that likely would have patients with acute bleeding (i.e. intensive care, medical surgery, operating rooms). There are locations that should not typically transfuse patients afterhours, such as orthopedics, intermediate care, and neurological units, but using the heatmapping methodology, they were identifiable. Overall, this study will allow our transfusion service to change the culture surrounding after-hours transfusions with the goal of improving safety.

Investigation of Anti-D in a Patient Following Multiple Rh Negative Blood Transfusions (081)

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Introduction: A 47 year old male was admitted to hospital with warm autoimmune hemolytic anemia and no prior history of transfusion or IV drug use. The patient was O Rh negative with a negative antibody screen. Nine days post admission and transfusion with 20 units of O Rh negative red cells , the patient developed an apparent anti-D. An investigation to determine the specificity and cause of the antibody formation followed.

Investigation and Results: All donor units were retrospectively tested for the D antigen using an indirect antiglobulin test to detect weak D. All were confirmed Rh negative; Weak D negative. The patient transfusion history was reviewed and platelet and IVIG transfusion excluded. Antibodies which react similarly to anti-D (anti-G and anti-Lwa) were serologically excluded. The presence of a warm autoantibody mimicking anti-D was ruled out by DAT testing and elution studies of patient cells. Genotyping confirmed RHD negative with no variants detected. The possibilities of passively acquired donor anti-D, or a donor weak D variant with recipient D alloimmunization were considered. Donor history revealed one of 20 donors with a known anti-D. Titration of the anti D on the implicated donor sample indicated a titre of 128.

Conclusions: The maximum amount of plasma present in RBCs collected by Canadian Blood Services is 29 mL/unit. Literature reports of patients with passively acquired anti-D from Rh negative donor transfusions exist. Our patient's antibody screen 6 weeks after first antibody detection was negative. This is consistent with a transient, passive anti D. Further investigations including re-testing of the patient when next admitted and consideration of Del typing and/or genotyping of the donor samples may be helpful. Identification and confirmation of antibody specificity is necessary in providing proper patient treatment. Even small amounts of passive, donor anti-D can contribute to a positive patient antibody screen.

Acquired Hemoglobinopathy Following Exchange Transfusion for Sickle Cell Anemia (033)

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Introduction: Red cell exchange transfusion for stroke prophylaxis in patients with sickle cell disease is a common therapy. Selection of donor red cells is challenging as alloimmunization is a frequent complication of transfusion and can lead to acute and delayed hemolytic transfusion reactions or to sickle cell hyperhemolysis. To minimize these risks selection of donor units which are antigenically or genotypically matched for the recipient red cell antigen profile is recommended. Case Report: DD is a 9 year old boy with sickle cell anemia, a history of stroke and Moya Moya disease. He is treated with red cell exchange averaging 5 units every 2 weeks to maintain hemoglobin S concentration less than 30%. He has an inconclusive antibody and is O Positive, C negative, Kell negative with Fy GATA mutation on genotyping. The red cell antigen phenotype required for donor units is C and K negative with Fya negative preferred. Post erythrocytopheresis hemoglobin fractionation was performed, and showed 79.4% Hemoglobin A, 1.8% Hemoglobin F, 4.4% Hemoglobin S and an abnormal hemoglobin peak comprising 1.1% of total hemoglobin. This peak was absent from pre transfusion samples and was noted previously in the same patient following a prior exchange transfusion. Donor segments were assessed and a variant hemoglobin identified in one of five. The proportion present in the donor and recipient sample are consistent with an alpha globin variant. The HPLC and electrophoretic characteristics did not permit definitive identification. Discussion: The presence of an alpha globin variant in the post exchange sample on two evaluations suggests that the red cell phenotype based selection of donors has selected a repeat donor with a hemoglobin variant. Alpha globin variants are typically clinically insignificant when present as a single gene variant (one of four alpha globin genes affected). Transfusion-acquired hemoglobinopathies have been previously reported. This case reminds us that selection of phenotypically matched donors for red cell antigens may select for donors with a higher prevalence of hemoglobinopathies. Variant hemoglobins, present as a minor proportion of the total, are not typically problematic for the donor or recipient and need not result in donor deferral.

Prevalence of Clinically Significant Red Cell Alloantibodies in a Western Canadian Prenatal Population (034)

G Clarke MD; J Hannon MD; D Lane MD; T Petraszko M; E Alport MD; T Dolnik MLT; L To MLT; B Eurich MLT; L Grabner MLT, Canadian Blood Services

Introduction: Canadian Blood Services provides perinatal testing services in British Columbia, Alberta, Saskatchewan and Manitoba. Routine prenatal testing includes first trimester ABO and Rh typing and an antibody screen. For mothers not previously tested, as well as those who are D negative, repeat assessment is recommended at 26 weeks. For women with new or previously identified clinically significant antibodies (CSA) serial titers are performed. Referral to high risk obstetrical clinics is recommended for women with CSA including anti Kell and those that reach a critical titer.

Methods: ABO Rh testing and antibody screening is performed using an automated solid phase platform. Antibody identification is done in solid phase with investigations and exclusions performed using PEG tube and other specialized techniques. Antibody titration is performed using a saline indirect antiglobulin test once a critical titre is reached (16 – 32). For anti Kell, recommendations for referral to a high risk obstetrical service are made upon identification. Results: In four Canadian provinces over four years from 2010 – 2013 a total of 614 749 patients were tested. CSA known to be associated with hemolytic disease of the newborn were identified in 4071 patients. CSA prevalence in this pre natal population is 0.66%. The most common antibodies identified amongst the whole population included anti E (28%), anti Kell (15%), anti D (12%), and anti c (10%). Some differences in the antibody prevalence were noted between provinces.

Discussion: The prevalence of CSA in pregnant women, including both initial and subsequent pregnancies is less than 1%. Nevertheless, this represents more than 1000 women each year in western Canada who require antibody titration, high risk obstetrical assessment and monitoring. The use of Rh Immune globulin has reduced the frequency of anti D, however anti D alloimmunization continues to occur. Anti-Kell antibodies are also prevalent. New strategies to reduce Kell sensitization should be investigated.

Optimising the use of Group O Rh(D) Negative Red Blood Cells: Defining the Age of Child-Bearing Potential in Ontario Hospitals (007)

Allison Collins MD FRCPC, Physician Clinical Coordinator; Deborah Lauzon ART BHA, Regional Manager; Troy Thompson MLT, Regional Project Coordinator; the Ontario Regional Blood Coordinating Network (ORBCoN)

Background: While 7% of the population is blood group O Rh(D) negative, 10% of Canadian Blood Services (CBS) donors are of this blood group, due to active efforts on behalf of CBS to recruit and retain them. Hospitals, however, request that 12% of their red blood cell (RBC) stock be O negative. Because of the high immunogenicity of the Rh(D) antigen, and of the potential risk of hemolytic disease of the fetus and newborn, women of child-bearing potential should receive group O Rh(D) negative RBCs if transfusion is required prior to blood group determination as, for example, in emergency situations. Defining child-bearing potential with provincial data may be useful, as approximately 5.5% of O negative RBCs are issued because a female patient is determined to be of child-bearing potential, and her blood group is unknown or unconfirmed at the time of transfusion.

Methods: Data on the maternal ages of Ontario women in each of the 15 Local Health Integration Networks (LHINs) were requested from the Canadian Institute for Health Information (CIHI) and provided to the Ontario Regional Blood Coordinating Network (ORBCoN) for the fiscal years 2007-2008 to 2011-2012. The data were used to calculate the cumulative percentage of all births according to maternal age, and to identify the cut-off ages required to capture 98%, 99% and 99.5% of all births in each LHIN. Trends in maternal age over the five years were also noted.

Results: During the period studied, there were 662,042 births in Ontario. Of these, 24,975 (3.8%) were to women age 40 years and older and 637,067 (96.2%) were to women age 39 years and younger. The age cut-off which would capture 99.5% of all women of child-bearing potential varied by LHIN, from 41 to 44 years. Trends in maternal age over the five years varied markedly between LHINs. In Ontario, overall, the number of births to mothers aged 42, 43, and 44 years appears to be increasing slightly.

Conclusions: The age at which Ontario women should be considered to be of child-bearing potential, and thus eligible for receipt of only group O negative RBCs in an emergency situation, may safely be lowered from the commonly-used age of 50 years. Hospitals using an age cut-off of greater than 44 years as a definition of child-bearing potential may wish to review their local maternal age data and current policies. There is an opportunity to preserve group O Rh(D) negative RBCs for patients who truly need them.

The Significance of Chido/Rodgers Antibodies in Allergic Spectrum Transfusion Reactions (038)

Alioska Escorcia*, Farzana Tasmin*, Nayana Sondi*, Sally Balmer*, Jeannie Callum^, Yulia Lin^, Lani Lieberman*^, Jacob Pendergrast*, Christine Cserti-Gazdewich*; *University Health Network/^Sunnybrook Hospital (Sunnetwork, Laboratory Medicine Program, University of Toronto).

Background/Purpose: The extent to which plasma protein allotype sensitizations predict for allergic to anaphylactic transfusion reactions remains unclear. Beyond classic examples of IgA and haptoglobin deficiency are descriptions of high plasma volume – containing products associating with severe allergic reactions in those sensitized towards the Chido/Rodgers system, wherein the fourth component of complement (C4) carries the Rodgers (Rg) and Chido (Ch) determinants, on C4A and C4B respectively. As adsorbable antigens, antibodies to these targets can be discovered on routine indirect red cell antibody tests, without portending hemolytic significance despite (ultimately plasma-inhibitable) panel cell and/or crossmatch incompatibilities. However, whether or not patients with this discovery should be counselled in a manner akin to how IgA-sensitized individuals would be addressed is unresolved. We sought to explore a high-volume hospital transfusion service (eg. 2014: 60,000 components dispensed) for the absolute number of Ch/Rg-sensitized patients and their transfusion outcomes.

Methods: HemoCare LifeLine (HCLL) (Mediware Information Systems, Melville, NY) was retrospectively interrogated for records tagged with a history of Ch/Rg antibodies, and among those, adverse transfusion events.

Results: 121 Ch/Rg antibody cases were discovered, with 65 (54%) transfused at any time. Only one (with anti-Ch) experienced a post-seroconversion event, equivocal for attributability, as the dialysis-dependent (and recently under-cleared) patient had already had head/neck edema before administration of a low-risk/low plasma-volume-containing (packed red cell) product for gastrointestinal bleeding. Non-hypoxic dyspnea with restlessness and transient hypotension (103/52 to 88/51) occurred >1h after completion. No mucocutaneous eruptions were noted, but diphenhydramine was nevertheless administered. Another patient had reported a minor reaction (without a retrievable diagnosis or ensuing alerts) a year before her Ch seroconversion. The definite allergic transfusion reaction rate in Ch/Rg recipients was 0/65 (0-5% for 95% CI), while the rate of reporting a disturbance was no higher than 2/65 (3%, 95% CI 0-11%).

Conclusions & Recommendations: Although the Ch/Rg phenomenon may justify the practice of red cell antibody screening after severe allergic reactions for the sake of an explanation, anaphylactic alarmism cannot be supported in de novo antibody detections. Larger reviews are warranted, ideally striving to rank the significance of various anaphylactogenic plasma protein sensitizations.

A PROVINCIAL APPROACH TO COMPLIANCE: HEALTH CANADA BLOOD REGULATIONS AND BRITISH COLUMBIA'S TRANSFUSION MEDICINE SERVICES (028)

SUSANNA DARNEL ART, JENNIFER DANIELSON MLT, BSc., BRITISH COLUMBIA PROVINCIAL BLOOD COORDINATING OFFICE

Introduction:

The Health Canada Blood Regulations were developed to provide regulatory requirements that are clear, comprehensive and specific to blood, harmonized across Canada and that allow for timely updating as needed. The Blood Regulations apply to all establishments that handle blood and allocate the level of oversight that corresponds to the level of risk of the activity being performed by each establishment.

Objective:

To achieve compliance by October 23, 2014 to the new Health Canada Blood Regulations using a provincially coordinated, collaborative approach by all British Columbia (BC) hospital Transfusion Medicine Services (TMS).

Process:

A Health Canada Project Charter was developed using a project management framework. Lessons learned were applied from the successful collaboration of the BC Provincial Blood Coordinating Office (PBCO) and the BC health authorities in reaching compliance to the CSA Z902 Canadian Blood Standards, which resulted in standardized safety standards for the handling of blood and its components at hospital TMS's in BC. The PBCO coordinated the development of the BC Health Canada Working Group (HCWG) whose membership consisted of a technical leader from each of BC's seven health authorities; from the Yukon Territories and from the Canadian Blood Services. The working group met monthly via prescheduled webinars to review and discuss each section of the Regulations, and participated in Health Canada webinars as required. The BC Transfusion Medicine Advisory Group and the Ministry of Health were provided regular updates of progress and of any concerns arising.

Results:

All of British Columbia's Transfusion Medicine Services met the Health Canada Blood Regulations requirements by October 23, 2014 and 7 sites applied for Registration by the deadline of January 23, 2015. Tools and templates developed for use by the HCWG were placed on a dedicated section on the PBCO website.

Conclusion:

The Health Canada Working Group provided the technical leaders with a forum for discussion and peer-to-peer support. This provincially coordinated and collaborative approach avoided duplication of work; provided opportunities for consolidation; and optimization of resources towards achieving mandatory compliance.

Acknowledgements:

The BC Technical Resource Group, Transfusion Medicine Advisory Group.

Contingency planning requires hospital participation (082)

Cheryl Doncaster BSc. MLT DHSA; Kathryn Webert MD, MSc, FRCPC Canadian Blood Services

Introduction: Within the blood system serving all provinces and territories with the exception of Quebec, both Canadian Blood Services and hospitals hold blood component inventory. The web-based Blood Component and Product Disposition System hosted by Canadian Blood Services provides a mechanism for individual hospitals, or a lead hospital representing a group of hospitals, to input daily blood component inventory levels. Resulting reports compile hospital inventory level submissions with Canadian Blood Services inventory levels for comprehensive total blood inventory reports used to support decisions regarding inventory level phases per the guidance of the National Blood Shortages Plan.

Process: In January 2015, as part of contingency planning to prepare for a potential labour disruption that would impact the supply of blood for Canadian patients, hospitals were encouraged to share red blood cell and platelet inventory levels on a daily basis. Between January 6 – 23 inclusive, hospital participation rates were monitored and hospitals were reminded to submit inventory data by 12noon EST daily.

Conclusions: In consultation with hospitals, the Canadian Blood Services Account Management Team deemed a total 242 inventory level submissions to be 100% hospital participation. For the duration of the inventory sharing period, 100% participation was not reached on any day. The participation rate (excluding weekends) ranged from 86% (209) to 49% (119). Hospital engagement and consistent timely hospital participation is imperative during inventory challenges to ensure decisions regarding inventory phase declaration and resulting actions are appropriate and informed. Consistent, timely communication to hospitals, education and adequate resources at hospitals will help to increase participation of hospitals.

Acknowledgements: Hospitals, Canadian Blood Services Account Management.

Two cases of the variant DAU5 RHD allele associated with anti D mediated hemolytic disease of the newborn (025)

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1.University of Alberta; 2.Alberta Health Services; 3.Canadian Blood Services

Introduction: Rh is a complex and immunogenic blood group system with a wide range of variant genotypes. Due to their complex epitope expression, potential exists for clinically significant D variants to be misidentified as Rh positive by standard serological analysis. Accurate identification of these variants is necessary during pregnancy to allow for timely Rh Immune globulin (RhIg) prophylaxis, as anti-D alloimmunization can occur in these individuals. Here, we describe two cases of the DAU5 RHD variant associated with anti-D production and mild hemolytic disease of the newborn (HDN) in two unrelated African patients.

Methods: The prenatal specimens on both patients were initially tested at Canadian Blood Services at 12 and 13 weeks gestation. Prenatal serological screening of both patients on the Galileo Neo with Immucor ® Series 4 and Series 5 anti-D reagents indicated group A Rh positive and group O Rh positive in patient A and patient B respectively. Both had negative antibody screens. Follow up serological testing at time of delivery, on the Galileo Echo with Series 4 and Series 5 anti-D, typed both patients as Rh positive. Antibody screens were positive with anti-D identified in both patient samples. There was no record of either patient receiving RhIg and DAT testing was negative. Cord testing was performed on their infants. Both were ABO identical with their mothers. DAT was positive in both (1+/weak). Anti-D was eluted from red cells of the cord sample from one infant while the eluate from the second cord sample was negative. Genotyping was performed on both maternal specimens by Progenika ®. DNA sequencing indicated the partial D variants RHD*Psi/RHD*DAU5 and RHD*DAU5/RHD*r's.

Conclusions: Prenatal patients expressing the DAU5 variant RHD allele may be classified as Rh positive on the basis of standard serological testing and subsequently not receive RhIg prophylaxis during pregnancy. These individuals are at risk of anti-D formation during pregnancy and subsequently HDN. Routine molecular testing in prenatal patients may play an important role in accurately identifying these patients.

Donor Re-entry at Canadian Blood Services (046)

Dolly Cordi MBA, Canadian Blood Services; Irene Dines MLT, CBS; Vito Scalia MSc, MLT, CBS; Gerry Pilot MLT, CBS; Carol Lalonde MLT, CBS; Margaret Fearon MD, FRCP, CBS

Introduction: Many donors have been permanently deferred from donating blood because of a false reactive transmissible disease (TD) screen test result. In February 2014, Health Canada approved the implementation of a donor re-entry (DRE) programme for Canadian Blood Services (CBS) to coincide with the implementation of eProgesa to allow deferred donors to qualify to resume donating blood.

Methods: The donor re-entry programme (DRE) allows donors to be re-qualified both prospectively and retrospectively. The Prospective group includes any donors who test false positive for HIV, Hepatitis C Virus and Hepatitis B surface Antigen (HBsAg) as of February 2014 and going forward. The donor must wait 6 months before providing samples only for reentry. The Retrospective group includes any donor(s) who was permanently deferred for TD false reactivity for the same markers and also includes the HIV-1 p24 antigen, prior to eProgesa implementation. Donors are selected from the previous four years, using search functionality in eProgesa through Business Intelligence warehouse, as well as from lists of qualified donors who have contacted CBS with an interest in re-entry. The donors selected are then manually coded for follow up re-entry testing.

Results: Following is the donor re-entry data (DRE) from Feb. 2014 to Feb. 2015. Prospective group: 784 invited for re-entry, 43 (5%) returned, 19 (2%) eligible, 24 (3%) failed re-entry. Retrospective group: 168 invited, 66 (39%) returned, 58 (35%) eligible, 8 (5%) failed. Total 952 invited, 109 (11%) returned, 77 (8%) eligible, 32 (3%) failed re-entry.

Conclusion: Based on the findings after a one year period, the number of prospective and retrospective donors returning to provide samples and donors that become eligible for DRE, the programme has given a low yield of returned donors. This was not unexpected, as other blood operators have experienced similar results with donor re-entry programmes.

Ebola Preparedness at Canadian Blood Services (053)

Margaret Fearon MD FRCP, Canadian Blood Services; Robert Skeate MD, CBS; Mark Bigham MD, CBS; Patricia Cronin RN BN, CBS; Jennifer Biemans BSc ART, CBS; Kristina Guenette, CBS; Lindy McIntyre BA, CBS; Susan Shimla MLT, CBS; Michelle Dunbar, CBS

Introduction: The 2014 Ebola outbreak in West Africa is the largest since the virus was first recognized in 1976. As of March 2, 2015, more than 23,000 cases have been documented in Liberia, Sierra Leone and Guinea, with approximately 50% mortality rate. Although the likelihood of cases of Ebola virus disease occurring in Canada is small, Canadian Blood Services (CBS) considered it prudent to put measures in place to deal with blood donors with potential exposure, and protocols for the collection and/or procurement of Ebola convalescent plasma which could be used to treat Canadian Ebola patients.

Methods: An internal Ebola committee was formed to decide on measures CBS should put in place for dealing with potentially exposed blood donors. The committee also formed working groups to develop methodologies for providing Canadian hospitals with Ebola convalescent plasma to treat patients, if required.

Results: CBS now has a Health Canada approved directive which can be implemented to defer Ebola exposed donors who are not already deferred for possible malaria exposure (all travellers to or residents of West Africa). This directive allows for an additional question on the Record of Donation and the deferral of an exposed donor for 56 days. Directives will also be in place for the collection and distribution of Ebola convalescent plasma from suitable Canadian donors to designated recipients. Procedures have been developed with Emory University and Cerus Corporation in the United States, to import Ebola convalescent plasma if required for a Canadian patient.

Conclusions: It is important for CBS to be prepared for national or international emergency situations where potential donor exposure to an emerging infectious disease may pose a risk to the blood supply. It is also important that CBS contributes to patient treatment with products that it can collect or procure, such as convalescent plasma.

Human Babesiosis and Tick Distribution in Canada (000)

MA Fearon, Canadian Blood Services; SF O'Brien, Canadian Blood Services; G Delage, Héma-Québec; V Scalia, Canadian Blood Services; F Bernier, Héma-Québec; S Dubuc, Héma-Québec; M Germain Héma-Québec; G Pilot, Canadian Blood Services; QL Yi, Canadian Blood Services; R Lindsay, Public Health Agency of Canada

Introduction: Global climate change has impacted on emerging infectious diseases in a variety of ways. One is the geographic distribution of vector insects such as mosquitoes and ticks. Insects such as the black legged tick are expanding farther north with the changing habitat, potentially increasing the risk from tick borne diseases such as Babesiosis. The agent responsible, *B. microti*, is already well established in ticks in the North-eastern USA where there are about 1500 community cases per year and where there have been more than 160 transfusion-transmitted cases to date. We aimed to assess the percentage of B. microti infected ticks in selected locations in Canada relative to blood collections.

Methods: Passive surveillance of ticks involved testing of community submitted ticks for *B.microti*. Active surveillance involved collecting and testing samples of ticks (eg using drag nets) at locations suggested by passive surveillance data. The percentage of *B.microti* positive ticks from active surveillance by census division were superimposed on maps of the percentage of provincial blood donations by census division.

Results: Passive tick surveillance from 2013-2014 of more than 12,000 blacklegged ticks identified *B. microti* in Manitoba (10), Ontario (1), New Brunswick (1) and Quebec (2). Active surveillance of 2,734 host-seeking ticks from Manitoba, Ontario, New Brunswick and Nova Scotia representing established tick populations (2009 – 2014) identified 6/361(1.7%)infected with *B. microti* in Manitoba, and 3/641 (0.5%) in Quebec. These were in geographic locations where blood donor clinics are commonly held.

Conclusions: Although a seroprevalence study in 2013 showed completely negative results for *B. microti* antibody in close to 14,000 donors, passive and active tick surveillance carried out by NML shows that prevalence of black legged ticks is increasing, particularly in southern Manitoba, Ontario and Quebec. Furthermore, *B. microti* appears to be establishing in tick populations in these areas, notably in Manitoba where the first human community case acquired from tick exposure in Canada was reported in 2013. Monitoring and risk assessment of tick borne diseases in our donor population will be of increasing importance with the rapidly changing ecology of Canada.

Anatomy of a Stem Cell Drive (035)

Fingrut, Warren, University of British Columbia

Introduction: Patients with a variety of blood cancers and metabolic diseases may require a stem cell transplant as part of their treatment. However, over 70% of patients do not have a suitable genetic match in their family. Canada's stem cell donor database, OneMatch Stem Cell and Marrow Network, is used to match potential unrelated donors to patients worldwide. Individuals aged 17-35 years can register online or at a stem cell drive where they provide consent and a tissue sample (buccal–swab) for Human Leukocyte Antigen (HLA) allele typing. To date, no guidelines or technical reports have been published to recommend a process for stem cell donor recruitment at drives.

The UBC Stem Cell Club was founded in 2011, and we are accredited through OneMatch to run stem cell drives independently. Here, we describe our approach to stem cell drive design.

Process: Our stem cell drives includes five stations: pre-screening, informed consent, registration, swabbing, and reconciliation. Registrant confidentiality and privacy is maintained throughout. Registrants are first pre-screened to persuade them to register and ensure donor eligibility. Volunteers at the prescreening station target the most-needed stem cell donors according to the literature: young, healthy, and ethnically-diverse males. Ineligible and non-optimal donors are redirected to help in other ways. Volunteers then educate registrants about the stem cell donation process, and secure informed consent according to the World Marrow Donor Association's (2003) suggested procedures for procurement of informed consent. Registrants are subsequently guided through registration, where they provide contact/demographic information, complete a health questionnaire, and sign a consent form. Following registration, registrants proceed to swabbing, where they swab their cheeks to provide a tissue/DNA sample. Finally, registrants visit reconciliation, where their understanding of the donation process is assessed to verify informed consent and their swab kits and paperwork are checked for errors.

Conclusions: In summary, this presentation describes the first published approach to stem cell drive design, an approach which is applied to every UBC Stem Cell Club drive. Our drives incorporate relevant WMDA guidelines, emphasize targeted recruitment of the most needed stem cell donors according to the literature, and feature built-in quality control and informed consent checkpoints.

The UBC Stem Cell Club: Recruiting the Most-Needed Stem Cell Donors (036)

Warren Fingrut, University of British Columbia; Simran Parmar, University of British Columbia; Tim Walters, University of British Columbia; Eric McGinnis, University of British Columbia; Alice Graham MSc., University of British Columbia; Xiu Qing Wang, University of British Columbia; Kiran Rikhraj, University of British Columbia; Jason Randhawa, University of British Columbia; Justin Cheng, University of British Columbia; Erin Charman, University of British Columbia

Introduction: Patients with a variety of blood cancers and metabolic diseases may require a stem cell transplant as part of their treatment. However, over 70% of patients do not have a suitable genetic match in their family, and need an unrelated donor. The ideal stem-cell donors are young, male, and ethnically-diverse. Patients are more likely to match to a donor in their own ethnic group; younger and male donors are associated with improved patient outcomes. However, males under age 35 represent only 16% of Canada's current donor-database (7% non-Caucasian males).

Design/Methods: The UBC Stem Cell Club was founded in 2011, aiming to improve the quantity and quality of membership on Canada's stem-cell donor database. We have established a community partnership with Canadian Blood Services. We are the first student-run group worldwide that has been accredited to independently run stem cell drives. We have five active chapters at university campuses across British Columbia.

Results: To date, we have recruited 3146 potential stem cell donors (representing 1% of all donors on Canada's current donor-database). Our recruitment strategy focuses on the most-needed donors according to the literature. From 11/2012-02/2015, 68% of 2162 recruited registrants were male. From 10/2013-07/2014, of the 688 males recruited, 53% self-reported as non-Caucasian and 77% were age 17-25. We have recruited 35 young Aboriginal males, increasing this demographic group's representation on Canada's registry by ~5.5%.

Conclusion: Our initiative represents a sustainable model of quality stem cell donor recruitment that can be applied to campuses across Canada.

Development and Implementation of Checklists for Quality Control at Stem Cell Drives: A UBC Stem Cell Club Approach (078)

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Background: Checklists are important tools in error management, and their use improves best practice adherence. However, no published checklists exist which outline a process for stem cell donor recruitment onto donor-databases at stem cell drives.

The UBC Stem Cell Club is a community partner of Canadian Blood Services, and includes five chapters. As of 02/2015, we have coordinated 44 stem cell drives, signing up 3210 stem cell donors. We have previously described a model of stem cell drive design including five stations: prescreening, informed consent, registration, swabbing, and reconciliation (Fingrut, 2015). Here, we describe the design and implementation of a checklist-based approach to ensuring quality control and securing informed consent at stem cell drives. The objectives of this checklist include standardizing stem cell drives run by different teams; equipping volunteers with a memory recall tool; and enhancing volunteer training.

Design: Our five-station stem cell drive design was used as a starting point to create five station-specific checklists, designed for ease of use at stem cell drives. All World Marrow Donor Association suggested procedures for securing informed consent at time of registration (2003) and recommended training topics for volunteer recruiters (2013) were incorporated into the checklists.

Results and Conclusions: Since 01/01/2015, checklists are brought to each UBC Stem Cell Club drive. Volunteers are instructed to refer to their checklists for guidance during their shifts. All training materials have been updated to incorporate the checklists, so that new volunteer recruiters are familiar with them prior to their first volunteer shift.

These checklists have standardized the way UBC Stem Cell Club recruits stem cell donors. This system offers a streamlined way for our club to change our procedures and ensure that volunteer training and registrant experience is similar across all chapters. The checklists are relevant to Canadian Blood Services and to any community groups who run stem cell drives. Any stem cell drive staff and volunteer recruiters could benefit from learning and referring to this resource

Acknowledgements: This work was supported by Canadian Blood Services, Doctors of BC, Canadian Federation for Medical Students, and UBC Medical Undergraduate Society.

Facilitating cord blood research in Canada (042)

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Introduction: Umbilical cord blood is a rich source of hematopoietic stem cells and has many applications both clinically and in research. Research performed with cord blood ranges from studies to improve cord blood collection, manufacturing, and storage processes; to studies evaluating the use of cord blood in the treatment of hematopoietic and non-hematopoietic diseases. A survey of Canadian researchers in 2010 found that access to cord blood for research was not adequate to meet the demand and that the cord blood available for research was not always ethically sourced.

Design: In 2013, Canadian Blood Services launched the National Public Cord Blood Bank (NPCBB), which collects, processes, tests, and stores cord blood units for transplantation; however, not all collected cord blood is suitable for storage and transplantation. The Cord Blood for Research Program (CBRP) and NPCBB developed processes to distribute de-identified cord blood units not suitable for storage and transplantation to the scientific community for biomedical research purposes, minimizing the number of cord blood units discarded and facilitating access to cord blood for research.

Results and Conclusions: In August 2014, the CBRP launched in Ottawa. Mothers donating to the NPCBB at The Ottawa Hospital are now given the option to donate to the CBRP if their baby's cord blood is not suitable for storage and transplantation. The consent rate for research for mothers donating to the NPCBB has increased from 33% to 65% in the first 6 months of CBRP operations. Canadian researchers nationally are able to apply to receive cord blood products for research and, in the first 6 months of CBRP operations, 40 cord blood units have been distributed to 6 researchers from British Columbia and Ontario, to projects ranging from cord blood expansion to the hematopoietic reconstitution enhancing activity of osteoblasts. To further facilitate access to research cord blood samples for TOH and Ottawa Hospital Research Institute researchers, Canadian Blood Services and TOH have created a joint research working group that facilitates access to cord blood and related research samples that cannot be obtained through the CBRP due to study requirements.

THE IDENTIFICATION OF U- AND U+var DONOR RBC UNITS (022)

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BACKGROUND: To accurately type rare U- vs. U+var frozen RBC units, fresh donor samples were tested to confirm their U antigen status serologically and molecularly. U (MNS5) is a high prevalence antigen found in 99.9% of donors. Individuals who are S-s- may be U-or weakly express U, referred to as U+var. U- & U+var phenotypes are primarily found in Blacks and are difficult to distinguish serologically but are genetically very different. Phenotyping red cells for U- and U+var serologically requires rare unlicensed anti-U/GPB antisera. The U- phenotype is due to the deletion of the GYB gene. The 4 genes responsible for the U+var phenotype result in altered forms of GPB and/or low level production of GPB.

METHODS: Serologic methods consisted of using human antisera known to contain anti-U/GPB by IAT. Molecular testing was performed using the IDCore XT assay (Progenika) to interrogate the total absence of the GYB gene (U-) or polymorphisms which would predict a U+var phenotype.

RESULTS: 13 donor RBC units were tested. 11(85%) were concordant (8 U-, 3 U+var) and 2 were discordant (1 possible U+var by serology, found to be U- on genotyping, 1 possible U- by serology found to be U+ on genotyping). All 3 U+var donors had the g>t mutation at +5 of intron 5 that results in skipping of exon 5 of GYB.

CONCLUSION: Molecular testing is more accurate than serologic methods in determining U- and U+var status and is becoming the gold standard for typing these rare donors.

Resolution of "possible D" phenotype reported following genotyping using Immucor BioArray RHD BeadChip™ Kit (024)

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Purpose: Canadian Blood Services employs Immucor BioArray RHD BeadChip™ Kit (BioArray) for resolution of RhD typing discrepancies on prenatal patients. In some cases, predicted phenotype based on genotype results is reported as "possible D". The significance is uncertain for determining eligibility for Rh immune globulin (RhIG) prophylaxis. Methods: Between 2014-06-01 and 2015-01-31, 16 of 108 (14.8%) of genotyped samples were reported "possible D". To further elucidate the RhD type, 12 samples were referred to the CBS National Immunohematology Reference Laboratory for genotyping using Progenika BLOODchip™ Reference Kit (BLOODchip). Four (4) samples were sent to BioArray, New Jersey, for investigation. As each genotyping platform interrogates specific variants, it was hoped that additional testing would resolve at least some of the "possible Ds". Results: Results for 12 samples sent to Progenika reported 5 RHD*VII type 1, 1 double heterozygote RHD*IVS8-31C/RHD*weak D type 42, 1 RHD*weak D type 55, and 5 RHD present but possibility of a mutation not interrogated by the assay could not be excluded. In 4 of 5 cases with RHD present, a unique RHD variant (RHD*1175G, RHD*208T, RHD*731T, RHD*842C) was subsequently identified on gene sequencing. Samples sent to BioArray reported 1 RHD*weak D type 9, 1 RHD*DV type 5 (DHK), and 2 RHD*DVII. Conclusions: 15/16 (93.8%) of "possible D" individuals were determined to have a weak or partial D which placed them at risk for development of anti-D. Therefore they were considered RhD negative for purposes of RhIG therapy. One (1) patient had the RHD gene which was confirmed by gene sequencing. This patient was considered RhD positive. In 4 cases, with BioArray and BLOODchip results alone, patients would have been considered RhD positive although variants were subsequently recognized when their samples were used to control gene sequencing assays. Based on the results of this study, all prenatal women reported as "possible D" using the BioArray assay should be managed as RhD negative and RhIG prophylaxis should be recommended. Although it is interesting to follow-up on "possible D" patients, this may not be necessary other than for academic interest.

Bringing Blood to the Scene on Time (071)

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In 2013, Alberta STARS Air Ambulance requested development of a process for providing blood to be stored at their hanger and taken on scene calls. Consultations with the Provincial Transfusion Medicine Network were carried out and transfusion medicine laboratories in Calgary volunteered to pilot the initiative.

The Golden Hour Cooler was selected to store and transport blood for this program. The criteria for acceptability were based on CLS specific requirements, as well as STARS on board limited space availability and weight restrictions. Extensive temperature validations were conducted over a range of minus 20 to plus 35 °C. Various temperature controlled environments within transfusion medicine were first used, and then strategically initiated trial runs were carried out in the field with STARS personnel afterward.

When establishing protocols for timely provision, exchange and re-processing of coolers, it was evident that coordination between lab, STARS and courier staff was essential. Routine stock exchange processes were developed with consideration to cooler temperature validation, freezer pack conditioning requirements, hours of operation, staffing and previous utilization of blood products by STARS. To best capitalize on the potential benefits that this program may provide in life threatening situations, STARS needed to be able to have blood with them at all times, even when multiple traumas required transfusion and transport in rapid succession. It became apparent that communication between STARS and the lab staff in real time was critical if blood was to be ready upon arrival of the helicopter at the hospital for exchange.

After nearly a year of the program being in place, the benefits of the initiative are promising. There have been at least 15 situations that STARS has utilized the unmatched red cells. Of those, approximately half of the patients have survived. All of the patients received multiple products after transport, showing that the blood was being utilized in appropriate transport missions. With the success of the Calgary program, expansion to the other two Alberta bases has already occurred.

Effect of liposome treatment on rat red blood cell membrane microvesiculation during hypothermic storage (079)

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Background: The loss of red blood cell (RBC) membrane phospholipid asymmetry leads to phosphatidylserine (PS) externalization, culminating in microparticle (MP) formation and release. RBC MPs have been associated with storage lesion, exhibiting both procoagulant and proinflammatory activities. Liposome treatment has shown to mitigate several aspects of storage-induced RBC membrane lesion. This study aimed to assess specific effects of liposome treatment on rat RBC microparticle concentration and PS externalization during storage.

Methods: Unilamellar liposomes were synthesized using an extrusion method to contain lipid bilayer of unsaturated (1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC):cholesterol, 7:3 mol%). The leukoreduced, packed RBCs from Sprague-Dawley rats (n = 6) were incubated for 30 minutes at 37 °C in a mixture of AS-3 solution with either HEPES-NaCl solution (control) or 2 mM lipid from DOPC liposomes. RBC microvesiculation was assessed by flow cytometry after liposome treatment (fresh) and upon six weeks of hypothermic storage. Percent hemolysis was measured using the Drabkin's method.

Results: Flow cytometry analysis showed no difference in MP concentration immediately after treatment (25,845 ± 7,724 MPs/µL vs. 29,146 ± 6,083 MPs/µL, p = 0.219) and increased MP concentration in liposome-treated RBCs (812,113 ± 322,762 MPs/µL vs. 598,073 ± 132,869 MPs/µL, p = 0.028) after 6 weeks of storage. The intensity of PS exposure was lower in liposome-treated MPs than in control MPs (1.16 ± 0.14 vs. 1.84 ± 0.54, p = 0.031) after 6 weeks of storage. Mean fluorescence intensity of microparticle PS decreased with storage in both liposome-treated and control, with more prominent decrease observed in liposome-treated MPs (63.1% vs. 39.2%, p = 0.009). Although hemolysis values remained lower in liposome-treated compared to control RBCs, a significant difference was no longer detected after storage (5.4 ± 0.5 vs. 6.1 ± 1.1, p = 0.12).

Conclusions: Liposome treatment increases MP concentration, while decreasing PS externalization after hypothermic storage. More studies need to be done to characterize MP bioactivity after liposome treatment.

Selective Exclusion of High Titer Donor Plasma and Immunoadsorption Chromatography as Steps to Reduce Isoagglutinin Titers in IVIG (105)

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Introduction

Hemolysis is a rare but potentially serious complication of high-dose IVIG therapy. Isoagglutinins originating in donor plasma are believed to play a major role in these reactions, but host factors are also important. We determined the effects of excluding plasma from donors with high isoagglutinin titers from the pools used to prepare IVIG, and of specific anti-A/B immunoaffinity chromatography (IAC), on the anti-A and anti-B titers of IVIG products prepared using the process for Privigen/Hizentra.

Methods

A high-throughput assay was used to identify plasma donors with the highest anti-A titers. The effects of addition of IAC with A/B-trisaccharide-coupled resins into the manufacturing process were also studied. Anti-A/B isoagglutinin titers in the resulting IVIG preparations were measured by indirect agglutination and flow cytometry.

Results

Exclusion of the 5% of plasma donors with the highest anti-A titers reduced both anti-A and anti-B isoagglutinins in the final product by approx. 50% (a single 2-fold dilution step, i.e. reduction of the titer from 1:16 to 1:8, and 1:8 to 1:4, respectively. N=30 lots). Specific IAC reduced anti-A and anti-B titers by at least two 2-fold dilution steps in the final product (>80% reduction shown by flow cytometry on standard red cells), while the content of antibodies against common microbial antigens remained unchanged.

Conclusion

Anti-A/B isoagglutinin reduction in IVIG products is feasible using screening and exclusion of a small percentage of high anti-A titer donors and with specific IAC. These approaches may reduce the risk of hemolysis in IgG therapy.

Are blood transfusion reactions under recognized or under reported? (060)

WRHA Blood Conservation Service Nursing Team (G Khuu RN BN, L Alcantara RN, A Courcelles RN, L Dyck RN BN, J Gould RN, S Paul RN BN and Kenny S RN MSc DipPH)

Introduction: Blood transfusions have become an important adjunct in health care. Nonetheless, there are risks associated with transfusions. Identifying and reporting blood transfusion reactions are fundamental aspects of patient safety. However, transfusion reactions are frequently under recognized and under reported.

The purpose of this chart review is to determine the number of immediate transfusion reaction(s) and to identify gaps in recognition and reporting.

Methods: Retrospective chart reviews of allogeneic red blood cell recipients admitted to facilities within the Winnipeg Regional Health Authority between 2005 and 2013. This convenience sample included transfusion records from Blood Conservation Service (BCS) referred patients or from Quality transfusion audits. These transfusion records represent patients in the gynecology, obstetrical, critical care and orthopedic surgery programs within Winnipeg Regional Health Authority Facilities.

Trained data collectors reviewed the charts for documentation related to red blood cell transfusion. Data was recorded on a standardized audit tool aligned with the Public Health Agency of Canada transfusion reaction definitions. Data on the presence of immediate transfusion reaction signs and symptoms, treatments, and evidence of reporting transfusion reaction were recorded.

Results: A total of 1705 transfusion records were reviewed. Suspected immediate transfusion reactions occurred in 6.8% of the audit sample (n=116/1705). Transfusion reaction symptoms were documented in 43% of the cases (n=50/116). All documented reactions symptoms were treated. However, only 30% (n=15/50) of these cases were documented as a transfusion reaction. A small number (14%, n=7/50) were reported to the Blood bank.

Conclusion: This review confirms that immediate transfusion reactions are occurring in patients receiving red blood cells. Management of patient symptoms is occurring. There are gaps in the recognition of the signs and symptoms as a transfusion reaction and in their reporting to the Transfusion Medicine Service. In order to ensure patient safety, all transfusion reactions in Manitoba must be reported to the Transfusion Medicine Service/ blood bank. Based on the results from this review, future research could include further exploration into the barriers for health care staff on transfusion reaction(s) reporting.

An unexpected antibody: Apparent anti-D in a D negative patient who had only received D negative blood (088)

Liese Bolte, Canadian Blood Services; Lynne Oldfield, Canadian Blood Services; Tammy Ison, Canadian Blood Services; Wendy Lau, Canadian Blood Services

Case Report: A sample was referred in for antibody investigation. Patient was a fifteen year old female with hereditary spherocytosis, scheduled for splenectomy. Hospital investigation showed her blood group to be B negative, DAT negative, phenotype C-E-c+e+, antibody screen positive with anti-D and anti-C identified. She had only been transfused once before, 6 months ago, with two B negative units. The possibilities included variant D donor, passive anti-D from a donor with high-titre anti-D, patient had anti-G. This patient's transfusion was six months ago and both donors were antibody screen negative, so passive anti-D was ruled out. One donor was C-E-c+e+, one donor was C+E-c+e+. We decided to investigate the patient for anti-G before testing the donor for D variant.

Serological Testing: G antigen is present on D positive and C positive red cells; anti-G appears to be a combination of anti-D and anti-C. Alloadsorption was performed with a R2R2 (D+C-) and a r'r (D-C+) cell. Eluates were made from the adsorbed cells.

Investigational Testing	Observation	Conclusion
Initial Panel	Reactive with D+ and C+ panel cells	Anti-G?
R2R2 (D+C-) adsorbed plasma	Reactive with C+ panel cells	Anti-C
r'r (D-C+) adsorbed plasma	Non-reactive	No anti-D
Eluate from R2R2(D+C-) cell	Reactive with D+ and C+ panel cells	Anti-G
Eluate from r'r (D-C+) cell	Reactive with D+ and C+ panel cells	Anti-G

Conclusions: This D negative individual, who received D negative C positive red cells, appeared to have made anti-D and anti-C. Adsorption and elution studies identified anti-G and anti-C instead of anti-D and anti-C. For transfusion purposes, it is not necessary to differentiate between the two, as the patient will receive D-C- red cells. However, this differentiation is important for female patients of childbearing age. Transfusion laboratories who do not have the resources to do alloadsorption may perform titration studies instead. When anti-G is present without anti-D, the titre vs C+D- red cells would be higher than the titre vs C-D+ cells. (Ref: Guidelines for Prenatal and Perinatal Immunohematology, AABB press 2005). RhIG should be administered to prenatal patients whenever serological testing suggests the presence of anti-G and the absence of anti-D.

ABO discrepancy in a paediatric patient (089)

Wendy Lau, The Hospital for Sick Children; Liese Bolte, Canadian Blood Services; Lynne Oldfield, Canadian Blood Services

Case Report: An eleven year old girl was admitted with fever, weight loss, anemia and neutropenia. A sample was sent to our Transfusion Laboratory for type and screen. She typed as O positive, antibody screen negative. On review of her transfusion history, it was noted that she previously tested A positive in this hospital 6 years ago, and she received one A positive unit without incident. In order to exclude mistaken patient identity, the Transfusion Laboratory requested a second sample for repeat testing. The second sample again tested O positive. Both samples had no anti-A on reverse typing, so we suspected the patient's previous blood grouping result was indeed correct.

Serological Testing: The patient sample was sent to the reference laboratory for investigation of ABO discrepancy, phenotyping and genotyping. The results are as follows:

Forward typing: microscopically reactive with anti-A and anti-A,B (microscopic reading was not a routine for ABO typing, was only done for this case), non-reactive with anti-B. Reactions did not change after the patient's red cells were treated with papain. In the reverse grouping, group B cells reacted 3+, group A1, A2, O cells were negative. The patient's phenotype was: D+C+E-c+e+, K-. Jk(a+b+), Fy(a+b-). M+N+S+s+, Le(a+b-), P1+. All positive reactions were 3+ or 4+, there were no weak reactions.

Blood Group Genotyping: The ABO genotype was A2,O1, otherwise the genotype matched the phenotype.

Conclusions: This patient's red cells showed loss of A antigen, while the other blood group antigens were preserved. At presentation, her bone marrow aspirate showed erythroid hyperplasia and 9% myeloblasts. There was no cytogenetic or molecular abnormality. The differential diagnosis was myelodysplastic syndrome vs acute myelogenous leukemia (erythroleukemia). Loss of A and B antigens on her red cells support the diagnosis of a clonal disorder involving the red cell line. Weakening or loss of A and B antigens have been reported in certain disease states including myelodysplastic syndromes and leukemias.

Automating the "Mini Panel" for Detecting Additional Antibodies (069)

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Introduction: CSTM Standards specify that a “process” be in place to determine the presence of new antibody(ies) in patients with previously identified antibody(ies). Practices differ as to type and frequency of investigation but most involve manual methods to perform a “mini panel” or select cells. Our practice had been to initiate additional antibody detection steps only if the antibody screen reactivity showed changes in pattern or strength, or if crossmatched antigen negative units were incompatible. Despite no evidence of missed antibodies causing delayed serologic or hemolytic reactions, we considered that perhaps we were under investigating. The implementation of new automated platforms within our region was an opportunity to improve our process without increasing staffing levels.

Method: We devised a process called Enhanced Screen by Automated Panel (ESAP) where if the antibody screen was positive, one of 3 solid phase panels was selected for additional antibody screening depending on the previously identified antibody. Testing frequency by automated select panel was based on recent transfusion. If the extra screening panel results corresponded to the known antibody, no further action was taken. New or uncertain reactivity triggered a full investigation to rule out new antibodies.

Results: Of the 760 ESAP tests performed over a 16 month period at 3 sites, 709 (93%) were reported as "No Additional Antibodies present”. Of the 51 cases referred for full antibody investigation, no additional or clinically insignificant antibodies were found in 48. New clinically significant antibodies were found in 3 cases or 0.4% of the ESAP tests performed. One case could have been detected by noting the change in screening cell reactivity. We were unable to determine retrospectively if the crossmatching could have detected incompatibility.

Conclusion: For patients with known antibodies, the ESAP is effective for detecting new antibodies while reducing the need for manual select cell panels. Nevertheless this process requires more reagent resources than our previous approach. We plan to improve ESAP panel selection using an algorithm tool developed in-house; examples of most appropriate panel selection using the tool will be presented.

Anti-erythrocyte antibody mediated phagocytosis in vitro is linked to its therapeutic role in murine immune thrombocytopenia (ITP) (056)

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Introduction

Rh immune globulin (anti-D) is composed of anti-RBC antibodies and is used in the treatment of immune thrombocytopenia (ITP). Anti-D is in limited supply and its mechanism is currently speculative. Monoclonal anti-erythrocyte antibodies can be effective in treating ITP; however, determining an in vitro method to discriminate which antibodies will be effective in vivo has not yet been established. We hypothesized that anti-RBC antibodies which are capable of inducing in vitro RBC phagocytosis will be the ones which increase platelet numbers in a murine model of ITP.

Design and Methods

In vitro phagocytosis experiments were performed using erythrocytes from selected transgenic strains of mice including HOD (Hen egg lysozyme-ovalbumin-human Duffy) mice and human glycophorin A expressing mice. Erythrocytes were opsonized with monoclonal anti-RBC antibodies of different antigen specificities, antibody isotypes and different abilities to ameliorate ITP. Erythrocytes opsonized with these antibodies were then incubated with RAW264.7 macrophages for 30 minutes at 37°C. Following incubation, cells were then fixed and visualized by light microscopy to determine the ability of each antibody to induce phagocytosis. To assess the efficacy of anti-RBC antibodies in the amelioration of ITP, mice were injected intravenously with the anti-RBC antibody of interest followed by anti-platelet antibody to induce ITP. The ability of different anti-RBC antibodies to cause anemia as well as inhibit the induction of ITP were compared.

Results and Conclusions

This work compared the ability of eight different monoclonal and polyclonal anti-RBC antibodies to induce anemia, ameliorate ITP, as well as mediate phagocytosis in vitro. Surprisingly, it was observed that not all antibodies which induced anemia in vivo were capable of inducing in vitro phagocytosis. There was however an absolute positive relationship between the ability of anti-RBC antibodies to ameliorate ITP and their ability to induce in vitro phagocytosis of sensitized-erythrocytes. Thus, the ability of an antibody to cause erythrocyte phagocytosis in vitro could be indicative of its ability to ameliorate ITP in vivo. We speculate that a future screening tool to test the therapeutic ability of monoclonal antibodies in ITP may be possible using an in vitro phagocytosis assay.

Acknowledgements

Canadian Blood Services

Screening for IVIG Associated Hemolysis – An Institutional Experience (087)

Lenore Mierke, Joanna McCarthy, Dr. Meer-Taher Shabani-Rad

Purpose: To monitor IVIG recipients for isoagglutinin associated hemolytic anemia post IVIG infusion.

Method: All IVIG recipients were included in a database and group A, B, or AB patients were screened once for hemolysis post infusion. Group O patients were excluded from the IVIG screening process. A 3-10 day post IVIG infusion sample was collected and the post-infusion hemoglobin was compared to the hemoglobin pre-infusion. No further testing was performed in cases with less than a 10g/L decrease in hemoglobin levels post IVIG. In all cases where the hemoglobin dropped by more than 10g/L a DAT, Haptoglobin, LD, and Bilirubin were tested. The results were reviewed by the TM Physician to determine if IVIG induced hemolysis had occurred. Recommendations for future treatments were made at the time of review. Further hemolysis screening was performed at the discretion of the attending physician, or if the recipient required a change in IVIG brand.

Result: In 2014, a total of 562 IVIG infusion courses (479 patients) were enrolled. From those, a post IVIG specimen was not collected on 116 courses. 54 out of 446 cases (12%) were eligible to be reviewed by the TM Physician. Eighteen of the reviewed recipients (4%) were confirmed as having IVIG associated hemolysis. However, considering the severity of hemolysis, the brand of IVIG was switched in only 8 of the cases. All four IVIG brands that are supplied by Canadian Blood Services have been implicated in causing hemolysis (see table). Gamunex showed a higher percentage of hemolysis compared to other brands (2% vs 0.7%) respectively.

Conclusion: Hemolysis associated with isoagglutinin content of IVIG has been demonstrated in recipients being transfused with all brands of IVIG supplied by Canadian Blood Services. A screening process should be in place to identify these recipients and mitigate the associated risks.

Keyword: Hemolysis

IVIG

Transfusion Medicine Data Mart (045)

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Introduction / Objective

The goal of the Transfusion Medicine Data Mart (TMDM) project is to build a data mart that integrates and transforms information from the disparate transactional information systems that make up Island Health's electronic health record (EHR) into one Transfusion Medicine subject area. Progress made on the data mart to date enables comprehensive analysis of transfusions in relation to surgical cases, while future development will support analysis of transfusions in relation to non-surgical interventions, diagnosis, co-morbidities and encounter-related information. When completed, the data mart will provide an information base for decisions regarding the medical utilization and inventory management of blood products, and will help identify variation in transfusion practices across medical diagnoses and interventions.

Methods

The TMDM is created by leveraging relationships between various source transactional systems in Island Health's EHR to relate data that are associated with the practice of Transfusion Medicine. The six data sources that provide the required data elements for the TMDM include Blood Bank, Laboratory, Discharge Abstract Database, Pharmacy, Surgical and Admissions databases. These data elements are then presented to the data analyst or decision maker through an analytical interface that features intuitive drag and drop functionality as either qualitative or quantitative data elements. A vast number of unique reports may be created using this analytical interface. Data warehousing methodologies are employed in support of this approach; as such, a close relationship between the clinical end user and the data warehouse team has been the key to the success of the project to date.

Results / Conclusion

Early use of the TMDM prototype has indicated considerable potential to improve the quality of care Island Health's clients receive. Examples of use cases for the TMDM include hypotheses generation; filtering for outlying cases of interest from which to perform manual chart reviews; and regular monitoring of utilization at facilities and by physicians. This structured and comprehensive approach helps remove barriers that exist in accessing the wealth of transfusion practice data that is stored in our health organization's transactional databases. Exposing this clinical data will support research in our organization relating to the practice of Transfusion Medicine.

Validation of CBS transport boxes for shipping red cells between DSM sites (080)

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Introduction: Distances between blood banks are great in rural Manitoba. In order to meet current standards and safely transport blood between sites, we validated the use of Canadian Blood Services shipping containers. The objective of this validation is to ensure that red cells being shipped between Diagnostic Services Manitoba (DSM) blood banks remain within the required temperature range of 1° and 10° C during the entire transportation route.

Method: In 2013 shipments containing 2, 5 and 10 red cell units were packed using DSM packing protocols and a temperature data logger was included in each container. This was performed on the Westman Laboratory trucking routes and each one was performed by different MLTs. To encompass the extremes of shipping temperatures we performed the validation in both summer and winter months. After a successful initial validation period, we decided to have continuous temperature monitoring of all shipments and the data from this is presented below.

Results: Initial validation demonstrated that shipping temperature was maintained between 1° and 10° C in all shipments for up to 8 hours. On-going monitoring of the units shows a 3.1% (n=7) failure rate (n=223). The causes of failure included temperature <1° c (n=5), temperatures above 10°C (n=1) and data logger failure (n=1).

Conclusion: The current packing configuration and the use of CBS transportation boxes maintains temperature within acceptable limits for up to 8 hours. Using this arrangement, blood can safely be redistributed within the province of Manitoba.

Co-infusing Red Blood Cells, Platelets, and Cryoprecipitate with Ringer's Lactate and Plasmalyte (090)

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Background: Transfusion medicien standards state that blood products should only be transfused with 0.9% normal saline (NS) but the CSA standards states it's acceptable to transfuse with other solutions if proven safe. Blood components are stored in Citrate-phosphate-dextrose so one concern for non-saline fluids, is an increase in calcium (Ca2+) or magnesium (Mg2+) surpassing the citrate's chelating ability, thus causing clots. This study aims to answer is transfusing blood products with Ringer's Lactate (RL) or Plasmalyte (PL) safe as requested by our anesthesiologists?

Design and Methods: Units of red blood cells (RBC) and platelets (PLTs) were split into thirds. Each third was mock transfused with RL, PL, and NS at 50 mL/h. Every 15 minutes, samples were collected and tested for RBC viability and clots up to 75 minutes. Various hematological indices (i.e. Hb, LD, potassium, RBC count) were measured in order to identify hemolysis. Clot detection was determined macroscopically. TEn pooled cryoprecipitate (CRYO) units were also mock transfused to identify clot formation. After pooling, 10 mL of RL, PL, and NS were each added to the residual contents of one of 3 CRYO bags for further clot detection. A titration method determined the Ca2+ concentration that would cause clotting in pooled PLTs, apheresis PLTs, and CRYO. Specimens were checked after a 15 minute incubation at room temperature (RT) plus an additional15 minutes at 37° and following another 30 minutes at RT.

Results: No clots were formed during the mock transfusions. RBC viability with RL and PL was compromised as there was a clinically significant difference in hematological values compared to the NS values. The CRYO residua caused instant clot formation for RL and PL but not for NS. For the titration experiment, no clots were detected with titration at RT-15 or 37° incubation. However, clots occurred at the last 30 minute incubation with high RL concentration for all three blood products.

Conclusions: We have demonstrated the possible safety for routine transfusion of RL and PL with CRYO and PLTS as clotting was not shown for clinically relevant calcium concentrations but caution is still recommended. RBC should continue to be transfused with NS alone.

Where is all the plasma going? A Prospective Audit of Plasma Usage (099)

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Introduction: Frozen plasma has long been a therapeutic staple however the question of what constitutes appropriate use of this blood product is continually raised. The purpose of this study was to assess when and why plasma was being requested and to explore the appropriateness of these requests.

Methods: A prospective audit of all plasma requests during April 2014-July 2014 was conducted. All requests captured patient demographics, indication, coagulation and bleeding status on a standardized data sheet for discussion with a transfusion physician for approval to issue, cancel or substitute an alternate product unless the following criteria were present: massive hemorrhage protocol or plasma issued to the cardiac OR. Requests were grouped according to indication, coagulation parameters, bleeding status, and changes made to the order.

Results: A total of 666 plasma requests were received. 88 of these requests lacked audit forms due to product issue as part of an MHP or for initial cardiac OR management. Of the 578 requests with completed audit forms, 161 (27.9%) were for cardiac patients (CVICU, CCU, and ECMO). Across the zone, 8.8 % of the requests were changed to prothrombin complex concentrate (PCC) instead. 128 requests (22.1%) were for pre-bedside procedures (ie. paracentesis, line insertion etc.) and 68.8% of the 128 were in patients who were not on any anticoagulation. Over half were for patients with an INR ≤ 2 (56.5%) when data was available for evaluation.

Two thirds of the total requests (n=448, 67.3%) were at the University of Alberta Hospital (UAH). For these patients with available coagulation data (n=290), 70% of requests were made when the INR was less than 2. Of the 448 prospectively reviewed requests at this site, 15.7% resulted in the patient NOT receiving plasma.

Conclusion: The results of our study suggest that cardiac procedures account for large proportion of plasma utilization in our zone. It also indicates that there are still knowledge gaps in the appropriateness of PCC over plasma and pre-procedural correction of coagulopathy. Better dissemination of the recent CSTM Choosing Wisely recommendation for pre-procedural INR correction is necessary in our jurisdiction.

Implementation of remote inventory control in transfusion medicine – challenges, work arounds and benefits. (100)

Kristen Yanitski, Alberta Health Services; Molly Ortlieb, Alberta Health Services; Nada Nsier, Alberta Health Services; Kathy Hamacher, Alberta Health Services; Susan Nahirniak MD, FRCPC, Alberta Health Services. Introduction: Satellite blood fridges had been in place to store emergency and patient specific units in specific clinical situations. After a non-conforming event resulting in the transfusion of the wrong blood unit into a patient, the fridges were removed and replaced with patient specific bedside coolers or pneumatic tube provision of product at time of transfusion. The quality assurance recommendation was for a new system to manage the storage and distribution of blood products on care wards be implemented.

Methods: A working group for this project was established and the Haemonetics BloodTrack system was selected. The system was customized for the diverse needs at three specific patient care wards: Pediatric Intensive Care Unit (PICU), Adult Day Medicine, and Centre for Bleeding Disorders for implementation in February of 2015.

Results: First challenge of no direct communication between LIS (Sunquest) and Blood track resulted in a unidirectional information push through our tag printer. Since the information capture was via the tag print, there was an alert when a tag printed for an unconfigured product. This required configuration of all commonly used products in the lab even if they were never going to be tracked by BloodTrack (e.g. platelets).Second challenge was that the system is designed for RBC and needed to be reconfigured for room temperature plasma protein products(PPP). We created a virtual issue fridge to “trick the system” so that the RT PPP could be stored in kiosk cabinet. We then developed “pseudo batches” by vial size and lot to minimize the work for entry of each patient’s PPP to avoid vial by vial entry. Time savings in PICU alone were significant - for a 5 week period prior to going live, 692 coolers were prepared and/or exchanged for the PICU taking 5-10 minutes for each. In the 7 weeks since going live, only 2 coolers have been required. The technologists are tracking a saving of 1 to 1.5 hour(s) per shift.

Conclusion: The BloodTrack system, despite its challenges, has allowed for significant time savings and the safe storage and rapid delivery of blood components and PPP for our patient care wards.

Red Blood Cell Usage and Iron Overload Trends in Chronically Transfused Patients (101)

Shannon Porter BSc., University of Alberta; Kristi Lew BSc., University of Alberta; Gwen Clarke MD, FRCPC, University of Alberta; Susan Nahirniak MD, FRCPC University of Alberta & Alberta Health Services

Background: Chronically transfused patients, defined as having received a red cell (RBC) transfusion at least once every two months for at least six months, are exposed to large quantities of RBCs and iron. Iron overload, defined as serum ferritin levels >1000µg/L, is an important adverse consequence associated with chronic transfusion. The aim is to assess red cell usage characteristics and iron overload trends. Patients receiving exchange transfusions are compared to those with top-up transfusions to determine whether exchange mitigates iron overload.

Material and Methods: A retrospective study was performed using data collected from the Laboratory Information System (LIS), including number of episodes and units received. Chronically transfused patients from January to December 2014 were identified. Misys and NetCare were used to obtain patient demographics, primary diagnoses, pre- and post-transfusion hemoglobin, and serum ferritin levels.

Results: A total of 223 patients were identified as chronically transfused. Of these patients, 30 were receiving exchange transfusions. The three most common diagnoses were hemoglobinopathies (19.3%), leukemia (14.8%), and GI bleeds (13.4%). Over 30% had serum ferritin levels >1000µg/L, whereas less than 15% on exchange transfusion were iron overloaded. 41 patients were transfused regularly from 2011-2014 with the most common diagnosis being hemoglobinopathies. Over 65% of these patients had iron overload, compared to less than 25% of exchange transfusion patients during the same period. Exchange transfusion patients showed a mean decrease in serum ferritin levels of 29.6% over four years compared to a mean increase of 31.6% in patients receiving top-up transfusions.

Conclusions: Patients transfused chronically for longer periods of time were more likely to have iron overload. Despite receiving more RBC units, patients undergoing exchange transfusion had a lower incidence of iron overload due to chelation effects of the circuit.

Rh (D) Alloimmunization in Rh negative Patients Receiving Rh positive Red Cells (102)

Kristin Yanitski, Alberta Health Services; Hilda Gaal, Alberta Health Services; Gwen Clarke MD, FRCPC University of Alberta; Susan Nahirniak MD, FRCPC, Alberta Health Services & University of Alberta

Background: Our transfusion service's policy allows for Rh negative males over the age of 4 months and Rh negative females over the age of 50 years to be given Rh positive blood to conserve Rh negative stock in unmatched situations and to be considered in large volume transfusion (>8 units). We conducted a retrospective study to determine the rate of anti-D formation and compared that rate to published rates in similar patient populations.

Methods: Blood bank records and Rh mismatch transfusion reports from January 2012 to January 2014 were reviewed to identify Rh negative patients, within the set age/sex criteria, who received at least one unit of Rh positive red blood cells. Parameters recorded included: age, sex, blood group, diagnosis, attending physician number of mismatched units received and serologic follow-up. Acceptable follow-up serological testing for antibody formation was restricted to 10 days or greater following the initial Rh positive transfusion(s).

Results: A total of 69 patients were identified as receiving Rh mismatched blood. This was not restricted to only group O patients as 18 group A, 11 group B and 1 group AB patients were included in group specific Rh mismatches. Only 26 eligible patients had sufficient data for alloimmunization review. Of these; 5 formed anti-D antibody, for an alloimmunization rate of 19%. Compared to the published rate of 22%, no statistically significant difference was found (P-value: 0.6608, significance level: 0.05). No significant difference in alloimmunization was apparent based on sex or blood group. Despite lack of statistical significance, alloimmunized patients received 5 or fewer units (median =2).

Conclusion: The 19% alloimmunization rate calculated for our transfusion service is congruent with published rates. This risk of antibody formation is balanced by the benefit of mitigating shortages of Rh negative units for patients who are more vulnerable to the risks of anti D development, such as females of child bearing age. Our results indicate that this should not be restricted to group O.

Prothrombin Complex Concentrate (PCC) for Reversal of Vitamin K antagonism in Pediatric Patients – A retrospective case series. (103)

Tom Noga MD University of Alberta; Heather Blain BSc, Alberta Health Services; Susan Nahirniak MD, University of Alberta & Alberta Health Services.

Background: Prothrombin Complex Concentrates (PCC) are licensed in adult patients for treatment of bleeding or urgent pre-procedural prophylaxis in the setting of Vitamin K antagonist therapy (VKA) or deficiency. No manufacturer's recommendations are available in the pediatric population but the small infusion volumes may be of additional benefit in the pediatric cases. Due to a large congenital cardiac program with several pediatric patients receiving VKAs, our transfusion service has developed pediatric dosing, based in part on manufacturer's dosing scales and National Advisory Committee audit data. The dosing is broken down into six groups using weight (<10kg, 10-25 kg and 25-50 kg) and INR (<3.0 or >3.0)

Methods: After ethics approval, any patient aged less than 16 years receiving PCC between 2009 and 2013 was extracted from the transfusion service's PCC database into a report. The data elements captured included patient age, PCC dose administered, indication for PCC, pre and post dose INRs, 30 day post dose adverse event monitoring and additional blood products received. Follow up chart reviews for confirmation and validation of the data was also performed.

Results: Eleven patients, ranging in age from 1-16 years, received PCC for VKA reversal. There were 7 males and 4 females. All received product as part of perioperative cardiac care with only a single dose of PCC administered. Pre- dose INRs ranged from 1.9-7.2 (avg = 4.4). Post dose INRs in the 9 patients with data ranged from 1.1-1.9 (avg=1.3). Only two patients did not require additional blood component support. Only a single patient had a documented thromboembolic event (left IJ) at the 30 day follow up but line association limit causality association. No mortality occurred in this group.

Conclusion: This retrospective data suggests that the use of PCCs for licensed indications in the pediatric population is likely safe and effective but larger dose finding studies are recommended. Our surgical group also needs to be reminded of the importance of post dose INR testing to ensure adequate reversal.

Prevalence and incidence of cytomegalovirus in blood donors and transplant patients (031)

Sheila O'Brien Ph.D., Canadian Blood Services; Margaret A Fearon MD., Canadian Blood Services, Susan Nahirniak MD., Alberta Health Services; Vito Scalia, Canadian Blood Services; Jutta Preiksaitis MD., University of Alberta

BACKGROUND Cytomegalovirus (CMV) is a common leukocyte--associated virus which can cause serious infection in immonocompromised hosts. Transfusion recipient risk is mitigated by pre-storage leukoreduction and providing CMV seronegative blood to high risk patients. We estimated the prevalence and incidence of CMV in Canadian blood donors and compared these with Northern Alberta solid organ transplant (SOT) donors and recipients.

METHODS: All blood donors tested for CMV between 2005 and 2014 were included. Prevalence was estimated as the percentage of CMV positive donations from all first time tested blood donors. Incidence was calculated as the percentage of all incident cases (any donor with a positive result after two negative results). Pre-transplant CMV seropositivity in SOT organ donors and recipients transplanted between 1984 to 2014 were calculated. These were broken down by age group and sex.

RESULTS: There were 1,253,350 first time tested blood donors; 528,556 (42% prevalence) CMV positive, plus 363,107 blood donors with at least 2 negative test results; 2,506 subsequently positive (0.69% incidence). Prevalence increased with age among blood donors from 30.3% of 17 - 19 year olds to 66.7% of 70+ ($p<0.05$). There was no age trend for incidence. There were 2,719 organ donors; 1,421 (52.3%) positive and 4,445 SOT recipients; 2,780 (62.5%) positive. The prevalence increased with age in organ donors (41.5% of 17-19 year olds to 69.8% of 70+, $p<0.05$) and recipients (45.9% of 17-19 year olds to 69.7 of 70+, $p<0.05$). In all groups the percentage was slightly higher in females.

CONCLUSION: CMV prevalence is correlated with age in blood donors, organ donors and recipients consistent with a cumulative effect of lifelong infection and similar to reports from other Western countries. Data in blood donors is limited by lack of confirmatory testing, but there appears to be a small percentage of new infections in donors. Higher prevalence in SOT recipients may be due to the combined effect of differences in demographic characteristics related to CMV risk, and previous organ-donor transmission in SOT transplants being re-transplanted. A small contribution from transfusion-acquired CMV in SOT recipients who sometimes receive pre-transplant blood transfusions cannot be ruled out.

Integrating Two Error Reporting Systems In Transfusion Medicine: Going From Paper to Electronic Submission (016)

Kathy Paton, B.Sc., QM., Brian Berry, MD., Derek Miller, B.Sc., Tami Williams, ART

Introduction / Objective

Occurrence management is an integral part of any healthcare system. It facilitates increased patient safety through ongoing quality improvements and decreases product wastage. Transfusion Medicine (TM) related errors at Island Health were reported on a paper Quality Improvement Report (QIR) since 2005. The information on the QIR was then manually entered into the Transfusion Error Surveillance System (TESS), a secure online database, for detailed coding and data analysis. In 2011, as part of a provincial initiative to make healthcare safer in British Columbia (BC), Island Health was mandated to implement an electronic error reporting system and database called the British Columbia Patient Safety & Learning System (BC PSLS). This report will show how TM at Island Health was able to integrate TESS data elements into BC PSLS in an electronic reporting system with flexible and timely reports.

Methods

The Island Health TESS team collaborated with the BC PSLS stakeholders to create a TM module within BC PSLS. A TM specific electronic reporting form was created, allowing for capture of all required TESS data elements. The reporting was made available to both laboratory and clinical staff, for ease of reporting TM related errors no matter where the error occurred. A dedicated TESS data mart was also created, providing access to all non-patient identifying TESS data elements and integrated into the existing BC PSLS Business Intelligence (BI) Tool for production of customized data reports.

Results / Conclusion

It took almost a year to map comparable data fields for the TESS/ BC PSLS integration. Following implementation of the electronic reporting form, data analysis showed a significant decrease in the reporting of TM related errors occurring in the laboratory setting, while reporting of TM related errors occurring in clinical areas increased. Additional communication and training was necessary to increase compliance for voluntary error reporting. Customized reports have been developed, and can be created either ad hoc or as ongoing automated reports. The integration also allows for easy capture of TESS data for all health authorities within BC.

Collection of Crossmatch Specimens by a Private Laboratory to Facilitate Hospital-Based Transfusions: Results of a Feasibility Study (097)

Jacob Pendergrast MD, University of Toronto and University Health Network; Sally Balmer, University Health Network; Janice Nolan, LifeLabs Medical Laboratory Services; Kate Uchendu, University Health Network

BACKGROUND

Provision of outpatient RBC transfusions requires patients to either present to the hospital on two occasions for each transfusion (once for sample collection and once for transfusion), or to wait at the hospital on the day of their transfusion for completion of their crossmatch. Both approaches consume limited hospital resources and are inconvenient for patients who live at a distance. A feasibility study was therefore conducted to determine if crossmatch samples could be collected by a private community laboratory and shipped to the hospital in advance of transfusion.

STUDY DESIGN AND METHODS

Following extensive consultation between a private community laboratory and the hospital's red blood cells disorders (RBCD) clinic, blood transfusion service, and legal counsel, a process of sample collection and shipment was developed and offered to a group of chronically transfused hospital outpatients. Patients were asked to document sample collection and blood transfusion times during a two month run-in period, during which they were offered the usual options of sample collection in either the hospital's medical day unit (MDU) or diagnostic test centre (DTC); similar feedback was then sought during a 6 month pilot phase of community outpatient sample collection at Lifelabs Medical Laboratory Services (LL)

RESULTS

A total of 115 samples were collected on 25 patients by LL during the pilot phase, 8 (7%) of which were rejected due to either collection or transportation errors, a borderline statistically higher rate than the 4% rejection rate observed for the hospital as a whole ($p = 0.07$). No subsequent incidents were documented following the testing of the remaining 107 accepted samples or the transfusion of units prepared from those samples. A total of 108 patient feedback forms were received, 67 during the run-in period and 41 during the pilot period. Of the feedback forms received during the run-in phase, 42 documented sample collections in the MDU, and 17 documented collection in the DTC (8 feedback forms did not specify). Sample collection times at LL averaged 23 +/- 11 minutes, which was significantly faster than collection times in either the MDU (average 50 +/- 14 minutes, $p < 0.0005$) or the DTC (average 34 +/- 16 minutes, $p = 0.004$). No difference was observed in the average transfusion time per unit, regardless of where the samples had been collected. Patient satisfaction amongst those participating in the pilot project was high.

CONCLUSION

Collection of hospital crossmatch samples by private laboratories in the community can be performed safely, decreases the burden on hospital resources, and results in increased patient satisfaction.

However, careful auditing of sample collection and transportation processes is necessary to ensure that quality of care meets the same standard as offered within the hospital setting.

Umbilical Cord Blood Collection: First Year Operations at the Canadian Blood Services, National Public Cord Blood Bank (072)

Elmoazzen H, Halpenny M, Martin L, Mostert K, Lawless T, Quinlan E, Allan D, Petraszko T, Dibdin N, Campbell T, Yang L. Canadian Blood Services

BACKGROUND: Successful cord blood (CB) stem cell transplantation is directly associated with the quantity and potency of stem cells harvested in a CB unit. Two parameters commonly used to evaluate a CB unit include the total volume and total nucleated cell counts (TNCs). Obtaining high quality CB units at time of collection is a main focus in CB banking and the first step for transplant success. The Canadian Blood Services, National Public Cord Blood Bank (NPCBB) initiated operations as of September 30, 2013.

STUDY DESIGN AND METHODS: Collection process development resulted in both ex utero and in utero collection methods implemented at the NPCBB. A collection kit was developed in house containing the CB collection bag (MSC1208DU, Macopharma®). The two needle collection bag and its double packaging system is manufactured and validated to meet GMP and ISO standards to ensure safe, consistent and reliable cord blood collection performance. Following informed consent from donors, CB units were collected according to established SOPs by appropriately trained workers using both in utero and ex utero collection methods. Retrospective review was performed on CB units collected in the first 12 months of operations at the NPCBB. Quality collection parameters included; collection volume, TNC and microbial contamination.

RESULTS: A total of 2,067 CB units were collected between September 30, 2013 and September 29, 2014. 1347 (65.6%) and 720 (34.8%) CB units were collected using ex utero and in utero collection methods, respectively. The NPCBB developed acceptance criteria to determine eligible/bankable CB units: Collection volume >40ml, TNC > 1.3x109 for non-Caucasian and >1.5x109 for Caucasian. As a result, a CB unit eligibility rate of 25.6% (n=346) for ex utero collection and 28.75% (n=207) for in utero collection was observed. Mean volume and TNC counts were 85.04±31.95 ml, 1.09x109±0.66 for in ex utero collections and 96.76±32.79 ml, and 1.21x109±32.79 for in utero collections. In addition, microbial contamination was tested on 553 qualifying CB units using an in-house validated BacT/ALERTmethod. Our results demonstrated a microbial contamination rate of 0.29% (n=1) in ex utero collections and 2.42% (n=5) for in utero collections.

SUMMARY: Our results indicate the feasibility of collecting cord blood units from Caucasian and non-Caucasian donors using the NPCBB collection kit, including the Macopharma® collection bag to collect CB units that meet high quality acceptance criteria. Collection data from both collection methods, ex utero vs in utero, allows for a direct comparison between methods and will allow further analysis with post CB unit production and post-transplant data in the future. The data demonstrates our collection process results in a low contamination rate in total qualifying CB units collected.

Umbilical Cord Blood Processing: First Year Operations at the Canadian Blood Services, National Public Cord Blood Bank (073)

Elmoazzen H, Halpenny M, Martin L, Mostert K, Allan D, Petraszko T, Dibdin N, Campbell T, Letcher B, Yang L Canadian Blood Services

BACKGROUND: Umbilical cord blood (UCB) stem cells have great medical potential and are currently being used as an alternative source of hematopoietic progenitor cells for patients in need of transplantation. As the potential uses and the demand for genetically diverse UCB inventory continue to grow, there is a global tendency to encourage public cord blood banking. The Canadian Blood Services, National Public Cord Blood Bank (NPCBB) initiated operations as of September 30, 2013, for UCB collection, processing, testing, cryopreservation, storage and distribution. The purpose of this abstract is to report the results of UCB processed during first year operations at the NPCBB.

STUDY DESIGN AND METHODS: Before initiating operations at the NPCBB, all collection, processing and testing methods completed an extensive validation process completed by the Canadian Blood Services Validation team with Quality Assurance Department final approval for operations. From September 30 of 2013 to September 29, 2014, UCB units were collected from 3 collection sites using a combination of both in utero and ex utero collection methods. A total of 412 UCB units were processed, cryopreserved and stored for transplantation purposes. All these units initially qualified as per an in-house developed quality acceptance criteria: collection volume >40ml, TNC (total nucleated cell counts) >1.3x109 for non-Caucasian and >1.5x109 for Caucasian donors. All UCB units were processed within 48 hours of collection by appropriately trained NPCBB staff following established SOPs. Processing was completed using the SepaxTM 2 (Biosafe) Cord Blood Processing Unit - a fully automated, functionally closed and sterile system. The BioarchiveTM system (Cesca Therapeutics) was used for cryopreservation and storage. Each UCB unit was evaluated post processing and before cryopreservation for TNC recovery, CD34+, viability and Colony Forming Units - Granulocyte Macrophage (CFU-GM). UCB units processed in the first 12 months of operations at the NPCBB were retrospectively reviewed.

RESULTS: After volume reduction, mean values of pre-cryopreservation TNC, CD34+ cells, CFU-GM, and viability per unit were 1.37x109±0.40, 5.74X106±3.34, 21.54X105±11.60, and 96.51%±2.41, respectively. SepaxTM post processing mean TNC recovery was 78.91%.

SUMMARY: Our results demonstrate: 1) NPCBB has designed, validated and implemented a standardized, automated processing and cryopreservation methodology enabling reproducible banking of high quality cord blood units. 2) Sepax 2 processing unit with cord blood specific software and single use processing kits is highly efficient and results in consistent cell recoveries. 3) UCB testing instrumentation has been successfully implemented at the NPCBB including the XE-2100 Hematology Analyzer (Sysmex) for TNC, FC500 Flow Cytometer (Beckman Coulter) for CD34+ / viability and STEMvision (Stem Cell Technologies) for CFU assay.

Numeration of Colony-Forming Unit Granulocyte-Macrophage (CFU-GM) Colonies in Cord Blood Using an Automated Instrument: STEMvisionTM (075)

Elmoazzen H, Halpenny M, Martin L, Mostert K, Allan D, Petraszko T, Dibdin N, Campbell T, Letcher B, Yang L Canadian Blood Services

BACKGROUND: Successful cord blood (CB) stem cell transplantation is associated with the quantity and potency of stem cells harvested in a cord blood unit (CBU). Building a successful cord blood bank (CBB) requires selection and banking of these high quality CBUs. To achieve this, CBBs focus on accurate, standardized testing methods to determine CBUs with the highest quantity of hematopoietic progenitor cell populations. The colony forming unit (CFU) assay is the standard in vitro functional assay for measuring the number of progenitor cells in human hematopoietic cell samples. Traditionally, numeration of CFU-GM is performed manually based on morphological criteria with an inverted microscope. Accurate classification and counting of colonies is challenging, time consuming and costly. Our experience and other reports have confirmed that manual colony counting is a major source of variation in the CFU-GM assay and limits the utility of CFU results due to individual interpretation of colonies and lack of standardized procedures. In order to standardize colony counting and to minimize both inter-operator and inter-laboratory variations, we implemented STEMvision™ (Stem Cell Technologies) - an automated instrument and computerized system with sophisticated image analysis software for scoring CFU-GM colonies. The Canadian Blood Services National Public Cord Blood Bank (NPCBB) initiated operations as of September 30, 2013, herein, we describe our experience using the automated STEMvision™ for imaging and scoring colonies in the CFU-GM assay.

STUDY DESIGN AND METHODS: Following manufacturer's recommendation, SOPs were developed to perform CFU-GM assay on 412 eligible CBUs after volume reduction and prior to cryopreservation. Three plating concentrations of WBCs (0.4x105, 0.2X105 and 0.1x105) in duplicate plates were incubated at 37°C, humidified (>95%) incubator with 5% CO2. Cultures were scored on day 14 using STEMvisionTM.

RESULTS: In addition to validation studies performed by manufacturer, prior to implementing the STEMvisionTM, an in house study was conducted at NPCBB. STEMvisionTM and manual counting (by an experienced technician) was parallel performed to score CFU-GM colonies from samples obtained from CBUs to confirm correlation. During operations at the NPCBB, the STEMvision™ has been used to score colonies from CFU-GM assays that were performed on CBUs after volume reduction and before cryopreservation. Our results demonstrated a mean CFU-GM of 21.5 x 105 (+/- 11.6) per unit.

SUMMARY: 1) Validation studies demonstrate that the STEMvisionTM imaging and counting of CFU-GM has good correlation with the manual microscope counting. 2) The introduction of the automated imaging scoring system of STEMvision™ improves reproducibility and minimizes both inter-operator and inter-laboratory variations experienced with microscope determination. 3) Digital images can be stored in the computer for future review or further classification if required. 4) Our results (using STEMvisionTM) support implementation for high-throughput operations associated with cord blood banks 5) NPCBB is positioned to performed data analysis using this CFU data set and assess correlation with engraftment outcomes.

Characterizing the Impact of Osteoblast Conditioned Media on the Expansion and Chemotaxis of Hematopoietic Stem and Progenitor Cell Compartment (043)

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The hematopoietic stem and progenitor cell (HSPC) compartment consists of a series of subpopulations diverging from one another by their multilineage potential and self-renewal activity. Hematopoietic stem cells (HSC) possess long-term engraftment whereas downstream progenitors such as multipotent progenitors (MPP) and common myeloid progenitors (CMP) support engraftment transiently. Homing of transplanted HSPC to the bone marrow is largely mediated by the chemokine stromal-derived factor-1 (SDF-1) and it's receptor CXCR4. Recently, the activated leukocyte cell adhesion molecule (ALCAM) was shown to be important for HSC engraftment. The main limitations of umbilical cord blood (UCB) transplantation include limited numbers of HSPC, and slow platelet and neutrophil engraftment. Ex vivo expansion of UCB HSPC prior to transplantation has been shown to improve hematopoietic engraftment. Previously, we reported that medium conditioned with mesenchymal stromal cell-derived osteoblasts (M-OST CM) increases expansion of UCB CD34+ cells enriched in HSPC. The objectives of this study were to define the identity of HSPC expanded in M-OST CM and investigate their homing and chemotaxis activities. UCB CD34+ cells were cultured in standard medium (control) or M-OST CM. Expansion of HSPC subpopulations and expression of CXCR4 and ALCAM were quantified on day-7 by cytometry. A SDF-1 migration assay was used to measure the chemotaxis capabilities of HSPC.

Cell expansion was significantly greater in M-OST CM cultures (4.6 ±1.8-folds, mean ± SD, $p=0.02$) vs. control. However, the most striking differences were the increased expansions of CMP ($p=0.2$), megakaryocyte-erythroid progenitors (MEP, $p=0.02$) and granulocyte-macrophage progenitors (GMP, $p=0.02$) in M-OST CM cultures, which were on average 8-, 7- and 9-folds greater than those measured in control, respectively. Conversely, expansion of HSC and MPP were slightly reduced. The frequency of HSPC expressing ALCAM in M-OST CM cultures was greater than control (71±1% vs. 48±1%, $p<0.001$), as well for CXCR4 (61±7% vs. 36±3%, $p<0.001$). Moreover, HSPC produced in M-OST CM consistently showed increased migration towards SDF-1 in all experiments ($p=0.10$).

These results suggest that M-OST CM preferentially promotes the expansion of myeloid progenitors downstream of MPP, promotes expression of receptors implicated in homing and engraftment and may improve the chemotaxis activity of HSPC toward SDF-1.

WHAT IS THE TRUE COST OF TRANSFUSING A UNIT OF RED BLOOD CELLS IN A CANADIAN HOSPITAL? (094)

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Objective: Costs associated with a unit of packed red blood cells (PRBC) in a hospital setting, from delivery and storage through to transfusion, involves numerous personnel, materials, and capital items across multiple locations. To our knowledge, there has been no direct and thorough accounting of the cost of transfusing a PRBC within a Canadian hospital in recent history. Our study sought to determine the cost accrued for a unit of PRBC within a Canadian hospital related to the inventory management, storage, testing, issuing and administration of the product.

Method: An eight-step costing model was developed to determine the cost of PRBCs from the time of receipt at the hospital to the time of transfusion to a patient. We assessed personnel, consumables and capital equipment costs within each step of the model. A combination of activity-based accounting methods, engineered accounting methods, and time analyses were applied based on availability of data and the most accurate way of assessing a particular cost. The process steps included: inventory entry, product storage, product transport, patient specimen collection, pre-transfusion testing, product issuing, product delivery, and administration of product to a patient. The final PRBC costs were calculated based on the cost of labor, consumables and the relevant proportion of capital costs.

Results and Conclusions: Preliminary data analysis showed a total unit cost of $254.47 per PRBC based on 10,475 units transfused in 2014 at the Royal Alexandra Hospital in Edmonton, Alberta. Hospital personnel, consumables, and capital costs contributed 77.85%, 19.48%, and 2.67% to this cost, respectively. For ease of use at other facilities, the eight-station costing model includes a flexible graphical user interface (GUI) that allows associated costs to be modified based on the facility needs. Future work will allow for validation of the model and the GUI in hospitals of various sizes and with varying staff complements or process steps, as well as other blood products.

Fatal false-negative transfusion infection with a buffy coat platelet pool contaminated with Staphylococcus epidermidis: a case report (014)

Sandra Ramirez-Arcos* PhD, Canadian Blood Services; Yuntong Kou MSc, Canadian Blood Services; Franco Pagotto PhD, Health Canada, Barbara Hannach MD, Canadian Blood Services

Introduction: Bacterial contamination of platelet concentrates (PCs) poses the major post-transfusion infectious risk in developed countries. The aerobic microorganism most frequently isolated from PCs is coagulase-negative Staphylococcus epidermidis, a normal inhabitant of the human skin, which has been involved in fatal transfusion reactions worldwide.

Case report: In September 2014, a splenectomised elderly male patient, suffering from leukemia, was transfused with two 5-day-old buffy coat platelet pools. The patient returned to emergency on the same day with a low-grade fever. He was bacteremic and expired on the next day. Microbiology and molecular testing revealed that a blood sample from the patient and one of the pools were contaminated with the same S. epidermidis strain. Further microbiological analysis revealed that this strain is able to form surface-attached aggregates known as biofilms.

Discussion: At Canadian Blood Services, PCs are screened for bacterial contamination with the BacT/ALERT culture system at approximately 24 hours post-collection. The implicated platelet pool had been tested and yielded false-negative culture results. A titration experiment indicated that, at the time of screening, the contaminated pool likely had a concentration of ≤0.08 colony forming units (CFU)/mL of S. epidermidis. Mathematical models have predicted that up to 70% of PCs contaminated with coagulase-negative staphylococci at concentrations of 0.02 CFU/mL can be missed by BacT/ALERT screening.

Conclusion: Despite several mitigation strategies, false negative cultures with current platelet screening practices still occur. This report creates awareness of the pathogenicity of opportunistic S. epidermidis, a seemly harmless organism, in susceptible patients who may not develop a typical transfusion reaction.

Acknowledgements: The authors thank Sandra Bakker, Jon Fawcett, and staff at the Canadian Blood Services Brampton site, for the follow up and communication during the investigation of this case report. Kevin Tyler is acknowledged for his assistance with molecular assays.

Validation of Microbial Testing in Hematopoietic Progenitor Cell – Apheresis Product at Canadian Blood Services (015)

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Introduction: International Standards mandate sterility testing for Hematopoietic Progenitor Cell – Apheresis (HPC-A) to prevent the transmission of microbial infections to immunocompromised transplant patients. The BacT/ALERT automated culture system was validated to detect microbial contamination of HPC-A prepared with Hespan.

Design and Methods: HPC-A products were collected, processed, sampled and tested for sterility and infectious agents following routine practice at the Stem Cell Manufacturing Facility in Ottawa. Only HPC-A products that exceeded the required cell dose based on the pre CD34+ estimation were sampled for validation. The microorganisms used for HPC-A spiking included the aerobic bacteria Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus aureus, and Staphylococcus epidermidis, the anaerobic bacterium Bacteroides fragilis, the yeast Candida albicans and the mold Aspergillus brasiliensis. A mix of 2.5mL of HPC-A, 2.5mL of cryoprotectant solution and 0.5mL of microbial suspension for a target final concentration of 100 colony forming units/mL, was prepared for each testing organism at Canadian Blood Services, Microbiology Laboratory. BacT/ALERT aerobic (SA) or anaerobic (SN) culture bottles were inoculated in duplicate with 2mL of the final mixture. Culture bottles, which were not identified with the inoculated microorganism (ie, blind samples), were shipped to the Ottawa Hospital, Microbiology Laboratory, where they were incubated in the BacT/ALERT system until positive or for a maximum of 5 days. Identification and Gram stain of each positive culture bottle was performed as per regular procedures at the Ottawa Hospital, Microbiology Laboratory.

Results and Conclusions: Analysis of the validation results revealed 100% agreement between the organisms inoculated at Canadian Blood Services and the identifications performed at the Ottawa Hospital. Therefore, the current sterility testing system implemented by the Stem Cell Laboratory in synergy with the Ottawa Hospital, Microbiology Laboratory is an effective process in capturing potential pathogens of clinical relevance for transplant patients.

Acknowledgements: The authors acknowledge the contribution of the Stem Cell Manufacturing Facility and the Ottawa Hospital personnel for a successful validation. The validation protocol was developed by M. denAdmirant (Validation Department, Canadian Blood Services).

Assessment of anesthesia residents transfusion knowledge (085)

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OBJECTIVE: Previously published data have identified transfusion medicine knowledge as an area of weakness among practicing physicians, with concerns ranging from blood product utilization, adverse event management, and informed consent. Transfusion medicine education is also lacking. The purpose of this study was to assess transfusion medicine knowledge among graduating anesthesia residents in order to identify strengths and weaknesses in transfusion medicine education and facilitate curriculum development.

METHODS: A 21 question transfusion medicine exam was created by three transfusion medicine experts and piloted on hematology, hematopathology, and anesthesia trainees who ranged from PGY1-PGY6. The knowledge areas to be assessed included indications for transfusion of cellular and plasma products, special transfusion requirements for anti-coagulated patients, basic blood bank testing, prevention, identification and management of adverse outcomes of transfusion, complications of massive transfusion, and components of informed consent for transfusion. The exam was administered to 20 graduating anesthesia residents at the start of a one month transfusion medicine rotation. Scores on the pre-rotation exam were assessed for each resident.

RESULTS: Twenty residents completed the pre-rotation exam. The mean score out of 22 was 14.8 (67%), with a standard deviation of 2.78. The range of correct responses was 10 to 20 with a mode of 16 (8 respondents). Residents performed well on items related to red cell transfusion and vitamin K antagonist anticoagulation and had difficulty with questions related to non-RBC transfusion products, transfusions in special populations, and transfusion medicine laboratory testing.

CONCLUSION: The residents in this study performed relatively well compared to physician scores in similar studies. However, further studies would need to utilize a larger sample size in multiple cohorts and conduct pre- and post-rotation comparisons. Nevertheless, this study provides direction for curriculum development in transfusion education for anesthesia trainees. Further research is required to delineate causes for gaps in transfusion medicine knowledge, attitudes towards transfusion medicine, and assess efficacy of future educational strategies to improve transfusion medicine knowledge.

Acknowledgements: The authors wish to acknowledge the role of Drs. Yulia Lin and Jeannie Callum in the creation of the survey tool

Evaluation of an On-Line Transfusion Education Program for Medical Laboratory Technologists (009)

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Background: In 2008 an online tool, Bloody Easy Tech Assessment Program (BE Tech Assess) was created by the Ontario Regional Blood Coordinating Network (ORBCoN) to help assess and document theoretical knowledge in transfusion medicine through multiple choice questions. In 2014, the program was evaluated using a validated evaluation framework to identify usefulness, validity and impact.

Methods: Two surveys were conducted; one was a 35 question on-line survey sent to program managers, and the other was a survey of the program participants from volunteer sites.. In addition to the surveys, 20 program managers volunteered to be part of a focus group to review the survey results, and discuss in-depth questions in a conference call format.

Results:

A survey was circulated to all Ontario hospitals with Transfusion Services, whether or not they currently used the program. Responses from users and non-users were received. Response rate was 49%. 86% of respondents were from hospitals using the program for more than 2 years. 70% of user respondents state that they monitor results for annual competency records. 60% of respondents report that the program is mandatory for all transfusion laboratory staff. 15% use the program in initial orientation of staff. Improvements to the program were identified. 98% of respondents wanted ORBCoN to continue supporting the program. The participant survey went to 47 hospitals, 670 participants; response rate was 28%. 94% of participants surveyed rated the questions used as fair and relevant and 78% thought the length of the program is just right. Focus group participants were location managers from long-term user hospitals. Most participants agreed that the program enhanced their existing competency assessment programs, and that the impact of the program saved time for in-house development. The participants valued having a new test available annually; they also agreed that the program contributed to improving patient care.

Conclusions:

Evaluation confirmed that BE Tech Assess is rated as valued and relevant by the Ontario transfusion laboratory community. Recommendations arising from the project, including investigation of specific improvements suggested by evaluation project participants, are in planning at this time.

Improved prediction of cd34+ cell yield prior to peripheral blood hematopoietic progenitor cell collection using a modified target value-tailored approach (064)

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BACKGROUND. Mitterer et al. used the correlation between the pre-apheresis peripheral blood CD34+ cell count and the final number of CD34+ cells collected to devise a formula for "target value-tailored" (TVT) apheresis.{Mitterer M, 1996 #2} Using local data, the Canadian Blood Services Stem Cell Laboratory has created a similar model to determine the blood volume to process during apheresis collection.

OBJECTIVES. The objectives of this study were to:

1. Determine the correlation between the number of CD34+ cells predicted by the TVT formula and the actual number of CD34+ cells collected

2. Determine whether the TVT formula remains predictive when applied to an external data set

METHODS. All apheresis collections at the Ottawa Hospital between January 1, 2003 and December 31, 2011 were reviewed. For the external data set all autologous collections at the London Health Sciences Centre between December 1, 2008 and December 1, 2013 were reviewed. The external data set was divided into test and validation sets.

RESULTS. The Ottawa data set included 815 collections, 639 autologous and 176 donors (Table 1). Of the autologous collections, 586 (93%) were first collections. In 578 (97%), chemotherapy/G-CSF was used for mobilization. In 724 (88.8%), only 1 day was required to achieve the desired number of CD34+ cells. The TVT estimate was highly predictive of the number of CD34+ cells x 106/kg actually collected on apheresis day 1 ($r=0.90$, $p<0.0001$; Figure 1).

The London data set included 240 G-CSF-mobilized autologous collections. For the test set, the pre-collection CD34+ count was highly predictive of the number of CD34+ cells x 106/kg collected on day 1 of apheresis (Figure 2). Applying this model to the validation set, the correlation between the predicted and final and day 1 CD34+ cells x 106/kg count was 0.9186 ($p<0.0001$).

CONCLUSIONS. Using a modified TVT approach, the pre-apheresis CD34+ count can be used to accurately predict the number of CD34+ cells x 106/kg collected on day 1. This approach can be applied at other centres, and for different diseases and mobilization regimens. This method can be used to individualize the blood volume processed and thus optimize resource utilization.

Assessment of Ontario's TTISS program in the context of the WHO guidelines: Possible future directions (049)

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Introduction:

In 2005, the WHO published draft Guidelines for Adverse Event Reporting and Learning Systems (GAELS). Using the checklist from these guidelines the Transfusion Transmitted Injury Surveillance System (TTISS) program for Ontario was reviewed to identify gaps in guideline compliance and develop future strategies/activities to improve adverse transfusion events (ATE) reporting in Ontario.

Methods:

After gaps were identified, strategies and activities to fill these gaps were then proposed at; a brainstorming session attended by hematologists, laboratory technologists; and, at the annual Ontario TTISS meeting attended by several Ontario hospital participants.

Results:

Ontario's TTISS was fully compliant with 4/11 of the checklist items. Areas of partial or non compliance were: clarifying objectives of the TTISS as a system intended for learning or accountability for ATEs; establishing and expanding the types of learning as priorities including systems failures and best practice recommendations; having a common data infrastructure; classification of reports by risk and causation; performing risk and systems analyses; generating alerts to organizations on a periodic basis; and having sufficient resources for the capacity to investigate.

Possible strategies devised at the multidisciplinary brainstorming session to improve guideline compliance included: expanding sentinel site data capture and mandatory reporting of ATEs to enhance learning and accountability; additional data collection to facilitate further understanding of ATEs to develop bedside management algorithms; continued expansion of Ontario's REDCap database; strategies to improve underreporting of ATEs for more accurate risk statistics; incorporating error reporting for root cause analyses; more timely reporting to stakeholders as well as regulators; and incorporating expert analyses through increased physician involvement.

Conclusion:

The WHO GAELS was a tool to assess the quality of Ontario's TTISS system and serves as an internationally based framework for improving the quality of ATE reporting. Strategies to improve TTISS have been developed and will be implemented over 2015-2017. Assessment of other hemovigilance systems using GAELS will provide comparators to which the success of our improvement strategies can be measured.

Quantification of Cell Free DNA in Red Blood Cell Concentrates Produced via Whole Blood or Buffy Coat Methods (050)

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Introduction:

At Canadian Blood Services (CBS), whole blood (WB) donations are processed by: the buffy coat (B1) method in which platelets are removed after the WB is stored at room temperature for 20 hours; or, cooling and leukoreduction within 72 hours (B2). A recent report suggests that fresh blood may be associated with greater in-hospital mortality after the buffy coat method was implemented in Canada. We postulate that this observation could be due to differences in B1 and B2 processing methods, resulting in increased levels of cell free DNA (cfDNA) being released during the B2 processing, possibly as a result of longer delays in time to leukoreduction. cfDNA can activate coagulation, is associated with an increased risk of mortality in septic patients, and is associated with histones, which activate platelets and are cytotoxic to vascular endothelial cells.

Methods:

We aimed to test our hypothesis that there would be increased cfDNA in B2 units compared to B1 and that levels would be impacted by duration of storage. Red cells (RCs) for transfusion were selected with equal numbers of fresh (<2 weeks) and older (≥2 weeks). Samples were obtained, centrifuged and cfDNA was isolated from supernatant. The cfDNA was then quantified by spectrophotometry and PicoGreen (a dsDNA assay); and ELISA testing for nucleosomes (cfDNA-histone complexes) was performed. Analysis looked at the levels of cfDNA by WB processing method and duration of RC storage.

Results:

127 RCs were tested: 73 B1; 54 B2. By spectrophotometry, fresh RCs compared to older RCs had significantly higher cfDNA (3.66 ± 1.69 µg/mL vs 2.98 ± 1.49 µg/mL, p=0.0007) and a trend of higher cfDNA with B2 RCs compared to B1 RCs (3.56 ± 1.99 µg/mL vs 3.28 ± 1.28 µg/mL, p=0.06). Using PicoGreen, B2 RCs had higher cfDNA (1.08 ± 0.9 ng/mL vs 0.5 ± 0.77 ng/mL p=0.0009). Nucleosome ELISA confirmed the presence of DNA-histone complexes.

Conclusion:

We demonstrate higher cfDNA in fresh blood and in B2 units. These findings suggest that the method of blood processing could be associated with patient outcomes. Further studies are required to confirm these observations and to understand the pathobiology.

Treatment Satisfaction with Intravenous Immunoglobulin Among Patients with Immune Thrombocytopenia (083)

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Background

Patients with immune thrombocytopenia (ITP) are frequently treated with intravenous immunoglobulin (IVIg) to improve platelet counts. Although effective, results are transient and sometimes accompanied by bothersome side effects. Treatment satisfaction with IVIg is an important patient-centered outcome that has not been addressed in ITP.

Methods

We conducted a prospective, survey study of consecutive adults with ITP who were scheduled to receive IVIg at a tertiary academic hematology clinic in Ontario, Canada. Satisfaction with IVIg was assessed 7 days post-infusion across the following domains: side effect burden, effectiveness, convenience and global satisfaction using a validated tool (the Treatment Satisfaction Questionnaire for Medications). Responses were scored out of 100 and summarized across patients as a mean (SD) score; higher scores indicated greater satisfaction. Pre and post-infusion platelet counts, previous ITP therapies, and previous IVIg usage were reported.

Results

We enrolled 12 patients: 9 were female, and the median age was 44 (IQR, 35-69) years. Mean platelet increment 3-8 days post-infusion was 54.2 x109/L (SD, 47.6 X109/L). Satisfaction was highest in the domain of side effect burden (88.2/100; SD, 19.3): Of the 6 patients who reported IVIG-associated side effects, most were only ‘slightly’ or ‘not all dissatisfied’ by the impact of these side effects on physical, mental, or mood and emotional functioning. Effectiveness scores were lower than side effect burden (68.1/100; SD, 21.3) and the lowest rated domain was convenience (62.0/100; SD, 24.7). Global satisfaction with IVIg was comparable but rated as less convenient than treatments with multiple oral hypoglycemic agents for patients with type II diabetes.

Conclusion

Acceptability of IVIg is often overestimated. Half of the patients surveyed experienced side effects, which were generally not too troubling; and effectiveness and convenience were scored low by patients. These data can be used to compare patient satisfaction with different ITP treatments.

A Retrospective Review of the Efficacy, Safety and Tolerability of Privigen® in Patients with Myasthenia Gravis (098)

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Background & Rationale: Myasthenia gravis (MG) is an autoimmune disease characterized by disabling weakness of ocular, oropharyngeal, respiratory and limb muscles, sometimes severe enough to require assisted ventilation, a state known as myasthenic crises. Intravenous immunoglobulin (IVIg) can provide rapid symptomatic improvement in most patients with MG (50-90%). Clinical improvement usually begins within the first week of initiating therapy and lasts about 3 months. There are at least three brands of IVIg currently available in Canada. It is not clear whether these brands have variable efficacy. Study Objective: To assess the efficacy, safety and tolerability of Privigen® in patients with MG exacerbation. Methods: We reviewed hospital/blood bank and clinic records of MG who received Privigen® for MG at 2gm/kg dose. Details of previous IVIg administration including frequency and Infusion related adverse affects were recorded from the infusion room charts/hospital records. To assess the efficacy of Privigen® scores on a validated scale i.e. muscle manual testing (MMT) were compared before and within 8 weeks of Privigen® infusion. All patients had their blood indices monitored to assess the degree of hemolysis. Results: The study included 23 patients (19 males, 4 females) with a mean age of 58.7 years (range 19 to 68 years). In this group, 18/23 (78%) had good response after Privigen infusion; three did not show any appreciable response; and one worsened during the follow up period. The baseline MMT score of our cohort was 6.8 (2 to 14), which reduced by 60% to 2.7 (range: 0 to 5) post-Privigen® infusion. All patients received the full prescribed dose of Privigen® and no serious adverse events were reported. Specifically, there was no incidence of hemolysis post-infusion. Two patients developed a transient rash on their hands while five reported post infusion headaches. Conclusions: This retrospective study shows that Privigen® is an effective and safe therapy for MG worsening, and is well tolerated by most patients.

An intervention to rationalize cryoprecipitate use at St. Boniface Hospital, a tertiary care centre (096)

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Background: Cryoprecipitate is rich in blood-clotting proteins. Transfusion of cryoprecipitate has been used for a variety of coagulation disorders, most notably fibrinogen deficiency (congenital or acquired), especially in circumstances when the required volume of plasma is contraindicated. Typically, the trigger for the use of cryoprecipitate has been a Clauss fibrinogen level of <1.0 g/L. Cryoprecipitate is manufactured at Canadian Blood Services (CBS) in single units of approximately 15 mL; St. Boniface Hospital (SBH) does not use pre-pooled cryoprecipitate. Each unit costs approximately, $136 CAD. Historically, blood product usage data were collected by the Manitoba Health's Blood Office, with little analysis or feedback to the hospitals. We reviewed cryoprecipitate usage at SBH following a CBS report that SBH's usage was the fastest growing in Canada, with the intention of understanding the aetiology of the increase and implementing procedures to ensure appropriate use.

Methods: At SBH, the use of cryoprecipitate was reviewed over a three-year span, from January 2012 through January 2015. As a result, in November 15th 2013, the screening of all orders of cryoprecipitate started with the transfusion medicine physician on service screening all cryoprecipitate requests. The monthly usage before and after the policy change was appraised.

Results: Over the span of three years, 4707 units of cryoprecipitate were issued at SBH. Before November 15th, 3568 units of cryoprecipitate were used in a 22 month span (=162 units; minimum=60 units; maximum=485units). After the policy change 1139 units of cryoprecipitate were used in a 16 month period (= 71 units; minimum=10 units; maximum=140 units), which indicated a statistically significant reduction (t test P value=0.0026) in usage. This amounted to savings of approximately 400 work-hours and $46,920 CAD in product costs.

Conclusion: Effective screening and physician education on the appropriate clinical use of cryoprecipitate resulted in significant reduction in cryoprecipitate usage at SBH. This resulted in cost savings, as well a freeing up time for the blood bank staff. SBH now collects and monitors its own usage data, and is now able to act on trends before they become significant.

Validation of high-speed centrifuges for rapid preparation of platelet poor plasma to improve the turnaround time of routine coagulation testing (054)

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Introduction

Coagulation testing plays a critical role in evaluating bleeding patients and providing guidance for timely transfusion therapy. While developing a massive transfusion protocol at the Health Sciences Centre, different ways to improve the turnaround time of coagulation testing were explored. In compliance with the Clinical and Laboratory Standards Institute guidelines, sodium citrate tubes for coagulation testing had been traditionally spun at 1500g for a minimum of 15 minutes to achieve platelet poor plasma (PPP), with a platelet count less than 10x10^9/L, for accurate coagulation test results. Consequently, centrifugation of blood for coagulation tests was one of the major bottlenecks in laboratory throughput. The objective of this study is to evaluate if changing the time and centrifugation speed of coagulation samples from current method (1500g for 15 minutes) to faster speed for shorter time at room temperature, using Sorvall ST16 would provide significantly faster, yet accurate routine coagulation results.

Method

Safety of the new centrifuge Sorvall ST16 was first tested. Water-filled 3.2% Sodium citrate glass and plastic tubes of 3 different sizes, i.e. 5ml, 3ml and 2 ml were spun at different speed for different time length. No tube breakage occurred at maximum centrifugal speed of 4612g for 4 minutes. The tests were then carried out to confirm that the new centrifugation method provides acceptable platelet poor plasma and comparable results in routine coagulation testing including PT, aPTT, Clauss fibrinogen, and D dimer in both normal and abnormal samples. Normal samples were obtained from healthy volunteers working at our laboratory. Samples from consented patients on warfarin in anticoagulation clinics were used as abnormal samples. Additional abnormal samples included samples from normal donors spiked with unfractionated heparin of differing concentrations.

Conclusion

3.2% sodium citrate samples spun at 4612g for 4 minutes produce acceptable platelet poor plasma. Platelet counts remain acceptably low if testing is delayed up to 1 hour post-centrifugation. We found no significant differences in routine coagulation assay results and concluded that high-speed centrifugation using Sorvall ST16 at 4621g, with a shortened spin time of 4 minutes, significantly reduced the turnaround time for routine coagulation testing while providing accurate results.

A large-scale comparison study of plasma fibrinogen by Clauss and prothrombin time derived methods: an attempt to define critically low value of prothrombin time derived fibrinogen for bleeding patients when Clauss fibrinogen is not readily available (055)

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Introduction: Plasma fibrinogen measurement is critical in managing bleeding patients. Clauss fibrinogen (CFIB) method is widely accepted as the "gold standard"; however unlike the quick, easily available prothrombin time derived fibrinogen (PTDF) method it is not frequently performed at small laboratories. Manitoba has provincially run and standardized coagulation testing. This study is aimed to define the relationship between CFIB and PTDF and determine if PTDF can be used as an alternative measurement of CFIB in bleeding patients.

Method: We retrospectively reviewed all CFIB results from the urban laboratories in 2012. 2336 samples had both CFIB and PTDF results. Modified z-score method was used to check outliers in the datasets and t-test was used to determine the significance between CFIB and PTDF datasets. Regression analysis was employed to estimate the relationship between CFIB and PTDF. The analyses were divided into two phases. Phase I included all 2,336 samples, while phase II targeted on the 1,179 samples with abnormally low CFIB result (≤ 2.0 g/L).

Results: CFIB and PTDF values are significantly different ($P < 0.001$) and PTDF values are on average 52% higher than CFIB values. PTDF and CFIB values are highly correlated (correlation coefficient = 0.95). Polynomial relationship was established between CFIB and PTDF values. Phase I study indicated that the equivalent critical PTDF value is 1.6 g/L, which can identify 95% of patients (589 out of 619) with critically low CFIB (≤ 1.0 g/L). Phase II study found the equivalent critical PTDF value is 1.5 g/L, which can identify 94% of the patients (580 out of 619) with critically low CFIB.

Conclusion: To our knowledge, our study is the largest comparison of PTDF and CFIB to date. PTDF and CFIB values are highly correlated. The equivalent critical PTDF value can be defined at 1.6 g/L, which can identify 95% of patients with critically low CFIB. It is suggested in literature that clinical situations that may cause poor correlation between PTDF and CFIB consistently have higher PTDF. Therefore, bleeding patients with PTDF ≤ 1.6 g/L warrant prompt blood product support.

Plasma Utilization in Cardiac Surgery: a multi-centre observational Canadian study (093)

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Background:

In cardiac surgery, bleeding is a frequent complication and frozen plasma (FP) transfusions are a commonly used hemostatic therapy, either intraoperatively or postoperatively, to correct abnormal coagulation results and/or reduce bleeding. However, the proportion of cardiac surgery patients transfused FP varies widely and little is known about the epidemiology and effectiveness of FP transfusions in cardiac surgery.

Methods:

A 2-month prospective observational study of consecutive patients undergoing cardiopulmonary bypass was undertaken at 6 Canadian tertiary care centres in 2012. Baseline demographics, and perioperative laboratory and clinical data (up to 72 hours postop) were recorded for all patients. Physicians were asked to rank 6 clinical factors that could influence their decision to transfuse FP for all patients on a 7-poin Likert scale

Results:

A total of 968 patients were enrolled: 250 (26%) were transfused FP, 144 (15%) during surgery and 164 (17%) in the 72 hours post surgery. The percentage of patients transfused FP varied from 15% to 40% ($p<0.001$) across the different centres. Patients undergoing coronary artery bypass grafting were less likely to receive a FP transfusion compared to aortic valve replacement surgery (23% vs. 49%, $p<0.01$). Repeat cardiac surgery was associated with a higher rate of FP transfusions (59%). The difference in the median INR was not clinically different in patients transfused FP postoperatively compared to nontransfused patients (1.35 vs. 1.3). The amount of chest tube drainage was higher during all time points for patients who received FP postop. Postop FP transfusions reduced the mean INR for patients with an INR > 1.2 but were associated with a reduction in mean chest tube volume only when the pretransfusion INR was between 1.2 and 1.5. The most important reasons stated by physicians for transfusing FP were ongoing blood loss and concern regarding future blood loss.

Conclusions:

The most important factors in the decision to transfuse FP is ongoing blood loss and concern for future blood loss but FP transfusions were only associated with reduction in blood loss for patients with mild to moderate elevations in pretransfusion INR. These data may help to inform future research and improve transfusion practice in cardiac surgery.

A review of O negative red blood cell utilization following implementation of strict strategies (104)

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Introduction: In Canada, inventory of O negative red blood cells (RBC) frequently falls to critically low levels. Data from 2013 was previously analyzed to gain understanding of O negative utilization. Results of this audit pointed overwhelming to the inappropriate misuse of O negative RBC. New strategies and training were implemented to define stricter usage of O negative RBC to non-O negative patients. Data from 2014 was analyzed and compared to the 2013 data to determine the effectiveness of the new strategies.

Method: O negative RBC transfusion data from 2014 was retrieved from the laboratory information system and compared to pre-implementation data from 2013.

Results: In 2014, 2608 O negative RBC were received into inventory compared to 2060 O negative RBC in 2013. Although there was an increase in the overall inventory of O negative RBC in 2014, only 619 (24%) of those units were transfused to non-O negative patients compared to 1013 (49%) in 2013. The most common reasons for transfusing O negative RBC to non-O negative patients were comparable from 2013 to 2014; 289 (46.7%) units were transfused to sickle cell anemia patients; 130 (21.0%) were transfused to patients with one or more antibodies; 60 (9.7%) were used to prevent outdating; 69 (11.1%) were transfused to BMT patients and 41 (6.6%) were transfused to neonatal patients. A total of 20 (3.2%) units were transfused as unmatched blood and 3 units (0.3%) for other reasons. A review of monthly data showed a range of utilization between 9.4-53.6% with the highest rate of O negative RBC transfused to non-O negative patients in February prior to implementation of the new strategies and the lowest rate in May immediately following implementation.

Conclusion: The data comparison of O negative utilization from 2013 to 2014 showed beneficial results from the implementation of stricter strategies for the transfusion of O negative RBC to non-O negative patients. Some of the new strategies included: performing more in-house phenotyping of donor RBC and in turn requesting less frequently phenotyped RBC from the CBS; defining the selection of outdating to 3 days prior to expiry and requesting that the CBS not substitute for other ABO phenotyped RBC with O negative RBC. Constant monitoring and reporting of O negative utilization is essential for maintaining a sufficient supply of O negative RBC for patients where no other alternative is possible.

Del phenotype with anti-D formation and severe HDFN due to a novel RHD mutation: a case report (077)

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Background: Del is characterized by RhD antigen serologically detectable by adsorption and elution only. Del is often associated with RhCe or RhcE, in contrast to Rhce typical of RhD-negativity. Del usually includes the complete RhD antigen, and individuals are not RhD alloimmunized. Anti-D formation has been described in rare patients with “partial Del”, and incomplete RhD epitope expression. We describe a novel RHD mutation associated with Del and anti-D causing HDFN.

Case: A Caucasian female at 11 weeks gestation typed as A RhD- with a positive antibody screen and anti-D identified (titre 4). The sensitizing event was unclear: no transfusions, transplantations, or confirmed pregnancies reported. A possible unconfirmed pregnancy and miscarriage was postulated. There was no history of RhIG administration. Paternal typing was RhD+. Maternal anti-D did not reach critical titres, and an RhD+ male was born at term. Neonatal DAT was positive for IgG with anti-D specificity. The next pregnancy was complicated by a critical anti-D titre. MCA Doppler results were persistently elevated by 32 weeks. A fetal hemoglobin of 144g/L on cordocentesis, with a positive IgG DAT and eluted anti-D were found. Fetal Hb fell to 96g/L at 36 weeks, necessitating IUT. Postnatal exchange transfusion for rapidly rising bilirubin was also required.

Investigation and Results: The patient typed as RhD- (Immucor Series 4 and Immuncor Slide + Tube). RhCE phenotyping results were C-, c+, E+, e+. Surprisingly, the patient typed as D+ by RHD PCR. Patient red cells were non-reactive by direct agglutination and weak D testing with multiple anti-D reagents (Ortho Bioclone, Immucor Gamma-clone, and DBL Novaclone), and non-reactive by the Albaclone Partial D Typing Kit. Automated PK7000 analyzer (PK1 and PK7300 Anti-D monoclonal blend) result was A RhD-negative. Galileo solid-phase weak D testing was negative. Adsorption and elution studies confirmed a Del phenotype. RHD sequencing (Progenika) identified a novel intron 1 splice site mutation (IVS1+1G>T). The mutation and Del phenotype were also identified in the patient’s mother. A similar mutation (IVS1+1G>A) is associated with a partial Del phenotype.

Conclusion: The RHD IVS1+1G>T splice site mutation is associated with a Del phenotype, anti-D alloimmunization, and HDFN.

From Stone Age to Space Age - Developing an Online Orientation Tool (059)

Linda Tveden; Kelly Bizovie; Diana Kobes; Linda Middleton; Darlene Mueller

In the fall of 2014, the Fraser Health Transfusion Medicine Science department decided to move forward on standardizing new employee orientation. The objective is to have consistency across the Fraser Health sites, replace the current written assessments with online versions, and determine an accurate method for keeping employee records of orientation.

As well as reading the Standard Operating procedures, our current orientation includes the use of 38 Training and Competency Assessment documents. These assessments include a Written Assessment and/or a Direct Observation Checklist. This is a completely paper based method with trainers spending time photocopying and assembling binders.

A team of technical leaders have standardized the orientation into a 10 day checklist of readings. The written assessments are currently being reviewed and revised to change them to an online format which will be completed as an online quiz. This will allow new technologists to do the quiz on the computer and repeat them until they have achieved a score of 100. The online delivery will also provide immediate feedback to the learner. This method eliminates the need for the trainer to review the written assessments. An electronic document will be designed to keep records of the employees' completed competency assessments. The team anticipates that with this new standardization it will save 4-6 hours of preparation and review time for the trainer.

This new process will allow for orientation to be standardized across sites. It will also reduce the trainers' time to produce and review orientation packages by moving towards an almost paperless system. Employee records of Training Competency Assessments will be easier to manage and share between sites.

ResearchUnits: development and evaluation of a knowledge mobilization tool for transfusion medicine research (051)

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Introduction: Knowledge mobilization bridges the gap between the creation of evidence and its ultimate impact. In the context of transfusion medicine, this means enhancing the movement of knowledge generated by basic and clinical research to those whose work may be impacted by the findings (e.g. clinicians, collection and production staff, management, policy makers), to ultimately improve the health of donors and recipients, provide more effective services and products and strengthen the blood system. The impact of established knowledge mobilization tools for research, which include publications in peer-reviewed journals, can be hampered by their limited access, and the importance of developing specific tools to mobilize knowledge is increasingly acknowledged.

Design and Methods: A knowledge mobilization tool aimed at improving awareness of the Canadian Blood Services' research and development activities was initiated in early 2013. Called "ResearchUnits", this program's output is plain language summaries of notable scientific publications by the organizations' members or affiliates. Written in both English and French and published online on an approximately monthly basis, these are aimed at all stakeholders including donors. Here we present an evaluation of the impact of this program 2 years after its inception.

Results & Conclusions: A common template and writing guide were developed and the first ResearchUnit was published online in March 2013. In the first 18 months of the ResearchUnit program (March 2013 – September 2014), 14 ResearchUnits were made available online. These were on diverse topics, ranging from transfusion-transmitted infection risk to logistical issues related to distribution and inventory control and were downloaded >2100 times. In the 6-month period between April – September 2014, there was a 200% increase in downloads compared to the previous 6 months, indicating that although this program is relatively new, its impact is already measurable and is growing. A re-assessment of the program in November 2014 highlighted the need for clearer identification of stakeholders and more effective dissemination of the ResearchUnits to these key stakeholder. The on-going improvement of this program will proceed throughout 2015. Knowledge mobilization is an iterative and dynamic process, and continuous development and monitoring will improve ResearchUnits and lead to greater impact.