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Abstract Book

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A rare case of an IgM warm autoantibody causing autoimmune hemolytic anemia (AIHA)

Abstract Author Names :

Nour Alhomsi [1] * ^, Evelyn Diaz [2], Bryan Tordon [3], Gwen Clarke [4], Christine Killik [5], Karen Marie Premack [6], Karen Brayshaw [7], Rebecca Moorehead [8], Nancy Heddle [9], Shuoyan Ning [10]

Abstract Summary :

Background:

Autoimmune hemolytic anemia (AIHA) is categorized as warm (W) or cold with the former caused by IgG 37C reactivity and the latter by cold reactive IgM with thermal activity at ≥30C. Sometimes both antibodies are present term mixed/combined AIHA . We report a case of warm reacting IgM AIHA and highlight unusual serological findings.

Case Report:

A 19-year-old male post-renal transplant (2006) was admitted with severe progressive AIHA (hemoglobin 59g/L). Serological investigations suggested a warm reactive IgM antibody. Poor RBC transfusion increments led to initiation of daily plasma exchange with excellent response (Hb > 130g/L). Secondary workup revealed underlying post-transplant lymphoproliferative disorder, for which Rituximab 375mg/m2 weekly x 4 was administered.

Laboratory Investigations and Results:

Historically the patient was A Rh Positive with a negative antibody screen. Results on admission included: ABO discrepancy (forward grouping reactivity with anti-B); a positive RhD control; and a positive DAT albumin control. Antibody screen was positive with a pan-agglutinin and a positive auto-control. The cold agglutinin screen (4C; 1:64 dilution) was negative. Thermal amplitude showed reactivity with adult and cord cells (1:4 dilution) at 37C, 30C and 22C but negative at 4C.

Reference Laboratory investigations were performed and interpreted as follows:

- DTT (Dithiothreitol) treatment of patient's RBCs resulted in concordant forward and

reverse ABO grouping (A Rh Positive).
- DAT was interpreted as positive (C3d) following DTT treatment of RBC which rendered the albumin control negative.
- Saline tube testing was pan-reactive at 37C and IAT but negative at immediate spin.
- Clinically significant alloantibodies were excluded following alloadsorption with an Rh phenotype-matched RBC treated with ZZAP; adsorbed plasma was non-reactive.
- RESt adsorbed plasma showed persistent but weaker reactivity with all panel cells.
- Testing with adult and cord cells (4C) excluded specificity for M, P1, H, I and i. Anti-Pr was also excluded.
- DTT treated plasma was non-reactive with all cells tested; the autocontrol by immediate spin remained positive.

Between November 1 and December 26 RBCs were crossmatched and transfused as "least incompatible". Testing on the patient's plasma following PLEX was negative at 37C, 30C and 22C. The final diagnosis was AIHA due to a warm IgM panagglutinin secondary to a post-transplant lymphoproliferative disorder.

Conclusion:

IgM warm AIHA can present with multiple serological discrepancies and confusing results as the antibody auto agglutination but the cold agglutinin screen is negative. Reference laboratory expertise using specialized techniques can help make this diagnosis.

Acknowledgement: The Transfusion Medicine staff at Hamilton hospitals are acknowledged for their expertise and assistance in understanding this case.

Platelet transfusions in the extreme: a review of the literature

Abstract Author Names :

Bonnie Liu [1] *^, Nadia Gabarin [2], Yang Liu [3], Nour Alhomsi [4], Kayla Lucier [5], Michelle Zeller [6]

Abstract Summary :

Introduction: There are few clinical contexts in which platelet transfusion to patients with pre-transfusion platelet counts >100 x10^9/L is considered appropriate. However, past audits confirm that this practice still occurs. The objective of this literature review was to determine the extent of published literature on platelet transfusion with pre-transfusion platelet counts >100 x10^9/L where a clinical practice guideline was applied to determine appropriateness of transfusion.

Design and Methods: We conducted a comprehensive search of MEDLINE, EMBASE, Web of Science, HealthSTAR, and Cochrane databases from January 2005 to April 2022 or studies that evaluated the proportion of patients receiving platelet transfusion with pre-transfusion platelet counts >100 x10^9/L and adjudicated appropriateness using a transfusion guideline. There were no restrictions on language, publication status, study design, region, or clinical setting. Risk of bias was assessed using the Risk of Bias Assessment Tool for Nonrandomized Studies (RoBANS).

Results: Thirteen studies met eligibility and included 4,454 platelet transfusions, 13,706 platelet orders (including transfusion episodes), and 1,772 patients. Patient populations across studies varied: all transfused patients in a time period (7), intensive care unit (ICU) patients (3), all transfused patients up to a predetermined patient size (2), and patients with dengue fever (1). Five studies included adult and pediatric populations; one study included pediatric patients only.

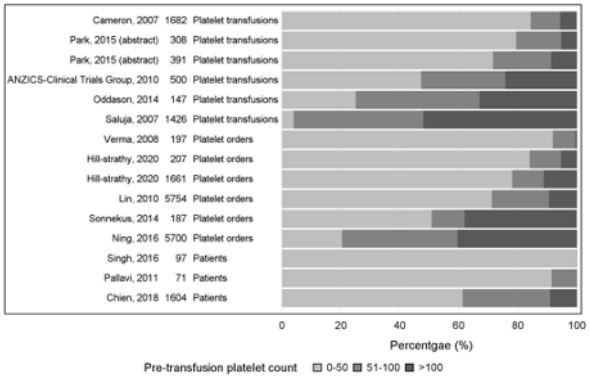
Studies reported up to 52% of transfusions occurred with pre-transfusion platelet counts >100 x10^9/L. No study reported on proportion of this specific patient cohort with regards to appropriateness of transfusion, nor were granular patient characteristics of this group provided.

Adjudication methods varied greatly between studies, including using internationally recognized guidelines (7), hospital-specific policies (2), or unclear methods (4). While the risk of bias was low, multiple studies failed to clearly describe their selection criteria, use internationally accepted guidelines, or report indications for transfusion, post-transfusion platelet counts, adverse transfusion reactions, or platelet collection process.

Settings associated with platelet transfusions to patients with a pre-transfusion platelet count >100 x10^9/L included hematology, ICU, medicine, cardiac surgery, general surgery, neurosurgery, and other specialties.

Conclusions: The proportion of patients receiving platelet transfusions with a pre-transfusion platelet count >100 x10^9/L varied significantly across studies and clinical settings. More research is required to determine if these transfusions fall within accepted clinical practice guidelines.

Acknowledgements: This study was funded through Canadian Blood Services Blood Efficiency Accelerator Award Program. We gratefully acknowledge support from the Michael G. DeGroote Centre for Transfusion Research.



First home blood transfusion in a pediatric patient in Quebec

Abstract Author Names :

Marie-Pierre Pelletier [1] *, Anne-Marie Girouard [2], Claudine Amesse [3], Nancy Robitaille [4], Georges-Étienne Rivard [5], Valerie Arsenault [6] ^

Abstract Summary :

Introduction: A pediatric patient with severe congenital factor V deficiency had to come three times per week to a pediatric tertiary care centre hematology clinic to receive plasma transfusion as no factor V concentrates are available. This was very burdensome for the patient and his family in terms of quality of life, travelling cost and work absenteeism. Therefore, the feasibility of the implementation of home blood transfusion program to address the special need of this patient was explored.

Design and Methods: A review of the literature including the medicolegal aspects and a research of the existence of home transfusion programs across Canada were done. A home transfusion program for this pediatric patient was created.

Results: According to CAN/CSA-Z902:20 National Standard of Canada Blood and blood components (section 17), "home transfusion shall take place under a formalized program, […] formal training shall be provided for transfusionists performing home transfusion" and "the transfusionist shall be at least a practicing registered nurse with demonstrated competence in administering blood transfusions." Our research showed that home transfusion programs exist in Canada mainly for adults receiving red blood cells or platelets in only two provinces, precisely Nova Scotia and Alberta, but there was no program in place in Quebec. Blood bank and homecare service of the Integrated University Health and Social Centre which serves the city district where the patient lives were contacted to set up processes in order to create a home based transfusion program for this patient. A formal training curriculum was created, and homecare nurses were trained by the transfusion safety officer. An emergency kit with instructions and medications was developed in case of transfusion reaction. First plasma transfusion took place in November of 2021 and transfusions have been given on a regular basis since that time which resulted in improved care experience and quality of life for the patient and his caregivers.

Conclusions: Quebec first home transfusion program for a pediatric patient was established thanks

to the close collaboration of a multidisciplinary multicenter team. An expansion of this program to other pediatric and adult transfusion-dependent patients across Quebec might be beneficial to improve patient quality of life as well as to decentralize overcrowded hospital health services.

Acknowledgements: Special thanks to the Montreal West Island Integrated University Health and Social Centre blood bank and homecare service as well as the Sainte-Justine University Hospital Centre homecare service and Department of Nursing.

Intravenous albumin in Cardiac and Vascular surgery: A Systematic Review and Meta-analysis

Abstract Author Names :

Aarti Bathla [1] *^, Jeanne Callum [2], Nikolaos Skubas [3], Homa Keshavarz [4], Dean Fergusson [5], Bovey Wu [6], Simon Stanworth [7], Nadine Shehata [8]

Abstract Summary :

Introduction: The ideal priming and resuscitation fluid for patients undergoing cardiovascular surgery is uncertain. With this systematic review and meta-analysis, we sought to understand the efficacy of intravenous albumin, as compared to synthetic colloids and crystalloids, for priming of the extracorporeal bypass circuit and/or volume resuscitation in pediatric and adult patients undergoing cardiovascular surgery. The review was conducted to support the ICTMG intravenous albumin guideline development group.

Methods: A systematic review and meta-analysis of randomized controlled trials (RCTs) of intravenous albumin compared to synthetic colloids and crystalloids on the primary outcome of all-cause mortality was conducted. Secondary outcomes included renal failure, blood loss, duration of hospital or intensive care unit stay, cardiac index, and blood component use; and subgroups included age, comparative replacement fluid, and intended use (i.e., for extracorporeal circuit pump priming and/or volume resuscitation). Databases, including MEDLINE, Embase, and CCRT, were searched from 1946 to November 23, 2022. The protocol was registered on the National Institute of Health Research's PROSPERO database (CRD42020171876). Random-effects meta-analysis was used to calculate risk differences with 95% CIs for dichotomous outcomes. The inverse variance-weighted average method was used to calculate weighted mean differences and 95% CIs for continuous outcomes.

Results: We identified 42 randomized controlled trials that met eligibility criteria. Mortality was assessed in 15 trials (n=2711) and the risk difference for mortality was 0.00, 95% confidence interval (CI) -0.01, 0.01. Intravenous albumin resulted in smaller fluid balance, with mean difference of -0.55 L, 95% CI -1.06, -0.4 (9 studies, 1975 patients), and higher albumin levels with mean difference of 7.77 g/L, 95% CI 3.73, 11.8 (6 studies, 325 patients). Patient important outcomes including renal failure, blood loss, duration of intensive care or hospital stay, cardiac index, and blood component use were not improved by intravenous albumin compared to other fluids.

Conclusions: Intravenous albumin was not associated with a statistically or clinically significant difference in mortality in adults or pediatric patients undergoing cardiovascular surgery when compared to synthetic colloids or crystalloids. The lack of improvement in patient-important outcomes with intravenous albumin and its significantly higher cost, suggests its use should be used restrictively in patients undergoing cardiovascular surgery.

RHD Genotyping for Selected Perinatal People to Reduce RhIG Administration

Abstract Author Names :

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Abstract Summary :

RHD Genotyping for Selected Perinatal People to Reduce RhIG Administration

Introduction: Traditional blood-typing methods sometimes lack the needed specificity to detect blood group variants. In the prenatal setting this can have a significant impact as the risk of alloimmunization for people with a variant D cannot be accurately assessed due to limitations of using serology alone. Thus, leading to unnecessary Rh Immune Globulin (RhIG) administration. Expectant mothers identified as weak D types 1, 2 or 3 (the most common variant *RHD* alleles) can be safely treated as D positive as there are no reported cases of D alloimmunization in people harboring these D variants. Insofar that expectant mothers with weak D type 1, 2 or 3 can also safely forego RhIG administration in all phases of pregnancy, delivery and postpartum.

Methods: Data was collected on prenatal blood group samples in a regional laboratory between April 2019-March 2023. Cases showing variable D reactivity by serology and subsequent confirmation by *RHD* genotyping were described using a standardized report. The *RHD* Bioarray BeadChip™ was used to resolve prenatal cases that showed variable D reactivity by traditional methods. Upon issuing results, expectant mothers with variant D were identified and information provided on alloimmunization risk and possible need

for RhIG.

Results: Over the study period, 200 people with child-bearing potential under the age of 45 were tested. Eight-one (41%) cases were identified as weak D types 1, 2 or 3 and were reported as being able to safely be treated as D positive and forego RhIG prophylaxis. Twenty-nine (36%) people who delivered, did not receive RhIG and suffered no consequences from this decision. However, fifty-two (64%) were treated as D negative and given RhIG prophylaxis. Furthermore, six cases with variants in the *RHCE* allele were investigated and additional clinically significant transfusion recommendations were made.

Conclusions: This study confirms that using genotyping on selected cases showing variable D reactivity can help guide clinical care. A testing algorithm that integrates serology and genotyping results can identify those that can safely forego RhIG prophylaxis. Educating healthcare providers and increasing awareness on the utilization and interpretation of genotyping is still needed and will help guide quality care. The implementation of RHD genotyping can help resolve cases showing variable D reactivity, however further education is needed in order to impact treatment decisions.

Estimation of Fetal Maternal Hemorrhage by Kleihauer Betke and Flow Cytometry

Abstract Author Names :

Marietta Biscocho [1] *^, Nadine Shehata [2]

Abstract Summary :

Introduction: Estimation of fetal maternal hemorrhage (FMH) is required to determine the dose of Rh immune globulin (RHIG) to reduce the risk of all immunization when there is antepartum hemorrhage after 20 weeks gestation and immediately postpartum in a RhD negative pregnancy who has a neonate who has RhD or is RhD indeterminate and to determine the volume of antepartum hemorrhage in RhD

positive individuals.

The Kleihauer-Betke (KB) acid elution test and flow cytometry are used to determine volume of FMH but use of flow cytometry, which is more accurate than BK testing, is not used as frequently because of limited availability.

Objective: To determine the rate of discordant tests using KB assessments compared to flow cytometric assessment of FMH that could potentially affect dosing of RhIg.

Methods: Annually, 760 KB testing were done at Mount Sinai Hospital. KB testing is conducted to determine the presence or absence of a FMH. If KB testing suggests a FMH, volume of the FMH is determined by flow cytometry except during weekend when flow cytometry is not available. If KB testing does not suggest a FMH, a sample is not sent to Flow Cytometry for confirmation.

We reviewed all instance confirmatory testing of FMH by flow cytometry at Mount Sinai Hospital from 2014 until 2022 to determine 1) Discordant results (presence of fetal maternal hemorrhage by BK testing but not flow cytometry) and 2) the differences in volume estimates of FMH using KB and flow cytometry.

Results:

During this time period 345 samples were assessed for FMH, 197 in individuals who were RhD positive, 89 in individuals who were RhD negative, and 59 where a blood group was not available (samples sent from remote sites). The proportion of discordant test results ranged from 9% to 64%/year. The volume of FMH was assessed by KB and flow in 30 samples. 10% (n=3) had volumes that were equivalent by flow cytometry and BK testing, 37% of volumes were higher by flow cytometry (n=11) and the remainder (n=16) were had volumes that were higher using KB testing. In 2 samples (6%) that amount of RhIg would have differed if BK testing were used instead of flow cytometry (as defined by a difference in volume of FMH of 6 ml or more).

Conclusions:

Larger volumes of FMH may need confirmation by flow cytometry to adequately determine dosage of RhIg.

Differentiation of passive and alloimmune anti-D using an enzyme indirect antiglobulin test

Abstract Author Names :

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Abstract Summary :

Differentiation of passive and alloimmune anti-D using an enzyme indirect antiglobulin test

Introduction:

Differentiation between passive and alloimmune anti-D is important in prenatal management to determine the eligibility for RhIg administration and the need for monitoring for HDFN. Often differentiation is difficult and may depend on knowing the timing of RhIg administration, review of antibody reaction strength and anti D titer. None of these methods provide certainty in distinguishing passive from allo-anti D. One published report suggests that reaction strength with enzyme indirect antiglobulin test (EIAT) compared to indirect antiglobulin testing (IAT) could be helpful in this distinction. The objective of this study is to determine whether EIAT enhancement can identify allo-anti-D with high specificity when compared to IAT testing with untreated cells.

Methods:

Prenatal patient and blood donor stored frozen plasma samples retained following antibody investigation were screened for eligibility. Samples were included if they met the following criteria: confirmed anti-D; a clear history of RhIg administration; and, sufficient plasma volume for additional testing. Samples were excluded if they had anti-D in combination with other antibodies. Samples were classified as passive anti-D if the patient/donor had received RhIg within 4 months prior to sample testing: and, as alloimmune anti-D if RhIg had been given more than 6 months prior or if no RhIG had been provided. Samples with history of RhIg received within 121 to 179 days were excluded to avoid misclassification. Plasma samples were thawed and tested in batches using IAT testing and EIAT testing against R2R2 and R^{o}r red blood cells with results graded from 0 – 4+. All testing was performed blinded to history information. Sensitivity and specificity of score difference in grading reactivity between the 2 testing methods (EIA -IAT) to differentiate alloimmune from passive anti-D were calculated and a ROC curve was plotted.

Results:

98 plasma samples met the eligibility criteria and were tested. Among 19 alloimmune anti-D, 16 showed ≥1+, 8 ≥ 2+ and 5 ≥ 3+ score difference; among 80 passive anti-D, 51 had ≥ 1+, 5 ≥ 2+ and 1 ≥ 3+ score difference. Sensitivity of the score difference of ≥1+, ≥2+ and ≥3+ was 85%, 42% and 26% respectively. The specificity of the score difference was 35%, 94%

and 99% respectively. EIAT enhancement by ≥3+ had 99% specificity for alloimmune but only 26% sensitivity.

Conclusions:

EIAT enhancement can be used to confirm but not to exclude the presence of alloimmune anti-D. Larger studies may help to confirm and generalize this finding.

Acknowledgements:

The technical team in the CBS reference labs in Vancouver and Edmonton made the testing and results documentation. Liu, Yang and Eisa, Kerolos performed the biostatistical analysis.

Red Blood Cell Transfusion Practice Pattern Before and After Implementation of a Local Restrictive Transfusion Protocol in a Neonatal Intensive Care Unit

Abstract Author Names :

Lily Chartrand [1] *^, Alexandra Zabeida [2], Andréanne Villeneuve [3], Jacques Lacroix [4]

Abstract Summary :

Red Blood Cell Transfusion Practice Pattern Before and After Implementation of a Local Restrictive Transfusion Protocol in a Neonatal Intensive Care Unit

Introduction/Objective: A restrictive red blood cell (RBC) transfusion guideline was established in 2019 in a neonatal intensive care unit (NICU). Our study aimed: 1) To determine its impact on the number of RBC transfusions and donor exposure; 2) to characterize RBC-transfusion determinants and justifications.

Design and methods: Single center retrospective historical control study comparing all neonates consecutively admitted to the NICU during two 5-months periods: 401 patients in 2013 before and 402 patients in 2021 after restrictive guideline implementation. Possible determinants were assessed via logistic regressions and justifications via a questionnaire.

Results: In 2021**,** 9.2% of neonates received at least one RBC transfusion compared to 13.5% in 2013 ($p = 0.075$). Adherence to protocol thresholds was of 50%. Implementation of a restrictive transfusion protocol had some impact on determinants related to neonatal morbidity and illness severity and some impact on justifications being mainly based on hemoglobin value.

Conclusion: Our study demonstrates that the implementation of a restrictive RBC transfusion protocoltended to decrease transfusion rates and donor exposure in the NICU, but the trend was not statistically significant. Future work should focus on improving protocol adherence.

Acknowledgements: We thank Karine Fondrouge for her help in data collection, Miguel Chagnon and Justine Zehr for statistical analysis as well as the patients and their families for contributing to this study.

Isohemagglutinin Titration: Donor versus component testing to identify low titre platelets.

Abstract Author Names :

Melanie Bodnar [1] *^, Dora Lopes-Carvalho [2], Cindy Lever [3], Ilona Resz [4], Charles Musuka [5], Gwen Clarke [6]

Abstract Summary :

Introduction:

Limitations in platelet inventory necessitate the use of ABO-incompatible platelets for transfusion. To mitigate the risk of hemolytic reactions, hospitals may perform manual isohemagglutinin titre (ISOT) testing to identify low titre platelet components deemed safer for transfusion to ABO incompatible recipients. Blood supplier based automated donor ISOT testing is an alternative strategy. As all donors in a pooled platelet concentrate (PC) must test low titre, the number of low titre PC is expected to be less than when testing is performed directly on the pooled component. The purpose of this study is to compare the number of apheresis (APH) and PC considered low titre by donor versus component ISOT testing strategies.

Methods:

Between November 8 2022 and February 8 2023 hospital based ISOT was performed on 1001 PC (A=459 B=35 O=443) and 254 APH (A=138 B=38 O=78) by manual immediate spin using a 1:50 dilution of the platelet supernatant tested separately against A1 and B cells. The absence of agglutination with both cells constitutes a low titre result. Component test results were compared with results derived from donor testing. The blood supplier performs automated ISOT on donor plasma at each donation on the Beckman Coulter PK7300 at a 1:32 dilution tested separately against A1 and B cells. A PC is labelled as "Low anti-A/B" when all 4 donors test below the cutoff. Results from both testing methods were compared and data analysis was performed using SAS software.

Results:

Of 1001 PC, 937 (93.6%) were low titre by the component testing compared to 335 (33.5%) by donor testing. Of 254 APH, 244 (96%) were low titre by component testing compared to 212 (83.5%) by donor testing. There were no cases of a PC or APH assessed as high titre by component testing when labelled low titre by the blood supplier.

Conclusions:

Automated donor ISOT testing is a safe and effective method for identifying low titre APH when compared to the manual hospital-based component method, however, the donor testing strategy misses 64.2% of low titre platelet pools as the inclusion of even a single donor with a titre above the cut-off prevents the PC from being labelled low titre. It is not feasible for the blood supplier to test the final component. The use of a higher donor titre cutoff for whole blood donations used to produce PC is a potential strategy to improve low titre PC inventory. This is an important consideration in the context of seven donor pathogen reduced platelet pools manufactured with platelet additive solution.

Alloimmunization following transfusion of DEL donor red blood cells: Two cases with different immunological responses

Abstract Author Names :

Melanie Bodnar [1] *^, Yulia Lin [2], Jeannie Callum [3], Nicole Abrena [4], Minda Agpalo [5], Evelyn Diaz [6], Jenette Goldstein [7], Tony Lyn [8], Carmela Pote [9], Shahla Azizi-Moghadam [10], Angela Sirosky-Yanyk [11], Andrew Stevens [12], Fiona Tantono [13], Jarin Tasnim [14], Beverly Weaver [15], Akash Gupta [16], Wendy Lau [17], Celina Montemayor [18], Gwen Clarke [19]

Abstract Summary :

Background: The DEL variant *(RHD*01EL.01)* is characterized by very low levels of D antigen expression on the red blood cell (RBC) surface that cannot be detected using standard D typing strategies. As a result, DEL blood donors are labeled as D negative. The risk of D alloimmunization in a D- recipient who receives DEL RBC is thought to be low, but has not been well characterized. This study examines two cases of apparent anti-D in D- recipients of DEL RBC.

Methods: Samples from two D- recipients with unexpected anti-D alloimmunization despite transfusion of D- RBC underwent hospital and reference lab serologic investigation including patient plasma testing against untreated, ficin and DTT treated reagent RBC, cord cells and differential adsorption-elution for anti-G differentiation. Suspected DEL donors underwent *RHD* genotyping by Immucor *RHD* Molecular BeadChip Test followed by *RH* next generation sequencing at an outside reference lab and adsorption-elution studies using polyclonal anti-D.

Results: Recipient A was a 53 yo male with acute leukemia who developed transient anti-D despite receiving D- components (19 RBC and 23 platelet pools). A traceback investigation ruled out donor passive anti-D (all predonation antibody screens were negative) but identified a DEL RBC donor homozygous for *RHD*01EL.01* and *RHCE*Ce*. Anti-D appeared 23 days after the implicated RBC was transfused and disappeared 17 days after first detection.

Recipient B was a 75 yo female with negative antibody screen who received two D- RBC post-operatively. An antibody screen 5 years later identified anti-D+C reactivity. No investigation was initiated for the unexpected antibodies. Differential alloadsorptions performed at a reference lab 9 years post-transfusion, triggered by a lookback study on a DEL donor, ruled out anti-D but confirmed the presence of anti-C + anti-G. The implicated donor was heterozygous for the DEL variant *(RHD*01EL.01/ RHD*01N.12)* and homozygous for *RHCE*Ce*.

Conclusion: Of two D- patients with suspected anti-D following exposure to DEL RBC, one appeared to have weak transient alloanti-D and the other anti-C+G. Thorough recipient and donor investigation is required for unexplained anti-D in D- RBC recipients. The association of the *RHD*01EL.01* allele in cis with *RHCE*Ce* is well described. The provision of confirmed D-C-E units to vulnerable D- recipients (ie childbearing potential, chronic transfusion) may be the most practical approach to prevent Rh alloimmunization but is not currently the standard of practice in Canada.

Optimizing Enzyme Enhancement for the Serologic Investigation of Rhesus Antibodies

Abstract Author Names :

Emily Willette [1] *^, Brenda Caruk [2], Gerri Barr [3], Gwen Clarke [4], Melanie Bodnar [5]

Abstract Summary :

Introduction: Proteolytic enzymes such as ficin and papain are useful tools for antibody identification. Enzyme treatment of reagent red cells enhances the reactivity of antibodies to Rh and Kidd antigens by cleaving sialic acid from the red cell surface to decrease negative charge and promote antigen-antibody interaction. While enzymes reliably destroy antigens in the Duffy and MNS blood groups, enhancement effects are more variable. The purpose of this study was to determine the most reliable method for enhancement of Rh antibodies.

Methods: Frozen donor (n=20) and prenatal (n=25) plasma samples with known Rh antibodies (anti-D 11, anti-E 11, anti-C 7, anti-c 11, anti-e 5) were thawed and tested in parallel against a single heterozygous red cell (R^or, R^1r, or R^2r) by saline IAT, Ficin IAT, papain IAT, gel IAT, ficin gel, and papain gel. Commercially treated ficin cells (Immucor Panocell 10) and an in-house two stage papain assay were used for enzyme treatment. Papain cells were prepared by treating 3-5% Immucor panel red cells with reconstituted papain. Ficin and untreated cells were from the Immucor Panocell 10 panel. Enhancement was defined as a change of $\geq$1 tube in reaction strength between treated and untreated cells.

Results:

Of 45 Rh antibodies, enhancement was seen in 25 (56%) ficin IAT, 7 (15%) papain IAT, 42 (93%) ficin gel and 21 (46%) papain gel. Ficin gel showed more consistent enhancement than ficin IAT for all antibodies except anti-C. The number of antibodies demonstrating enhancement for each enzyme/method combination is show in the table.

	Ficin gel	Ficin IAT	Papain gel	Papain IAT
Anti-D (n=11)	11	4	10	2
Anti-C (n=7)	7	7	3	1
Anti-E (n=11)	9	6	8	3
Anti-c (n=11)	11	7	6	0
Anti-e (n=5)	4	1	1	1

Conclusion: In this study ficin gel provided the most reliable enhancement for Rh antibodies and commercially treated ficin cells consistently showed better enhancement compared to papain in both saline and gel. While these findings need to be confirmed using larger panels of cells, the lack of enzyme enhancement may not reliably exclude an anti-Rh antibody. Antibody enhancement is dependent on the method and enzyme used. Each lab must validate, optimize and understand the limitations of their enzyme procedures.

Non-Invasive Perinatal Testing for fetal RHD: Preparing for Test Implementation

Abstract Author Names :

ALLAHNA ELAHIE [1] *, Gwen Clarke [2] ^, Melanie Bodnar [3], Jason Acker [4]

Abstract Summary :

Background: Non-Invasive perinatal testing (cell free fetal DNA testing) for fetal RHD from maternal plasma is a technique that has been widely implemented around the world for prediction of fetal RhD type to target RhIG prophylaxis. Several test methods are available commercially or described in the literature. Common to all is a need to validate using plasma samples from RhD negative mothers collected during pregnancy. The neonatal RhD type is also required to determine the accuracy of the test.

Purpose: The study aims included recruitment of consenting pregnant individuals to allow retention of plasma from routine prenatal blood samples and to link the RhD status of the neonate following cord testing. A second aim was to develop and evaluate educational materials targeted to health care providers and pregnant women.

Methods: Care providers including obstetricians, family physicians and midwives were approached with study information and asked for assistance in recruiting prenatal patients. Eleven agreed to participate. Educational materials were developed by communications and marketing staff at Canadian Blood Services following consultation with the study team. Patients were provided with information regarding NIPT, and study information. Those consenting had routine prenatal samples saved following testing with plasma separated and frozen at -80 °C. Cord RhD typing results were linked to the stored plasma samples following delivery through communication with the delivery hospital. Participating health care providers and patients were surveyed by email using a RedCaP electronic survey regarding the utility and efficacy of communication materials.

Results: A total of 292 signed consent forms were received of which 50.3% (n=147) were excluded because they were RhD Positive. The remaining 49.7% (n=145) were included. Of these, 118 samples from 109 individuals were aliquoted and saved. Nine participants had more than one sample collected during pregnancy. Of the 118 samples aliquoted, 5 were destroyed during preparation and four were not processed in time to proceed. Of the 292 patients enrolled, 209 (71.6%) agreed to participate in the survey and 78 provided an email. The health care provider survey had 4 responses (4/11 or 36.4% of clinics; 1 physician, 1 nurse; and 2 midwives). The patient survey had 22 responses (28.2% of emailed participants).

Conclusions: Acquisition of samples for validation of NIPT for RHD is difficult as prenatal samples are required and the neonatal RhD type is also necessary. This study successfully collected and stored prenatal samples and obtained corresponding neonatal RhD typing information. At the same time the participating providers and patients used and evaluated communication tools regarding the testing. These samples and data will be a valuable resource in the validation of NIPT for RHD.

Funding: This research was generously supported by Lois Hole Hospital for Women through the Women and Children's Health Research Institute.

Implementation of sexual risk-based criteria: impact on safety and adequacy of supply

Abstract Author Names :

Mindy Goldman [1] *^, Samra Uzicanin [2], Qi-Long Yi [3], Niamh Caffrey [4], Sheila O'Brien [5]

Abstract Summary :

Introduction: In September, 2022 time-based deferrals for men who have sex with men were replaced by gender neutral sexual risk-based criteria. Donors identified as male in our computer system are no longer asked about sex with a man, and donors identified as female are no longer asked about sex with a man who had sex with another man. All donors are asked about having a new sexual partner or more than one sexual partner in the last three months, and if yes, if they have had anal sex. All donors who have had a new sexual partner or more than one sexual partner in the last three months and have had anal sex are deferred from donation for three months. We evaluated the impact of this change on HIV rates and deferral rates.

Methods: Data on donors, donations, TD markers and deferrals were extracted from the Canadian Blood Services' data warehouse.

Results: Post-implementation from September 11, 2022 to February 28, 2023 there was one HIV positive donor (26-year-old repeat male donor, no identified risk factors to date) out of 377,782 donations screened (rate of 0.27 per 100,000 95% CI 0.007, 1.52), compared to a pre-implementation rate of 0.26 per 100,000 (95% CI 0.03, 0.93) in the previous year. In 13,514 of 449,353 donation attempts (3.0%), donors answered affirmatively to having a new partner and/or multiple partners in the last 3 months; 297 (2.2%) of these had anal sex and were deferred. Thus, overall 0.07% of donation attempts resulted in deferral.

Conclusions: There was no impact on HIV positive rates, and a lower deferral rate than predicted in a pre-implementation study. A longer observation period as well as planned post-implementation studies to assess donor compliance will strengthen these preliminary observations.

Implementation of an enhanced donor question regarding ethnicity/racial group

Abstract Author Names :

Mindy Goldman [1] *, Gwendolyn Clarke [2], Elaine Fournier [3] ^, Karen Mostert [4], Sheila O'Brien [5]

Abstract Summary :

Introduction: The frequency of red cell phenotype combinations and rare groups varies by ethnic/racial group. An optional question was added about donor ethnicity/race to identify donors for additional red cell typing to meet patient needs for rare blood, starting in 2016. We describe the development and implementation of new questions, made possible after a computer upgrade, and results from implementation on Oct 17, 2022 to Feb 6, 2023.

Methods: The initial question, based on the 2016 Canadian census, asked donors to choose if their background was Arabic, Asian, Aboriginal, Black, South Asian (e.g. India, Pakistan), Latin American, White, or other. Difficulties included overly broad categories for targeted extra testing for certain groups, outdated terminology, and lack of harmonisation with stem cell registrant terminology. A multidivisional group evaluated questions used by the blood, stem cell, and cord blood programs and developed a concordant classification. Terminology was compared to current Canada census terminology and US and international stem cell registries and reviewed by staff and consultants involved in our nascent diversity, equity and inclusion initiatives. Donors are asked to choose if their background is Arab, Asian, Black, Caucasian, Filipino, Hawaiian or other Pacific Islander, Hispanic/Latino, Indigenous (First Nations/Metis/Inuit), another ethnicity, or multi-ethnic. A yes answer to some categories results in further choices. All donors were asked the new question on their first successful donation after implementation on Oct 17, 2022. Data on ethnicity and donor demographics was extracted from the National Epidemiology Donor Database.

Results: Minor implementation difficulties included unclear definitions of some sub-groups, such as Northern European/Scandinavian as opposed to Mainland European, queries about why some options were very broad, such as South Asian, and why Jewish was included since it is not a geographical designation. A Q and A information sheet was prepared for staff post-implementation, after queries arose. 93.4% % of donors answered the optional question, with 37% of first-time whole blood donors and 19% of repeat whole blood donors identifying as non-Caucasian; non-Caucasian donors are younger and more often male compared to donors who identify as Caucasian.

Conclusions: An enhanced donor question was successfully implemented and will enable better targeting of donor groups for additional testing, comparison of blood and stem cell donors, and monitoring of efforts to increase donor diversity. Further enhancements would include asking first time deferred donors to respond as well, to allow more accurate assessment of deferral rates in different groups.

Donor re-entry following deferral for false reactive human immunodeficiency virus, hepatitis B virus and hepatitis C virus markers – Is it effective?

Abstract Author Names :

Steven Drews [1] *^, Mark Bigham [2], Samra Uzicanin [3], Peggy Huppe [4], Kevin MacDonald [5], Sheila O'Brien [6]

Abstract Summary :

Introduction/Objective

Prior to updates in January 2023 (syphilis and human T-cell lymphotropic virus-1/2), Canadian Blood Services had a donor re-entry (DRE) program in place for unconfirmed human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) serological markers and false positive nucleic acid tests (NAT). There is no current donor re-entry process for anti-hepatitis B Core total (anti-HBc total). This program was implemented in 2014 and allows Canadian Blood Services to re-test donors with a specimens-only donation after a 6-month deferral period. Donors who are negative for all routinely screened transmissible disease (TD) markers are then eligible to return to donate blood products. The objective of this study is to evaluate the yield of re-entered donors for HIV, HBV and HCV markers and identify areas for improving program yield.

Design and Methods

Donor data were stored in an ePROGESA database (Mak-System, Brussels, Belgium) Canadian Blood Services. Data were collected for the period February 3, 2014 to September 30, 2022. Temporary deferral codes, re-entry codes and laboratory results for donors were identified. Data analysis used GraphPad Prism 9.5.0 (GraphPad Software, Boston, MA, USA).

Results

Table. Number of donors that were eligible for re-entry, tested and donated: February 3, 2014 to September 30, 2022 for HIV, HBV, and HCV.

Deferral targets	HIV	HBV	HCV
# donors eligible for re-entry	2651	430	3690
# (%) donors who attempt re-entry[a]	671 (25%)	151 (35%)	1135 (31%)
# (%) tested donors re-entered [b]	381 (57%)	105 (70%)	671 (59%)
# (%) eligible donors who returned to donate components	306 (80%)	79 (75%)	552 (82%)

donation yield (donations: re-entered donor ratio)	2407 (8:1)	966 (12:1)	4373 (8:1)

1. Donors re-entering to resolve an HIV marker were less likely to return (Chi-squared=31, degrees of freedom [df]=2, p<0.0001)
2. Test-negative results on re-entry were more likely with donors originally deferred for a HBV marker (Chi-squared=8, df=2, p=0.02)

Conclusions

Depending on the TD marker, most donors (range: 57-70%) are eligible to donate after re-entry. Donors who do successfully re-enter appear motivated to continue to donate. Process changes are being developed to increase the proportion of deferred, DRE-eligible donors who return for retesting.

Acknowledgement

The authors would like to acknowledge Canadian Blood Services operations and testing staff for their support of this project.

Patterns in unconfirmed syphilis repeat-reactive serology and potential confounders

Abstract Author Names :

Steven Drews [1] *^, Mark Bigham [2], Gordon Hawes [3], Balkar Gill [4], Peggy Huppe [5], Michiko Ng [6], Samra Uzicanin [7], Sheila O'Brien [8]

Abstract Summary :

Background

Currently, Canadian Blood Services (CBS) screens all donations for syphilis using an anti-treponemal-specific IgM/IgG test. We have not identified a direct causation for periodic increases in unconfirmed syphilis repeat-reactive (RR) rates, the vast majority of which are not confirmed by follow-up testing. There appears to be a temporal association between syphilis RR results and other potential confounders:

- vaccination campaigns for influenza/COVID-19
- and/or community-circulating:
    - influenza virus (I), except during the 2020/21 and 2021/22 influenza seasons.
    - COVID-19 since March 2020
    - other respiratory viruses (ORV), typically overlapping with influenza (IORV)

Here we further describe temporal associations between unconfirmed syphilis RR results and these potential confounders.

Methods

Syphilis RR results were obtained from CBS donations (September 2017-December 2022; PK 7300 instrument [Beckman Coulter; Brea, CA, USA]). Donor influenza and COVID-19 vaccination histories, within three months of donation, were extracted. The periodicity of syphilis RR results was graphed against vaccination data. IORV and Respiratory Syncytial Virus (RSV) data was acquired from the Public Health Agency of Canada Respiratory Virus Detection Surveillance System.

Results

Periodicity of unconfirmed syphilis RR rates (September 2017-December 2022).

Peak	Peak syphilis RR time range	Peak month	Peak month rate (per 10,000)	Interval-start of annual influenza vaccination campaign (months) to peak month	Other associations
1	October 2017-March 2018	November 2017	3.61	1	IORV season/influenza vaccination

2	October 2018-February 2019	November 2018	4.03	1	IORV season/ influenza vaccination
3	May-August 2019	June 2019	3.81	8	ORV
4	October 2019-February 2020	January 2020	3.03	3	IORV season/ influenza vaccination
5	October 2020-March 2021	January 2021	12.79	3	IORV limited/ COVID-19/ influenza vaccination/ COVID-19 vaccination since Jan 2021
6	July 2021-March 2022	September 2021	12.01	10	COVID-19/ influenza and COVID-19 vaccination/ ORV
7	June-October 2022	August 2022	8.49	9	COVID-19/ influenza and COVID-19 vaccination/ORV
8	November-December 2022	December 2022	6.43	2	COVID-19/ influenza and COVID-19 vaccination/ IORV/RSV

Note: Mean rate (per 10,000) for non-peak months

September 2017: 2.50

April-September 2018: 1.36

March-April 2019: 0.79

September 2019: 2.09

March-September 2020: 2.05

April-June 2021: 4.61

April-May 2022: 2.58

Discussion

This study identifies a temporal association between increased unconfirmed syphilis RR results and multiple immune activation confounders. Because the syphilis test detects IgM, it may be prone to repeat-reactive that do not confirm. Appreciating seasonal/temporal correlates of increased syphilis screening test reactivity can help inform blood operator donor eligibility policies for affected donors.

Blood donor eligibility of sexual partners of successfully treated or spontaneously resolved hepatitis C infection

Abstract Author Names :

Mark Bigham [1] *, Steven Drews [2] ^

Abstract Summary :

Introduction/Objective

In 2017 an estimated 317,000 persons in Canada had a history of hepatitis C virus (HCV) infection - 195,000 (61%) with chronic HCV - implying that >100,000 have cleared HCV infection – either a result of spontaneously resolved infection (SRI) or treatment-associated spontaneous viral response (SVR). Direct-acting antiviral treatment achieves very high rates of SVR, increasingly qualitatively characterized as "cure". Canadian Blood Services (CBS) donor eligibility criteria require indefinite deferral for a history of HCV infection, and their sexual partners for 12 months from last sexual contact. Cumulative experience showing that HCV SRI and treatment-associated SVR have very low risk of re-activated HCV disease, along with epidemiological evidence of very low risk of HCV sexual transmission, suggest that sexual partners of HCV SRI or treatment-associated SVR persons may be safe blood donors. Here, we review relevant evidence.

Design and Methods

A literature review examined evidence of relevant factors: sexual transmissibility of HCV; durability of HCV clearance in SRI and treatment-associated SVR, including the issue of persistent, extremely low viremia, post-treatment "occult" HCV infection (OCI). An internet search of blood operators' donor eligibility criteria was done.

Results

Several large prospective cohort studies have found no increased risk of HCV transmission among HCV-discordant couples, with an estimated probability of transmission of <1 per 10 million sexual contacts. Long term prospective follow-up of HCV-infected patients in Ireland related to 2 anti-D immunoglobulin-related outbreaks (1977-79 and 1991-4) suggests that SRI leads to probable cure. To-date, SVR is associated with a 97-100% chance of being HCV-RNA negative after long term follow-up, being de facto considered "cure". Although *in vitro* infectivity of peripheral blood mononuclear cells from treated, SVR patients has been shown, there remains no definitive evidence of sexual HCV transmission associated with OCI. At least one European country (UK) accepts sexual

partners of previously infected HCV persons, either 6 months after treatment-associated SVR, or with physician/laboratory-documented SRI.

Conclusions

Accumulating evidence suggests that HCV transmission to a blood donor from an HCV-infected sexual partner with either SRI or SVR, is highly unlikely, suggesting that CBS may safely consider options (with Health Canada approval) to allow sexual partners of HCV SRI or treatment-associated SVR persons, to safely donate blood, with minimal detrimental impact on transfusion-transmitted-HCV residual risk, currently estimated at 1:27 million transfused units.

Congenital thrombotic thrombocytopenic purpura diagnosed in a 68-year-old patient

Abstract Author Names :

Chloé Charbonneau [1] *^, Susan Fox [2], Catherine Dubé [3] ^

Abstract Summary :

Introduction: Congenital thrombotic thrombocytopenic purpura (cTTP) is a rare life-threatening disease with various triggers, including pregnancy, surgery or infections. In a retrospective study, median age at diagnosis was 16,7 years old. This case demonstrates how this disease can present with several non-specific events and be diagnosed at a later age.

Case presentation: A 68-year old Asian male presented with rectal bleeding following polypectomy two days earlier. His medical history was notable for chronic mild thrombocytopenia (around 80 x 10^9/L), stage 3 CKD, ischemic stroke two years prior and ischemic colitis fifteen years prior. During an episode of acute cholecystitis four years previously, his thrombocytopenia worsened down to 16 x 10^9/L and schistocytes were described on the smear, with spontaneous recovery. He did not have any family history of cTTP.

Initial workup showed thrombocytopenia (16 x 10^9/L) and hemolysis (Hb 129 g/L, LDH 537, bilirubin 26, undetectable haptoglobin). The peripheral blood smear revealed schistocytes. He tested positive for COVID, and had pneumonia on CT-scan.

ADAMTS-13 activity was 0%. The patient was put on daily plasma exchange therapy and prednisone for suspected acquired TTP. Hemolytic parameters quickly improved, but thrombocytopenia persisted around 75 x 10^9/L and the patient subsequently received 4 doses of rituximab 375 mg/m^2.

Extensive cancer screening, including bone marrow biopsy, was negative. A PET-CT showed a TIRADS-4 thyroid nodule, awaiting biopsy.

After a month, the patient was discharged with close follow up. The result of anti-ADAMTS13, received at a later time, was negative.

A week later, he was readmitted with fever, worsening thrombocytopenia and hemolytic anemia. Given the suspicion for cTTP, he was started on plasma transfusion alone. After four units over two days, he quickly improved. A subsequent episode a month later was successfully treated identically. On both episodes, ADAMTS13 activity was 0% with no ADAMTS13 antibody detectable by two different methods.

Prophylactic plasma transfusion therapy (15 mL/kg every three weeks) was started after his third hospitalization, according to guidelines.

Results: Genetic testing subsequently revealed compound heterozygosity for two variants. Variant c.2998C>T, found in 0.022% of East Asians, predicts an amino acid change of uncertain clinical significance. Variant c.849G>A, first reported here, predicts a premature protein termination and is likely pathogenic. The patient remains well with prophylactic plasma transfusion.

Conclusion Congenital TTP has a wide range of genotypes and phenotypes and can be misdiagnosed for several decades. We report here a new genotype which is likely pathogenic.

A Blood Donor Syncope/Faint Reaction Risk Assessment Tool

Abstract Author Names :

Mark Bigham [1] *, Francine Flahr [2] ^

Abstract Summary :

Introduction/Objective

pyncope/faint reactions are the most common blood donation-associated reaction. Review of Canadian Blood Services (CBS) reports of donor syncope/faint reactions identified inconsistency in clinical interpretation of the criteria and a blood operator survey revealed differences in donor management/deferral following a reported syncope/faint reaction. An evidence-informed approach to donor syncope/faint recurrence risk was developed to improve consistency and reliability of donor management procedures following a reported faint.

Design and Methods

A literature review informed a hierarchal ranking of risk factors associated with blood donation-associated vasovagal/ syncope/faint reactions. Each factor was quantitatively scaled (1 to 3) to approximate its reported association with syncopal/faint reactions from the literature, to produce an aggregate risk score of potential recurrence and/or severity risk. Possible off-setting qualitative mitigating factors were also included in a tool that was developed to assess risk of recurrent syncopal/faint reactions. The tool provides suggested donor management recommendations for 3 risk strata (high-moderate-low) of assessed recurrence risk. Validation of inter-observer consistency of the tool was assessed using 15 prospectively reported syncopal/faint reports, independently reviewed by a CBS Medical and Nursing officer.

Results

Six risk factors were identified: age (< 23 years=2; sex (F=1); estimated blood volume (cut-off 3.5 L=2); duration of reaction (>30 min =3); prior reaction history (1 prior syncopal/faint =2 or 2 prior syncopal/faints =3; 3 successive faints =6); ≥2 non-donation-related faints in past 12 months =2); and (reaction location (off-clinic =3). Indefinite deferral was recommended for an aggregate score of ≥6; review by the donor's doctor along with a range of possible short term donor deferrals was recommended for scores of 3-5; and, continued donation was considered acceptable for scores < 3. Inter-observer validation of the tool was achieved, with 100% consistency of interpretation using these criteria.

Conclusion

The authors aim to further validate the risk assessment tool methodology and process with experiential input of other CBS Medical and Nursing personnel.

Proposal to revise Canadian Blood Services' Blood Donor Criteria Related to Syncopal/Faint Reactions

Abstract Author Names :

Mark Bigham [1] *, Francine Flahr [2] ^

Abstract Summary :

Introduction/Objective

Syncope/faint reactions are the most common blood donation-associated reaction. Canadian Blood Services (CBS) currently indefinitely defers donors who have experienced two successive faints involving loss of consciousness or prolonged hypotension; or, after a faint complicated by tonic/clonic movements.

Design and Methods

Aggregate data were collected on CBS reports of vasovagal reaction between Jan 2017-May 2021. A random sample of 95 "severe" syncopal/faint reaction (i.e. loss of consciousness (LOC) >60 sec or LOC with loss of bowel/bladder control or tonic/clonic movements) in 2021 was also analyzed. Blood Operators were surveyed about donor vasovagal assessment and associated eligibility criteria.

Results

Between Jan 2017-May 2021, 8,634 donor vasovagal reactions were reported, resulting in 1,344 (16%) donor deferrals – an overall deferral incidence of 36.7 /100,000 donations and a mean 304 deferrals annually over the study period. Of 95 randomly selected "severe" syncopal/faint reactions, 72 (75.8%) resulted in indefinite donor deferral; 53/72 (73.6%) deferrals were due to reported observed tonic/clonic movements. Forty-five percent of deferrals were first time donors <35 years age and 20% were <24 years age, with 2-5 donations. Literature review indicates myoclonic jerks frequently accompany syncope/faint reactions, with no evident correlation to either reaction severity or risk of recurrence. No other surveyed blood operator (Hema-Quebec, UK, American Red Cross, Lifeblood Australia) defers donors solely on the basis of observed tonic/clonic movements.

Conclusions

Eliminating the current criteria of deferral for observed tonic/clonic movements could result in an estimated, potential donor deferral avoidance of ~150-200 annually, noting also that most are younger donors, that could result in a compounded loss of potential lifetime donations.

Blindspots in targeted RHD genotyping: a review of perinatal cases sent for gene sequencing

Abstract Author Names :

Melanie Bodnar [1] *^, Kirsten Hannaford [2], Carmela Pote [3], Tammy Ison [4], Marianne Stef [5], Gregory Denomme [6], Gwen Clarke [7], Celina Montemayor [8]

Abstract Summary :

Background:

Perinatal samples with variable, weak D phenotype or discordant serologic findings are sent for *RHD* genotyping to determine D antigen status and establish RhIG eligibility. Immucor's *RHD* Molecular BeadChip Test (BeadChip) is a single nucleotide variant genotyping assay which detects 35 genetic markers to resolve 66 common *RHD* alleles. Assay performance may vary depending on the population tested. This study evaluated *RHD* variants not detected by the BeadChip assay in the context of perinatal testing in the ethnically diverse Canadian population.

Methods:

Between January 1 and December 31 2022, 727 samples from perinatal or individuals of childbearing potential were tested on BeadChip following DNA extraction of EDTA whole blood using Qiagen Qiacube. "Possible D" on BeadChip indicates that a variant may be present but not detected. Samples with "possible D" were referred to an outside laboratory for gene sequencing if there were unexplained probe calls on BeadChip (n=1) or discordant serologic findings including variable/weak D phenotype (n=54) or anti-D in serologic D+ individual (n=1). Nonspecific *RHD* and *RHCE* quantitative next generation sequencing was performed.

Results:

Of 727 samples, a total of 30 different *RHD* allele calls were made by BeadChip with 326 (44.8%) samples having a weak D type 1, 2, or 3 allele. Among 204 (28%) "possible D" samples, 56 (27.5%) were sent for sequencing and in 53 (95%) an *RHD* variant was detected. On sequencing, 24 *RHD* alleles were identified with *RHD*DVII.1* (n=21), *RHD*weak D type 150* (n=8), and *RHD*weak D type 42* (n=5) being the most common. A normal *RHD*01* allele was identified in 3/54 (5.6%) samples with weak D phenotype which was attributed to the Ceppellini effect. In the single case of anti-D in a serologic D+ patient, sequencing revealed *RHD*deletion/RHD*weak D type 41.0.1*.

Conclusion:

Despite the absence of a detectable variant on a targeted *RHD* genotyping assay, a variable or weak D phenotype in the ethnically diverse Canadian population strongly predicts for a variant *RHD* allele. Although the risk of D alloimmunization for many variants is uncertain and hemolytic disease of the fetus and newborn (HDFN) is rare in this setting, current guidelines recommend that all *RHD* variants except weak D type 1, 2, and 3 be considered RhD negative for purposes of transfusion and RhIG eligibility. This data informs a recent change in reporting practice recommending that perinatal patients with weak D phenotype and no detectable *RHD* variant on the BeadChip assay be considered as RhD negative.

Availability of Maternal Phenotype Matched RBC for Intra Uterine Transfusion

Abstract Author Names :

Susan White [1] *, Pinal Patel [2], Vaishali Patel [3], Afsaneh Farzaneh [4], Melanie Bodnar [5], Gwen Clarke [6] ^

Abstract Summary :

Background: The provision of maternal antigen matched units for intrauterine transfusion (IUT) has been shown to reduce the risk of additional alloimmunization. We evaluated the availability of a variety of different phenotypes as fresh RBC suitable for IUT.

The additional need for CMV seronegative red blood cell units (RBC) may limit the number of suitable units available. Internationally CMV seronegative units are not uniformly required and pre-storage leukoreduction is acknowledged to reduce or eliminate the risk of CMV transmission for most indications.

Currently a supply of CMV seronegative DCE and K negative RBC < 5 days post collection are maintained at CBS distribution sites that support a facility performing IUT. For mothers with anti D, C, E or K, these pretested units are often requested and used without consideration of the maternal phenotype.

This practice introduces risk for additional alloimmunization, with potential for further antibody mediated hemolytic disease of the fetus and newborn (HDFN) in current and subsequent pregnancies.

Purpose: To demonstrate that it is routinely possible to provide fresh cognate antigen negative AND maternal phenotype compatible RBC when there is no requirement for CMV seronegative RBC.

Methods: Nine Special Request Order (SRO) forms with varied phenotype requests were sent during an 8- week period to the blood supplier distribution site. Each SRO included a request for 2 RBC with a specific antigen negative combination, a 24h timeline for issue and < 5 days post collection. The requests included various RhD positive and negative phenotype combinations involving C, c, E, K, Jka, Fya, and M.

Results: For 8/9 antigen combinations fresh RBC < 5 days post collection and with appropriate phenotype were available for immediate shipment. In one case with an RzRz phenotype request one liquid RBC < 10 days post collection was available along with units in frozen inventory.

Conclusions: Fresh maternal phenotype matched RBC negative for a variety of antigens corresponding to the HDFN implicated antibody are readily available to support urgent IUT when the requirement for CMV seronegativity is eliminated. A practice change to avoid requests for CMV seronegative RBC is safe and reduces the risk of maternal alloimmunization. Timely notification of the blood supplier regarding plans for IUT allows for optimal selection of fresh and phenotype matched RBC.

Establishing New Reference Interval for Total Protein and Immunoglobulin G Assay for Canadian Donor Population

Abstract Author Names :

Farzana Ali [1*^], Elaine Tang [2], Gordon Hawes [3], Terrie Butler-Foster [4], Akash Gupta [5], Matthew Yan [6], Gwen Clarke [7]

Abstract Summary :

Introduction: Canadian Blood Services (CBS) tests plasmapheresis donor samples at frequent intervals by refractometry and serum protein electrophoresis (SPE) as part of the regulatory requirements for assessment of product quality and donor safety. This process is manual and cannot meet the growing demand for testing as plasma donations increase. As a new initiative, CBS is implementing a quantitative total protein (TP) and Immunoglobulin G (IgG) automated test to replace refractometry and SPE. According to Clinical and Laboratory Standards Institute guidelines, an appropriate reference range must be developed for the new measurement of an analyte. To create a reference interval, at least 120 "healthy" individuals should be evaluated allowing calculation of the 90% confidence limits of a 95% reference interval determined by non-parametric statistics. In clinical laboratories local staff members are sometimes used as surrogate representatives of the healthy population with difficulty in accessing 120 unique "healthy" individuals. CBS has access to healthy donors, allowing for a robust evaluation of the normal distribution of any analyte in the Canadian donor population.

Design and Methods: This study processed 1020 donor samples to analyze the performance of the current versus new testing methods for serum and plasma results.

Between Oct 2022 to Feb 2023 the lab collected 566 paired serum and plasma samples and an additional 454 plasma only samples. The samples are centrifuged within 72 hours, stored frozen and tested within 1 month on the Roche cobas® c 702 using the Total Protein Gen.2 and Tina.quant IgG Gen.2 assays.[3] In addition, this study tested a commercial chemistry control panel manufactured by Randox (3 levels repeated 10x) to verify the c 702 system's accuracy and precision.[4]

Results: A comparison of the 566 paired serum and plasma samples for TP and IgG shows plasma provides higher results (TP plasma 72.0 g/L vs serum 65.1 g/L avg 9.5% difference; IgG plasma 10.6 g/L vs serum 9.6 g/L avg 9.3% difference). There was also better correlation between the current

TP refractometry method and the new c 702 immunochemical assay for plasma (-1.6%) vs serum (-11.0%). An additional 454 plasma only samples were tested for a total of 1020 plasmas and the TP results display a normal distribution.

Conclusion: Due to the large number of reference individuals included in the study, we were able to confidently alter our previous reference intervals from 63-96 g/L to 60-85 g/L for TP and from 4.6-16.2 g/L to 4.0-17.0g/L for IgG. This new assay increases TP and IgG testing capacity and removes the need for confirmatory assessments of SPE results, leading to more timely management of our plasma donors.

Finding rare HLA-matched platelets for a high-risk stem cell transplant

Abstract Author Names :

Akash Gupta [1] *^, Jan Storek [2], Natasha Rickards [3], Matthew Seftel [4], Davinder Sidhu [5], Peng Wang [6], Susan Nahirniak [7]

Abstract Summary :

Background

Platelet immune-mediated refractoriness is commonly seen in multiply transfused patients due to the development of HLA and/or HPA alloantibodies. Highly alloimmunized patients may be refractory to random platelet transfusions and are managed with the collection and transfusion of HLA-matched platelets. Here we present a case of a highly immunized (PRA: 100%) patient with AML with a high risk for bleeding who was planned for a stem cell transplant.

Methods/Case history

The patient was diagnosed with AML in May 2021. During her first round of chemotherapy, she developed pulmonary hemorrhage and it was only through continuous platelet infusions and an attempt to HLA desensitize with pheresis and immunosuppression, that she survived that episode. In total, she underwent multiple rounds of chemotherapy, including for 2 relapses. In 2022, her brother was tested and found to be a potential HLA-match for allogeneic stem cell transplant after her 3rd partial remission.

Because the patient had a history of significant bleeding, the clinical decision to proceed with the transplant would depend on the ability to acquire suitable platelets to maintain an adequate platelet count until she engrafted.

Multiple unconventional avenues to recruit platelet donors were explored, including directed donations from her sibling at CBS, local apheresis collection of platelets, recruiting donors who had switched donation types, and recruitment of donors who had stopped donating.

Results/Intervention

When investigating the sibling donor, it was discovered that he had a remote history of malarial infection, rendering him ineligible to donate at Canadian Blood Services (CBS) due to Health

Canada regulations. As such, despite the fact that he could donate stem cells, he could not donate apheresis platelets.

While local sites would historically collect apheresis platelets, this process has been moved to CBS and most local sites have only maintained the ability to collect stem cells from donors.

Specialized Cells at CBS, who managed the case, ensured the small number of HLA-matched/permissive donors were scheduled to donate at intervals to ensure the patient had 2-3 doses of platelets throughout induction and for 2-3 weeks post transplant. Pre-transplant she required platelets every other day. Post-transplant, engraftment occurred on day 16. Her last platelet transfusion was on day 19. Post transplant she required platelets ever 3-4 days with good increments.

Conclusion

Through collaboration between the clinical team, the blood bank, and CBS, a plan for collection and distribution of specific platelet products was developed with a very limited list of potential donors. This allowed for our patient to successfully undergo her transplant with adequate transfusion support.

Barriers and enablers to an inclusive and affirming experience for trans, nonbinary, Two-Spirit and other gender-diverse donors

Abstract Author Names :

Jennie Haw [1 * ^], Terrie Butler-Foster [2], Don Lapierre [3], Aaron Devor [4]

Abstract Summary :

Introduction / Objective: Trans, nonbinary, Two-Spirit and other gender-diverse donors (henceforth 'gender-diverse donors') face unique challenges in blood donation and have increasingly advocated for more inclusive and affirming donation policies and practices. While blood operators recognize the importance of improving donation experiences for gender-diverse donors, to date, no empirical study with these donors has been conducted to guide their efforts. This study addresses this gap and aims to identify barriers and enablers to an inclusive and affirming donation experience for gender-diverse donors.

Design and Methods: We report results from an exploratory qualitative community-based research study with gender-diverse blood and plasma donors (n=85). A Community Advisory Group (CAG) made up of gender-diverse people in the community was formed to guide all phases of the research study. All participants were recruited from the Canadian Blood Services' donor database. Inclusion criteria were: 1) identifying as gender diverse; 2) having donated, or tried to donate, in the previous 24 months; 3) comfortable in English. Potential participants had the option of being interviewed by a member of the research team or CAG who is gender diverse. All interviews were conducted July-October 2022 by phone or videoconference. All interviews were audio-recorded with participant's consent, transcribed, and returned to participant for member checking. Data were uploaded to *NVivo 12* and analyzed using a thematic analytic framework.

Results: Participants reported many more barriers than enablers to an inclusive and affirming donation experience. Barriers occurred at the systemic, policy, and interpersonal levels with some experienced throughout the donation process. At the time of the interviews, many barriers were identified including: 1) being deadnamed (i.e., use of their legal name when it is not their current name); 2) being misgendered, 3) being limited to binary gender/sex options only; and 4) trans screening criteria. Staff played a significant modulating role whereby they may have exacerbated or mitigated systemic and policy barriers. Enablers included queer-friendly signage, staff in the donor

centre who were allies, and clear actions by the blood operator to address barriers.

Conclusions: While several barriers have been removed for some gender-diverse donors with changes to the trans screening criteria, significant barriers remain. Barriers that compromise gender-diverse donors' psychological and physical safety in the donor centre should be prioritized. Systemic and policy changes must be coupled with effective staff and volunteer training to facilitate a more inclusive and affirming donation experience.

Frequency of vasovagal reactions with large volume plasma donations in Canada

Abstract Author Names :

Aditi Khandelwal [1] *^, Kaye Romans [2], Jessica Carswell [3], Mindy Goldman [4]

Abstract Summary :

Introduction: Vasovagal reactions (VVR) are reported as one of the most common adverse events with blood donation, and there is concern of increased VVR with large volume plasma collection. There is limited research from blood operators regarding the optimal combination of VVR mitigation strategies. Here we describe the observed rate of VVR at our new proof-of-concept plasma collection sites between 2020 and 2022.

Methods: Plasmapheresis donors can donate every 7 days with the maximum volume per donation decided based on the total estimated blood volume (TEBV) which is calculated based on measured height and weight. There is a stepwise process for increasing plasma volume collected, starting at 13% TEBV and progressing to a maximum of 18% TEBV. At every subsequent donation, donors were asked about experiencing vasovagal reactions prior to progressing to a higher TEBV threshold. Donors with over 562 mL of plasma volume collected were also given a 500 mL saline infusion. All donors are also advised to eat pre-donation, participate in directed applied muscle tension during procedure and consume at least 500mL of water and eat a salty snack post-procedure while resting.

Results: Between 2020 to 2022, 19185 donors made 78401 donations. The average age of donors was 43 years. Of these, 36961 (47.1%) of donations were made by donors registered as female. At the end of 2022, 18.5% of the donors registered as female and 24.3% of donors registered as male had completed the volume progression and were at 18% TEBV donation level. The overall frequency of VVR amongst donors registered as male was 14 in 10,000 donations, while those registered as female was 37 in 10,000 donations. Moderate to severe VVR occurred at 199 (0.25%) donations, with 86 (43.2%) of the VVRs classified as severe. Amongst the donors with VVR, 136 were registered as female with 31 at their first donation. Of the 63 reactions in donors registered as male, 37 were at their first donation. Of the VVR reported, 170 (85.4%) occurred during donation. Saline was administered in 52906 (67.4%) of donations with VVR reported in 32 of these donations, and the odds of having a VVR with saline of 0.0923 (95%CI 0.063 to 0.135; $p<0.0001$).

Conclusion: Within the first 2 years of large volume plasma collections at dedicated sites and current mitigation strategies, the VVR rate has been reported in 0.25% of donations with a reduced odds ratio during the procedures where saline infusions are given.

Liquid gold: A qualitative narrative study of immunoglobulin recipients

Abstract Author Names :

Kelly Holloway [1] *^, Dhara Chauhan [2], Quinn Grundy [3]

Abstract Summary :

Introduction/Objective: Human plasma has been referred to as "liquid gold," invoking its lifesaving potential when turned into medicines. Plasma supplies over 25 therapeutic proteins to treat bleeding, haemostatic, immunological and metabolic disorders. The plasma protein product in highest demand is Immune globulin (Ig). There is a need to better serve Ig recipients by understanding how knowledge about Ig is developed and re-produced in the everyday experiences of its use.

Design and Methods (longest and most detailed: This qualitative narrative study is aimed at informing change that can improve policy and practice. We conducted narrative interviews with recipients of Ig products in Canada to understand the recipient's illness experience, the story of how treatment affected them, their awareness of the product and the connection to a donor. Aims: 1) Document Ig recipients' lived experiences of illness and treatment within social, cultural, familial, and institutional contexts; 2) Investigate Ig recipients' knowledge related to the origins of the therapeutic products they have received.

Results: We completed 46 narrative interviews with 23 recipients of immune globulin, and co-created narrative accounts that can communicate the impact of Ig on the recipient. Early thematic analysis breaks down the participant story into a, pre-diagnosis, where they described their first symptoms and the referral process; b, diagnosis, where they described the testing process and adjustments for types of treatment for their condition; and c, treatment, where they discussed how immune globulin affected their quality of life. Our findings indicate that immune globulin has a significant impact on the life of the recipient, and that recipients want to express their appreciation to a donor. Further, recipients struggle to receive a diagnosis, obtain reliable information about their condition, and the treatment, and find support for managing chronic illness.

Conclusions: The sparse literature on patient experiences with Ig use does not address the social relations of illness and treatment such as how the treatment has an impact on the patient's life beyond the clinical response and location of treatment. Addressing these issues as situated in health systems can allow recipients to access a community that can support them and raise awareness about the impact of plasma products.

Acknowledgements: Thank you to the participants who generously shared their stories.

Donation experiences during the COVID-19 Pandemic

Abstract Author Names :

Kelly Holloway [1] *^, Jennie Haw [2]

Abstract Summary :

Introduction/Objective: During the COVID-19 pandemic, blood operators have had to balance risk of spread of COVID-19 with the need to attract donors to ensure a safe and secure blood supply. This research was guided by the following aims: 1) to understand why and how donors donated during the COVID-19 pandemic; and 2) to understand how donors perceive blood donation centres that were altered to meet safety requirements in response to COVID-19.

Design and Methods: Qualitative semi-structured interviews were conducted in April and May 2021 with donors in Toronto, ON, Vancouver BC, Halifax, NS and Calgary, AB. We recruited 10 donors per region, for a total of 40 participants. Locations were chosen to represent geographic diversity and focus attention on larger centres in cities. Interviews were transcribed verbatim, de-identified transcripts were coded in NVivo, and codes were used to generate thematic analysis.

Results: Data analysis generated to major themes. First, donation was socially oriented. Participants donated because they want to help save someone's life, because there was a need during the pandemic, or because they have a personal connection to someone who needed blood. Most did not see socializing with other donors in the centre as important, but they did value social interaction with staff. They gained a sense of community from knowing that they helped a recipient and from knowing that other people are donating. COVID-19 safety precautions did not undermine their sense of community. Second, participants' experience of donating during the pandemic was positive. Compared to their experience before COVID-19, most participants said their donation was faster and more efficient. They said the donation centre had a more regimented and clinical feel, but they understood the importance of the safety protocols, and some even found this comforting.

Conclusions: This study of donation during the COVID-19 pandemic indicates that measures undertaken by the blood service to enhance safety and minimize the spread of COVID-19 while maintaining the blood supply were well received by donors. Participants indicated that they donated to help save a life, that safety precautions did not minimize their sense of community, and that they felt the centre was efficient and safe. Despite safety precautions that limited physical contact, results suggest that participants viewed donation as a socially-oriented activity.

Acknowledgements: Thank you to the donors who gave their time to participate in an interview. Thank you to Fiqir Worku who helped with data analysis.

Optimal Packing Configuration for J82 Containers

Abstract Author Names :

Susan Nahirniak [1] ^, Bruce W Lyon [2] *, Gabrielle Versailles [3]

Abstract Summary :

Objective The primary goal of the project was to determine the single "best" packing configuration for maintaining temperatures for transport and storage of refrigerated blood components and plasma protein products (PPP). A secondary goal was to verify the acceptability of the new biodegradable shell and plastic overwraps with the J82 boxes. Our ideal box configuration would maintain storage temperature for at least 8 hours and transport temperatures for 36 hours regardless of external temperature.

Design and Methods J82 boxes with biodegradable shells and plastic overwrap were obtained from Canadian Blood Services. Using a packing configuration of two gel packs, one ice pack, cardboard dividers and packing material along with a TRED LogTag which trials suggested were the most likely best performing configuration, they were packed with 1 to 8 units of red cells, 1 to 8 units of thawed plasma or for PPP a minimal (1 box) to full capacity packing. These J82s underwent simulation runs using different external temperatures mimicking seasonal variations (winter-30°C, fall 4°C, spring 22°C and summer 35°C) to determine the length of time that storage (1-6°C) and transport (1-10° C) temperatures could be maintained.

Results The J82 was unable to maintain the desired storage and transport temperatures for red cells and thawed plasma units in all external temperature environments (see table), but the performance at 22°C met our desired outcomes. The durations obtained during the challenges using PPP had similar results when they were not stocked to max fill. However, the max fill PPP runs did have lower acceptable durations than the component runs, with a greater number of outliers. At 22°C the mean transport duration for PPP was 38.5 hr (max: 55.75 hr and min: 11 hrs with an SD of 17 hrs). No suitable explanation has been raised for inconsistencies between runs, as all major variables were standardized in the validation.

External Temperature	Mean time in Storage temperature	Mean time in Transport temperature
4°C	>96h	>96h
22° C	9.5h	42.5h
35° C	2.9 h	9.7h
Minus 30° C	2.4h	2.4h

Conclusions These results support implementation of our single packing configuration of the new J82 box to maintain storage and transport conditions for components, or PPP, requiring refrigerated conditions only if the external temperatures are maintained between 4° and 22° C. During extremes of external temperatures, the variable stability of internal temperatures may require internal temperature monitoring devices for quality assurance.

Validation of a Cabinet X-ray Irradiator for On Demand Irradiation

Abstract Author Names :

Amanda Felske [1] *^, Joanna McCarthy [2], Janice Gosling [3], Davinder Sidhu [4], Susan Nahirniak [5]

Abstract Summary :

Background: Irradiated cellular components are used to minimize risk of transfusion associated graft versus host disease in at risk patients but the irradiation of red cells has side effects of increased potassium and shortened shelf life of red cell units (RBCs). This creates a complex inventory management to ensure an adequate supply but avoid wastage without increasing risk to patients who do not need irradiated RBCs. Supplying freshly irradiated red cells for neonates on demand significantly reduces the risk of hyperkalemia.

Methods: A Raycell Mk1 cabinet X-ray irradiator was validated using replicates irradiated with a central dose of 25Gy (minimum of 15Gy and maximum of 50Gy as confirmed by RadTag). Three runs of a single or two units of expired RBCs placed in the canister were run to ensure change of the RadTag indicator. Additional testing was then done with a unit with a neonatal aliquot removed for irradiation and then two sets, each of two units that (5, 14, and 27 days each) were pooled and split in two – 1 irradiated and 1 control were created. All replicate pairs were tested for hemoglobin, hematocrit and potassium (K+) levels at 24, 48, 72 hours and 7 days up to expiry (14 days post irradiation or 28 days from collection expiry) to ensure that post irradiation hemolysis was < 0.8%, the Hb /HCT difference was < 10%, and K+ < 5mmol/L in the post irradiated RBC samples but higher than the companion unit. Average daily red cell demand changes pre and post on demand irradiation change were also monitored.

Results: All irradiated RBCs were found to be within the a priori criteria. An adequate dose of irradiation was confirmed in 100% by Rad-Tags. ADRD by blood group pre and post change was noted to decrease from 7.1 to 2.7 (O+); 3.4 to 1.7 (O-); 3.7 to 2.4 (A+); 0.6 to 0.3 (A-) and 0.6 to 0.3 (B+) 4 months after the change. Improved group O utilization is due to the ability to share a single group O unit between multiple neonatal patients in a 24 hour period post irradiation.

Conclusion: The implementation of on demand irradiation using the RayCell Mk1 cabinet X-ray irradiator meets the requirements for irradiation and has streamlined inventory management in our hub and spoke hospitals. Patients who do not require irradiated RBCs are no longer being transfused with them to manage wastage or outdates.

REMOVAL OF THE UPPER AGE LIMITS FOR WHOLE BLOOD DONATION INCREASE OLDER DONOR PARTICIPATION OVER TIME

Abstract Author Names :

Sheila O'Brien [1*^], Samra Uzicanin [2], Qi-Long Yi [3], Wenli Fan [4], Elaine Fournier [5], Mindy Goldman [6]

Abstract Summary :

Introduction/Objective: Many people enjoy good health into their 70's and 80's and can safely donate blood. As the general population ages, we analyzed the impact of changing blood donor upper age criteria.

Design and Methods: Donor criteria changes between 2005 and 2021 relating to age eligibility as well as the dates of implementation were extracted from Canadian Blood Services' records. All whole blood donors from 2005 to 2021 were included. The percentages of all donors/donations per year were calculated by age group and compared with the change dates in criteria.

Results: Prior to 2015 individuals could donate for the first time up to age 70 but required assessment by their physician after 61. Repeat donors could donate without an upper age limit under certain conditions. Between 67 and 70, if they had not donated in the last 2 years they required assessment by their physician; those over 70 were not eligible. Those over 70 who had donated in the last 2 years were eligible with annual evaluation by their physician. After 2015 first time and repeat donors were eligible without upper age restrictions or additional requirements. The largest cohort of donors was in progressively older age groups: 2005 those aged 46-50 (13.8%), 2013 51-55 (12.6%), 2021 56-60 (9.8%). The percentage of donors over 60 increased from 2005
(6.4%), 2013 (10.5%), to 2021 (18.6%). The percentage of whole blood donations among donors over 60 was greater: 2005 (8.5%), 2013 (13.7%), 2021 (22.7%). The percentage of donors over 70 increased from 2005 (0.2%), 2013 (0.6%), to 2021 (4.0%) and the percentage of donations they contributed was greater from 2005 (0.3%), 2013 (0.9%), to 2021 (5.1%).

To understand impact of age criteria changes first-time and repeat donors were examined separately. Among first-time donors the percentage 61 to 70 increased from 1.2 % in 2005 to 5.6%in 2021 and over 70 increased from 0 in 2005 to 1.4% in 2021. Among repeat donors the percentage 67 to 70 increased from 1.5% in 2005 to 5.1% in 2021 and over 70 increased from 0.3% in 2005 to 4.6% 2021.

Conclusions: Nearly one fifth of whole blood donors are aged over 60, and about 4% are aged over 70. These older donors donate more frequently than younger donors. Removing restrictions on the upper age of donation enabled more new donors to donate and more repeat donors to continue donating.

Epidemiology of and treatments for ligneous conjunctivitis: A literature review amid a surging demand for plasminogen eye drops prepared by Héma-Québec

Abstract Author Names :

Samuel Rochette [1] *^, Antoine Lewin [2], Marc Germain [3], Mélissa Girard [4]

Abstract Summary :

Introduction/objective: Ligneous conjunctivitis (LC) is the most common manifestation of congenital type 1 plasminogen deficiency (cPD). LC can be treated with plasminogen eye drops, which (in Québec) are prepared by Héma-Québec. Until recently, only one patient with LC had been initiated on plasminogen eye drops. However, three more patients with LC have recently been initiated on this treatment. Whether this surging demand may continue to grow is unclear, in part because the characteristics of patients with LC and their treatment patterns are not well characterized.

Design and methods: On May 5, 2021, we reviewed MEDLINE records to identify published cases of LC. We focused on articles published in 1997 or later owing to concerns related to diagnostic accuracy prior to the identification of cPD as the predominant cause of LC.

Results: Seventy-eight articles were published in 1997 or later and reported data on 210 patients with LC. Among the 206 patients with available data on sex, 130 (63.1%) were females, corresponding to a female:male ratio of 1.71:1. Among the 118 patients with available data on timing of disease onset, median age of disease onset was 1.4 years, with 99 (83.9%) patients experiencing their first symptoms <10 years of age. Included articles reported information on ≥1 medical (ie, non-surgical) intervention for 117 patients (55.7%). At the patient level, local or systemic corticosteroids (N=56 [47.9%]), antibiotics (N=46 [39.3%]), cyclosporine A (N=46 [39.3%]), heparin (N=30 [25.6%]), and eye drops of fresh frozen plasma (N=27 [23.1%]) were the most common medical interventions. Only nine patients (7.7%) received plasminogen eye drops, and seven articles explicitly mentioned the lack of a commercial preparation as a reason for not initiating this treatment.

Conclusions: To the best of our knowledge, no prior reviews have synthesized data on so many documented cases of LC. The first symptoms of LC typically manifest during early childhood, so that patients may need lifelong treatment. The treatment patterns for LC were highly heterogeneous, and few patients in our review received plasminogen eye drops, at least in part due to the lack of a commercial preparation. Therefore, the demand for plasminogen eye drops is poised to grow further as healthcare providers become aware of the apparent effectiveness of plasminogen eye drops. Nonetheless, more studies are needed to assess the efficacy of plasminogen eye drops.

COVID-19 impact on massive hemorrhage protocol (MHP) performance across multiple hospital sites

Abstract Author Names :

Daniel Roque [1 * ^], Jeanne Callum [2], Liying Zhang [3], Na Li [4], Mark Ly [5]

Abstract Summary :

Introduction: The purpose of Massive Hemorrhage Protocols (MHP) is to provide blood components to patients with clinically significant bleeding. Variability in rapid access to, and supply of blood components can impact MHP performance and compliance. On March 11, 2020, the World Health Organization declared a global pandemic coronavirus disease 2019 (COVID-19). The "first wave" in Canada occurred from January–July 2020, directly affecting the delivery of health care services. This study evaluates the possible impact of COVID-19 on MHP performance.

Methods: We conducted retrospective chart reviews of consecutive MHP activations from January 2019-July 2021, across multiple hospital sites in Ontario. We collected patient demographics, outcomes, and 9 evidence-based MHP quality metrics using an electronic data-collection-tool (REDCap®). The primary objective was to determine the impact of COVID-19 on MHP performance for 3 distinct time periods: Jan-July 2019 ("Prior"), Jan-Jul 2020 ("Pandemic") and "Jan-Jul 2021 ("After"). MHP performance was calculated as a proportional score out of a total of 9 quality metrics. The range of MHP scores were between 0 and 1. An autoregressive error model was used to correct for autocorrelations in the interrupted time series data, search for significant time trends and compare MHP scores.

Results: We analyzed a total of 866 MHP activations: Prior (n=307), Pandemic (n=252), and After (n=307). Mean MHP case scores were 0.748 (Prior), 0.720 (Pandemic), and 0.731 (After). No significant time trends (Jan-July) were detected in the Prior (p=0.41) and After (p=0.47) periods, however MHP scores were significantly decreased during the Pandemic period (p=0.0032). Comparing MHP scores between "Prior vs. Pandemic" period (2019 vs. 2020) showed no statistical difference (p=0.38) while, a significant difference between "After vs. Pandemic" period (2021 vs. 2020, p=0.033) was found, with MHP scores after the pandemic period likely to have lower scores over time compared to MHP scores in the pandemic period.

Conclusions: This multicentre study demonstrated that COVID-19 impacted MHP performance during 2020 and 2021. Interrupted time trend analysis (January to July) in 2019, and 2021 had stable MHP scores, while MHP scores in 2020, were significantly decreased. Comparing MHP scores between the 3 time periods, we found no significant difference between 2019 vs. 2020, however, MHP scores in 2021 vs. 2020 were significantly lower. Therefore, COVID-19 not only affected MHP performance during the pandemic onset, but likely had an ongoing impact on MHP performance in 2021.

Characterization of Ordering Practices and Testing Appropriateness of Cold Agglutinin Titres

Abstract Author Names :

Sarah Sekla [1 * ^], Bruce Lyon [2], Rosalyn Doepker [3], Jennifer Duke [4], Susan Nahirniak [5], Ghazala Radwi [6]

Abstract Summary :

Introduction

Cold Agglutinin Disease (CAD) is a rare IgM-mediated autoimmune hemolytic anemia (AIHA). Most CADs are DAT positive; patients display positive hemolytic markers (increased bilirubin, elevated lactate dehydrogenase and decreased haptoglobin). Clinical manifestations include Raynaud phenomenon, acrocyanosis, and livedo reticularis, among others. In this retrospective study, we examine cold agglutinin (CAG) titre ordering practices, patient demographics and the utility of a DAT to reduce inappropriate testing.

Design/Methods

All CAG titres tested in during the year 2022 were analyzed (n=406). The testing was performed at different local labs. Data collected: Titre values, hemolytic markers, DAT Poly, DAT IgG, DAT C3, and antibody screens (performed within the week prior), relevant diagnoses of primary CAD or secondary causes such as infections, monoclonal antibody therapeutics, malignancies, rheumatologic or autoimmune disorders, and distinct clinical manifestations listed above.

Results

Result	Not Tested	Pos	Neg	Invalid**	Total CAG titres
DAT Poly	320	51	30	5	406
DAT C3	353	49	4	0	

	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
DAT Poly	87.5%	43.8%	28.0%	93.3%
DAT C3	93.8%	8.1%	30.6%	75.0%

**Invalid DAT Poly results excluded

Conclusions

Considering CAG titres are only indicated if there is clinical suspicion of cold immune hemolysis or therapeutic interference, there is significant evidence of inappropriate testing. Additionally, most CADs are DAT positive meaning if DAT poly is negative, then titre will likely be negative. In our study, DAT Poly has an NPV of 93% which supports using DAT Poly to

decrease inappropriate CAG titres.

The cost of a DAT Poly test at our lab is ~$31 compared to ~$75 for a CAG titre. Assuming we cancel all CAG titres without a previous positive DAT Poly, then the cost savings is estimated to be ~ $16,500 per year.

Future studies may include implementing DAT Poly testing prior to titre to establish a better outcome for poly DAT predictivity. Once negative predictive value is established, labs may be able to cancel CAG titres which are DAT negative. Further data stratification according to patient demographics, test ordering practices and clinical indications is currently being analyzed.

Sample collection and handling errors association with the use of electronic positive patient identification devices (ePPID)

Abstract Author Names :

Aryana Singh [1] * ^

Abstract Summary :

Introduction/Objective:

Electronic positive patient identification devices (ePPID) have been implemented as a solution to minimize misidentification and reinforce labelling at the time of collection, thereby reducing the frequency of sample collection (SC) and sample handling (SH) errors. It has been observed that deviation from procedures with the use of ePPID have resulted in high severity errors with the potential to adversely impact patient safety.

Design and Methods:

The ePPID technology using Sunquest Collection Manager (CLM) was first introduced at a tertiary care trauma hospitlal in mid-2016, with full implementation across the institution in early 2021. The CLM application allows users to view orderable laboratory tests and print real-time labels. Blood bank test orders are not integrated in CLM and must be collected using temporary labels accompanied by a paper requisition. This combined electronic and paper approach has contributed to potential high severity errors when the ePPID process is not followed (i.e. pre-printed labels, mislabelled, documentation mismatch).

Data collection and tracking for this review were performed using the Transfusion Error Surveillance System (TESS), a database used by participating hospital sites to analyze transfusion-related errors. Potential high severity events identified in the SC and SH categories were extracted from 2016-2022.

Results:

From 2016-2022, 1,465 high potential severity SC and SH events were reported, of which 293 (20.0%) were errors in the ePPID processes. These errors were commonly attributed to sample ID and requisition ID mismatch (n=102), followed by incomplete/ illegible labels due to hardware malfunction (n=62), samples labelled with wrong patient ID (n=48), and the use of labels not printed at the time of collection (n=40). The error rate by total samples received in the blood bank increased from 2016 (0.000%) to 2020 (0.284%) and 2021 (0.295%) followed by a decrease in 2022 (0.191%).

Conclusion:

The rate of potential high severity SC and SH errors associated with ePPID is linked to errors in how patient ID is applied to the sample and/or requisition. It is evident that the combined electronic and paper approach has created an opening for mismatch and hardware errors to exist. It has allowed new errors to be detected (application of labels not printed at the time of collection). At the same time, ePPID has not contributed to wrong patient collected and armband errors, and potentially decreased non-labelled samples. Based on these findings, our ultimate goal is to fully integrate electronic blood bank test orders and eliminate the paper approach.

Evaluating the Variability in Use of Intravenous Albumin in Patients Undergoing Surgery for Cancer

Abstract Author Names :

Jane Yang [1]*^, Liying Zhang [2], Justyna Bartoszko [3], Jeanne Callum [4]

Abstract Summary :

Introduction: Large randomized controlled trials (RCTs) in broad clinical settings show that intravenous (IV) albumin is not associated with improved patient outcomes. Smaller RCTs in the cancer surgery patient population also show no apparent benefit to IV albumin. Despite high-quality evidence that IV albumin is not associated with patient-important benefits, albumin transfusion is common and highly variable between countries and within Canada. We examined the variability of albumin transfusion in patients undergoing cancer surgery.

Design and methods: We included consecutive adults ≥18 years old who received albumin during their hospital admission for cancer surgery between fiscal years 2018/19 to 2020/21 in all hospitals in Ontario, Canada. The primary outcome was the proportion of patients who received albumin transfusion during their cancer surgery admission. The secondary outcomes were the proportion of patients who received albumin during their admission by hospital site; the transfusion variability by hospital site and provincial region; and patient-important outcomes, including hospital length of stay and mortality. Statistical analyses were conducted to show the distribution of outliers (transfusion rates above the 95th percentile for IV albumin) by hospital site and cancer surgery type.

Results: A total of 104 hospital sites and 13 cancer types were included. The cancer types with the highest albumin transfusion rates were (3-year average, range): thoracic (6.2%, 0-100%), gastric (9.7%, 0-50%), and hepatopancreatobiliary (23.5%, 0-100%). Of the 104 hospitals included, 4 hospitals (3.85%) had outliers for one cancer type, 9 hospitals (8.65%) had outliers for 2 or more cancer types, and the remaining 91 hospitals (87.5%) had no outliers. It was determined that the 13 hospitals with outliers in at least one cancer type were not randomly distributed (p=0.0004). There was also a 69.23% chance that a hospital had a second outlier if the hospital already had one outlier in a different cancer type.

Conclusion: Albumin transfusion rates for patients undergoing cancer surgery are highly variable. This variation is not randomly distributed between hospitals, nor does it appear to be random within hospitals, suggesting a need to investigate hospital-level determinants of variable transfusion practice. Large RCTs are also warranted in this surgical population to confirm that albumin transfusion does not improve patient outcomes, thereby limiting the use of scarce resources and reducing healthcare costs.

An in-depth analysis of IVIG and SCIG utilization at three academic hospitals

Abstract Author Names :

Dilini Kekulawala [1], Aidan McKee [2], Ziad Solh [3] *^

Abstract Summary :

Introduction

Intravenous immunoglobulin (IVIG) and subcutaneous immunoglobulin (SCIG) are plasma protein products that are manufactured from pooled human plasma. In the context of rising demand, product shortages and increases in cost, the Regional Blood Coordinating Network in collaboration with the Ministry of Health (MOH) released utilization guidelines to clarify clinically appropriate uses of IVIG and SCIG in conditions for which there is evidence of efficacy. Currently, there is a lack of sufficient in-depth utilization data regarding patterns of IVIG and SCIG use in our province, which this study aims to improve.

Design and Methods

This was an observational retrospective study, which examined IVIG and SCIG orders placed, precise amounts dispensed, and clinical indications identified by ordering physicians on patients of all ages between January 1, 2018 and December 31, 2019 at three academic hospitals. The authors excluded orders for immune globulin products directed against specific antigens such as Rh(D) and microorganisms such as CMV or hepatitis. The following data were collected: patient sex and age, surrogate markers for clinical response to IG, clinical indications for IVIG and SCIG (both MOH-approved and non-approved, with the latter cases undergoing a review of clinical notes), doses of IVIG and SCIG dispensed per patient, and the hospital division of the prescribing physician.

Results

Over two years, IVIG and SCIG were ordered for 775 patients, 683 patients (88%) for MOH-approved indications and 92 patients (12%) for non-approved indications. Common MOH-approved indications included adult and paediatric immune thrombocytopenia (ITP), chronic inflammatory demyelinating polyneuropathy (CIDP), Guillain-Barre syndrome / Miller-Fisher disease, myasthenia gravis, primary and secondary immunodeficiencies, idiopathic inflammatory myopathies, and antibody-mediated rejection of solid organ transplant. MOH non-approved conditions for which large amounts (# of grams) of IVIG were dispensed included scleromyxedema, empiric treatment of autoimmune encephalitis and autoimmune seizures, paraneoplastic syndromes and lupus vasculitis. The highest users of IVIG and SCIG outside guidelines were Neurology prescribers.

Conclusions

The use of IVIG for conditions outside guidelines is common and worthy of further study given worldwide shortages, high costs, and risk of adverse reactions. The authors identified indications for which IG is commonly prescribed outside guidelines not only to encourage the optimal use of these blood products, but also to encourage future large research studies in specific areas such as neurology. The efficacy of IVIG and SCIG for scleromyxedema, empiric treatment of autoimmune encephalitis and autoimmune seizures, and paraneoplastic syndromes is of particular interest.

Acknowledgements

The authors would like to thank the transfusion safety officer for providing support with identifying data sources.

Plasma Transfusion Practices: Informing a Knowledge Translation Strategy at Six Tertiary Care Hospitals

Abstract Author Names :

Ziad Solh [1 * ^], Yulia Lin [2], Kathryn Webert [3], Michelle Zeller [4], Aditi Khandelwal [5], Alan Tinmouth [6], Akash Gupta [7], Jeanne Callum [8]

Abstract Summary :

Introduction

Hospital utilization of frozen plasma (FP) is largely unregulated which results in lower availability of plasma needed to manufacture plasma protein products. Three retrospective plasma audits sponsored by the Regional Blood Coordinating Network (2008, 2013, 2017) have been published, and they have shown a lack of plasma ordering behavioral change despite dissemination of audit reports and educational events. The audits revealed that 52% of plasma orders were inappropriate. Only 1/5 plasma orders were for appropriate clinical indications in addition to being properly dosed. The barriers to appropriate plasma utilization remain largely unknown. One Canadian study has identified some barriers and successfully made change to plasma practice in the intensive care setting (J Crit Care 2011), but sustainability was not ascertained. Our hypothesis is that the barriers to appropriate plasma use are multifactorial but identifiable, and that multi-faceted interventions are feasible and will lead to sustainable change with continuous stakeholder engagement.

Methods/Design

This study aims to identify barriers/facilitators and to design then implement a Knowledge Translation (KT) plan by integrating multi-faceted educational and organizational interventions mapped to each barrier. It is taking place at six tertiary care hospitals. Engineering this change has entailed the following iterative phases: 1) Retrospective and prospective real-time audits of plasma practice as a means of needs assessment and change measurement, 2) Systematic review of plasma transfusion to update guidelines, 3) One-on-one interviews with plasma ordering physicians and allied health staff from multidisciplinary hospital teams to delve into the plasma transfusion decision making process with stakeholders, 4) Steering committee development with membership from all stakeholders (multi-site and multi-specialty) to develop, implement, and sustain interventions and hospital-specific tools. Ethics approval has been granted.

Results

The steering committee was composed of representatives from Anesthesia, Critical Care, Hematology/TM, Trauma, Interventional Radiology, Cardiac Surgery, Hepatology/Transplant, Perfusion, Nursing, Lab Technologists, Canadian Blood Services, Regional Blood Coordinating Network, a plasma donor and a plasma recipient/patient. The committee held several barrier/facilitator brainstorming sessions and based on the results it was divided into the following 6 working groups to discuss interventions: Laboratory, Acute care (ICU/emergency/trauma/surgery), Inpatient, Ordering, Transfusion process, and Policy. Interventions were multi-faceted and mapped to barriers/facilitators. Currently, one-on-one interviews are being conducted with plasma prescribers to expand on steering committee findings.

Conclusions

Plasma transfusion practice is marred by several systems and educational barriers that are identifiable but not repairable by a single intervention. The study demonstrated collaborative attitudes and openness to change from stakeholders in all the involved specialties. Ongoing work with stakeholders is revealing the iterative steps required for sustainable change.

Acknowledgement

The authors would like to acknowledge the important contributions of the steering committee members including the regional blood coordinating network.

Pathogen reduced platelets at the Ottawa Hospital: One year's experience

Abstract Author Names :

Alan Tinmouth [1 * ^], Iris Perelman [2], Johnathan Mack [3], Hakan Buyukdere [4], Nancy Cober [5], Kim Luciano [6], Heather Maddison [7], Chantale Pambrun [8], Tanya Petraszko [9], Melanie Tokessy [10], Dean Fergusson [11]

Abstract Summary :

Introduction

Canadian Blood Services (CBS) switched to pathogen reduced (PR) whole blood platelet pools (WBPs) using the Intercept™ system on January 20, 2022 at their Ottawa site. PR-WBP differ from non-PR WBPs: 2 pools are made from 7 buffy coat platelet concentrates suspended in platelet additive solution. PR-WBPs have a lower number of platelets, a smaller volume, and shorter shelf-life of 5-days. Non-PR apheresis platelets with a 7-day shelf life remained available. To understand the impact of PR-WBP on transfusion practice, we undertook a pre-post study at the Ottawa Hospital (TOH) evaluating clinical effectiveness, platelet utilization, and ordering practice.

Methods

From January 1, 2021 to January 31, 2023, we collected laboratory and clinical data from the TOH Data Warehouse and the electronic medical record. All inpatient and outpatient encounters for patients receiving ≥1 WBPs were included. Transfusion data for all WBPs encounters were included, but encounter data where patients received both PR and non-PR-WBPs were excluded. Mean and median differences, and 95% confidence intervals were calculated.

Results

During the study period, there were 13,923 platelet transfusions; 9605 were WBPs. Hematology (48%) and cardiac surgery (9%) patients received the majority of WBPs. After PR-WBP implementation, a statistically significant decrease in 24-hour platelet count increment and time to next transfusion were observed, and an increased number of WBPs/encounter (Table). The greatest increase in the WBPs/encounter was seen in malignant hematology inpatients (2.80 vs. 2.01). The number of multi-platelet orders and same-day repeat platelet orders increased after PR-WBP introduction. The rate of adverse platelet transfusion reactions was lower with PR-WPBs. There were no significant differences in the number of RBCs transfused. Overall, the number of WBPs received at TOH from CBS (5704 vs. 4394) and the percentage of WBPs outdates (7.2% vs 4.7%) increased following PR-WBP introduction.

Conclusions

The introduction of PR-WBPs was associated with increased WBP demand and outdating, and reduced adverse reactions. The increased demand was likely due to the lower platelet content in PR-WBPs, changes in ordering practices away from apheresis units, and possibly increased platelet activation from PR manufacturing. The increased outdating is likely related to the shorter shelf-life for PR-WBPs.

	Non-PR WBP	PR WBP	Mean/Median Difference (95% CIs)
WBP transfused	4285	5320	
Mean 24-h platelet count(SD) increment ($x10^9$/L)	8.39 (27.11)	3.27 (25.01)	-5.13* (-6.69,-3.56)
Median (IQR) time to next transfusion (hours)	46.58 (23.33,73.23)	28.07 (21.63,52.70)	-18.48* (-21.66,-15.31)
Mean(SD) doses/encounter	1.35 (0.96)	1.44 (1.30)	0.10* (0.02,0.18)
Adverse reactions/1000 WBPs	7.7	4.2	-3.5* (-6.9,-0.2)

*statistically significant

Ethnic/Racial Diversity in Donors with Rare Red Cell Blood Types

Abstract Author Names :

Matthew Yan [1] *^, Susan Shank [2], Sheila O'Brien [3], Mindy Goldman [4], Gwen Clarke [5]

Abstract Summary :

Background

Rare blood types, especially those related to the absence of high prevalence antigens, may occur with greater frequencies in some ethnic/racial groups. For example, the likelihood of finding a Bombay phenotype (H negative) is greatest in the South Asian population. Accordingly, knowing a donor's self-reported ethnicity helps direct testing for specific rare phenotypes using targeted serological and genotyping tools. We looked at rare donors and compared their self-reported ethnic group to the general blood donor population. We also looked at the geographic region where rare donors with specific phenotypes donated.

Methods

Using donor data warehouse search strategies, we identified all donors coded as rare who donated between January 2021 and December 2022. We determined the rare phenotype, age, gender, ethnicity, and donation location for each rare donor. We compared this with the same characteristics amongst the general donor population for the same time period.

Results

During the 2-year period analyzed, 118 rare donors with 25 different rare blood groups donated whole blood. Rare donors included 65 donors registered as female and 53 registered as male. Five donors were under 20 years old; 22 were 21 – 30 years old; 20 were 31 – 40 years old; 20 were 41 – 50 years old and 53 were greater than 50 years old at the time of donation (range 17 – 80 years). Rare donors from all regions of Canada were represented in proportion to the population distribution. Seven different ethnic groups were reported including: 2% (2) Indigenous, 2.5% (3) Arab, 9% (11) Asian, 31% (36) Black, 1% (1) Latin American, 5.1% (6) South Asian, 14% (17) with ethnicity not available or not provided and the remaining 36% (42) White. The largest differences in comparison with the general donor population were in White donors (72% of general donor population, vs 36% of rare donors), and Black donors (0.6% of general donor population, 31% of rare donors). Most rare donors (96%) answered the optional question on ethnicity.

Conclusions

When compared to the general donor population, donors with rare phenotypes are more likely to come from a variety of ethnic groups representative of the Canadian population diversity. Black donors in particular make an extremely important contribution to the rare donor pool. Continued efforts at recruitment of donors from diverse backgrounds with phenotype testing directed by self reported ethnicity may help to identify additional donors with rare phenotypes.

Blood Antigen Genotyping Resolution for non-RH Blood Groups by Targeted DNA Sequencing: A 6-Year Retrospective Review

Abstract Author Names :

Sandra Zittermann [1] *^, Thomas Sierocinski [2], Tammy Ison [3], Carmela Pote [4], Marianne Stef [5], Gregory Denomme [6], Melanie Bodnar [7], Gwendolyn Clarke [8], Christine Frantz [9], Celina Montemayor [10]

Abstract Summary :

Introduction:

Molecular methods for red blood cell antigen typing are powerful tools with multiple applications in clinical transfusion medicine. A targeted genotyping method, based on probe hybridization coupled to flow cytometry, is currently available in Canada to interrogate non-RH blood groups. This assay evaluates 21 variants in 10 blood group genes. To resolve discrepancies between serology and genotyping, and to identify rare or novel blood types, samples are referred internationally for additional blood group genotyping using DNA sequencing methods. We describe here a retrospective review of 110 non-RH blood group sequencing investigations requested between 2018 and 2023.

Methods:

Samples were outsourced to a reference laboratory in Southern (n=105) and Northeast USA (n=6) for blood group sequencing. One sample was referred to both centers. Sixty-eight requests were fulfilled by Sanger sequencing, 39 by short-read Next Generation Sequencing (NGS), and 3 with allele-specific PCR methods. Blood group targets investigated included ABO/H (n=29), Kell (n=7), Duffy (n=4), Kidd (n=23) Lutheran (n=9), Vel (3), MNS (n=23), Dombrock (n=4) and others
(n=5).

Results:

In 27 of the investigations, no variants were found in the sequenced genomic regions. For the remaining 83 samples, variants were identified in homozygosis (n=19) or heterozygosis (n=64). Additionally, 16 samples revealed novel alleles in ABO/H (n=6), Kell (n=1), Kidd (n=1), Lutheran (n=3), MNS (n=3) and others (n=2). Twenty-two samples reported allele ambiguity and would have benefited from phasing; for these cases the most probable genotype was reported and the alternative potential genotypes noted. Sequencing provided important clues to explain discrepancies between serology and conventional targeted genotyping results. Moreover, NGS demonstrated the power to detect unbalanced ratios suggestive of clonal hematopoiesis, and clinical correlation was recommended in such cases. The number of sequencing requests has increased in recent years, with 69% corresponding to the past two years.

Conclusion:

Blood group sequencing can accurately detect rare and novel variants that are not interrogated by current targeted hybridization-based genotyping tests. Fifteen percent of Canadian samples investigated by sequencing methods in the past 6 years revealed a novel blood group genomic variant. A national Genomics Development Program has been established to develop new, more discriminatory sequencing methodologies for precise blood antigen determination in the diverse Canadian patient and donor population.

Transfusionist Education and Competency Assessment: Bloody Easy

Abstract Author Names :

Donna Berta [1] *^, Andrew Duyvestyn [2], Laurie MacLeod [3], Troy Thompson [4]

Abstract Summary :

Introduction / Objective

Canadian Transfusion Medicine standards mandate that all individuals performing activities related to blood transfusion participate in training and competency assessment programs[1,2]. The skills, theoretical and practical knowledge, essential to their role responsibilities must be addressed[1,2]. The Ontario Regional Blood Coordinating Network's (ORBCoN) mission is "inspiring and facilitating best transfusion practices in Ontario"[3]. To meet these goals, ORBCoN's Bloody Easy Blood Administration (BEBA) eLearning module was refurbished. Features of module development and outcome metrics are described.

Design and Methods

Revision of the BEBA eLearning module was based on principles of adult learning, recognizing transfusionists as mature learners with an abundance of prior learning experiences[4,5]. The adult learner is perceived as autonomous and motivated to learn evidence-based, practical information[5]. Module content is organized to align with the procedural steps for blood administration. Interactive activities are a strategic design element to inform learning. The assessment quiz incorporates scenario-based questions and provides explanation for the correct responses. Expertise in clinical content and innovative use of software simulation tools supported the module development process. The material is reinforced by the BEBA handbook, a widely used clinical practice reference.

The BEBA eLearning module is available to Ontario facilities via ORBCoN's Sharable Content Object Reference Model (SCORM) files and through a Canadian health care focused Learning Management System (LMS) provider. The LMS provider enables ORBCoN to independently track eLearning utilization, specifically aggregate assessment quiz responses. These outcome metrics will endorse ongoing appraisal of the module and identification of knowledge gaps.

Results

In the inaugural year, there has been significant uptake of the eLearning. Approximately 41 facilities accessed the SCORM files for their site. Data from the LMS provider reported an additional 87 facilities, including 3002 individuals have utilized the module. The aggregate responses to the assessment quiz, obtainable from the LMS provider exclusively, determined questions pertaining to documentation, informed consent and transfusion reactions were most frequently (94 to 99 percent) answered correctly. Questions regarding compatibility (antigens and antibodies), checking blood requirements and monitoring during transfusion were least often (47 to 69 percent) answered correctly.

Conclusions

The BEBA eLearning module was updated to reflect self-directed learning and current TM standards. Outcome metric analysis identified compatibility, checking blood, and monitoring requirements as foci for further learning to enhance transfusion safety.

Acknowledgements

ORBCoN appreciates hospital reviewers' contributions and the Ontario Ministry of Health's funding support.

References (available on request)

Preparing for Provincial Bedside Audit of Blood Administration (BABA): Re-tooling the Audit Tool

Abstract Author Names :

Tracy Cameron [1] *, Rebecca Barty [2] ^, Donna Berta [3], Theodora Ruijs [4], Ruth Sebastian [5], Alison Wendt [6]

Abstract Summary :

Introduction:
A provincial BABA tool, developed in 2011 and revised in 2018, includes a series of questions to assess clinical practice as well as a platform for data management and analysis to produce quality improvement reports. This tool is a vital component of the provincial blood utilization strategy. Re-tooling was undertaken to incorporate current Transfusion Medicine (TM) standards and provide functionality to meet the needs of hospitals.

Design/Methods:
A stakeholder survey was performed to determine the level of engagement with the 2018 bedside audit tool. The rebuild required implementing a secure web-based data capture solution; utilized the historical audit form; developed a mechanism for analyzing historical data; and a user guide focused on data entry and report generation. To prepare for the provincial BABA a gap analysis to align the audit tool with updated Health Canada and TM standards and Bloody Easy Blood Administration (version 3) was conducted. At intervals, two pilots were performed to validate the functionality and the applicability of the generated reports. To ensure users employed at multiple hospital sites could access more than one site's information data access groups were assigned to each hospital.

Results:
The rebuilt audit tool was piloted (4 sites) and received excellent ratings for ease of access (100%), organization (100%), data entry (100%) and written instructions (80%). The audit questions form, and report template were further improved using information gathered from the stakeholder survey (78 hospitals). Updated standards and practices were incorporated, resulting in 2 new sections, and expanded auditing capabilities for documentation practices, management of transfusion reactions, and blood products. The retooled BABA was piloted (9 sites) and received excellent (57%) to very good (43%) ratings for each section's clarity, comprehensiveness, and relevance to the current standards and best practices.

Conclusions:

The audit tool, retooled based on stakeholder feedback and alignment to current TM standards is now an effective tool for the provincial blood utilization strategy. It is being used in a provincial audit to measure blood administration compliance and can also be used by hospitals for quality improvement. Audit metrics are valuable patient safety indicators and provide opportunities for ongoing learning to enhance transfusion safety.

Acknowledgements:

Ontario Ministry of Health (funding support).

The Operational Impact of Introducing Cold Stored Platelets

Abstract Author Names :

John Blake [1] * ^

Abstract Summary :

BACKGROUND: Cold stored platelets (CSP), largely abandoned in the 1970's due to their rapid clearance from the body, undergo physical changes that make them better at initiating a clot. Thus, while cold-stored platelets are superior for reducing bleeding in actively bleeding patients, room-temperature platelets (RTP) are considered better for increasing platelet count in patients requiring a prophylactic transfusion. An active literature into cold stored platelets has recently emerged. However, many of the clinical and operational aspects of re-introducing cold stored platelets in an operational setting remain to be resolved, including whether the overhead required to maintain a dual platelet inventory consisting of both room-temperature and cold-stored platelets could be compensated by reduced platelet wastage resulting from the longer shelf-life of CSP.

STUDY DESIGN AND METHODS: A simulation model of a regional blood supply chain was built, with specific focus on the blood supply operations of a case hospital. Two scenarios were considered: "No-CSP" conditions, in which the hospital issues only RTP, and "CSP" conditions, in which SMH issues both RTP and CSP Within the CSP scenarios, conditions were tested under which the hospital receives only RTP and converts some to cold stored platelets and a second strategy where the hospital receives CSP from the regional supplier, in addition to converting RTP, as required.

RESULTS: Results suggest that a centralized supply of CSP is necessary to meet patient needs and that on-site conversion is limited by platelet age restrictions. Product shortages decrease with increased CSP inventory as does CSP wastage. It was also determined that, because relatively few RTP units can be converted on-site, that RTP wastage is not decreased with the introduction of CSP.

CONCLUSION: Given the clinical benefits for treatment of trauma, CSP is a desirable addition to a blood formulary. However, it is unlikely that significant RTP wastage savings will occur because of the introduction of cold stored platelets.

DATs for All Neonates? An Audit of Neonatal Direct Antiglobulin Testing (DAT)

Abstract Author Names :

Sarah Buchko [1]*, Lorena Cheung [2], Kayla Schuitema [3], Thushara Balasuriya [4], Thomas Covello [5], Matthew Yan [6], Michelle Wong [7]

Abstract Summary :

Background

The direct antiglobulin test (DAT) is a common test that is ordered to screen for hemolytic transfusion reactions, hemolytic disease of the newborn (HDN), autoimmune hemolytic anemia, and drug-induced immune hemolysis. In neonates, the DAT is routinely ordered with a serum bilirubin to assess for hemolysis secondary to HDN. These specimen collections pose risks to neonates due to the collection process and often do not inform or change patient management. Choosing Wisely Canada recommends that a neonatal DAT only be performed when anemia, hyperbilirubinemia or maternal antibodies are present. Therefore, we created a quality improvement action plan at our Health Authority (HA) with the aim of decreasing the number of unnecessary and uninformative DATs. Our HA has approximately 15,500 deliveries per year representing the largest region in the province.

Methods

Actions taken to address DAT utilization included providing educational rounds to pediatric staff (summer 2021), collaborating with a pediatric champion of Choosing Wisely Canada (summer 2022), and updating our DAT result comments to include the Choosing Wisely recommendation (winter 2023). A review of results from neonate DATs were pulled on a monthly basis from eight FH maternity hospital sites from 2021 to 2022 to examine the number of DATs ordered and the percentage of DATs that were positive (or potentially appropriate or informative). These results were shared with the HA Pediatric group along with the HA Maternal Infant Child and Youth (MICY) committee to provide timely feedback on the interventions taken.

Results

Since spring of 2021 (pre-intervention) to the fall of 2022, there has been a 17.7% decrease in total

DAT orders (from a mean of 384.6 +/- 31.0 to 316.4 +/- 22.4), and an increase of percent positive from 6.6% +/- 2.1 to 10.2% +/- 1.0. Updated analysis from 2023 following the implementation of our updated DAT result comments is pending.

Conclusion

A multi-pronged approach utilizing education and updating clinician facing information in our electronic health records has been successful in reducing the number of inappropriate neonatal DATs ordered. Additional approaches are being implemented to target clinician groups outside of pediatrics, such as midwives and family doctors who are involved in obstetric and neonatal care.

Implementing sexual behavior-based screening: Staff training has never been more important

Abstract Author Names :

Terrie Butler-Foster [1] *^, Aditi Khandelwal [2], Don Lapierre [3], Lindsay Wilson [4]

Abstract Summary :

Introduction: In September 2022, donation eligibility criteria at Canadian Blood Services (CBS) that deferred sexually active gay, bisexual, and other men who have sex with men were replaced with sexual behaviour-based screening criteria (SBBS) that asks all donors about specific sexual behaviours. This abstract describes the development and evaluation of a research and community-informed sex-positive training program, that supported the implementation of SBBS.

Methods: 2SLGBTBTQIA+ CBS employees and community members, front-line staff and researchers provided insights for implementation training. All agreed that intensive, interactive training was essential for the implementation of SBBS. A comprehensive training program with two arms was developed. Arm one, mandatory for all donor-facing staff, included an introduction to a sex-positivity e-learning module, and an in-person scenario-based session. Topics included cultural sensitivity, sexual and gender diversity, best practices for welcoming donors inclusively, self-awareness and bias, psychological safety, and responding to discriminatory comments. Arm two, mandatory for all staff who screen donors, included technical training with self-directed e-learning modules summarizing the research and evidence informing SBBS, and the practical implications of SBBS. In addition, all CBS employees were given access to the electronic training materials and encouraged to participate. After the initial training, feedback from course participants was gathered to further improve the course.

Results: When SBBS launched, nearly 1700 staff had completed arm one and 900 had completed arm two. 438 (34%) of the employees who completed arm one provided feedback on the training prior to SBBS implementation. The diverse roles of CBS front-line staff were well represented. 85% of respondents rated the training as good to excellent, and 85% also agreed/strongly agreed that the sessions were engaging. Most respondents (85%) found that the training was directly applicable to their job and 84% found the educational materials helpful. Those who disagreed about the utility of training (3%) described that they felt talking about sexual behaviour, even in the context of donor screening, was unnecessary in the workplace.

As a result of the training, 79% of the respondents felt that their communication skills improved. Many commented that they were prepared to be more understanding and respectful of people they interact with and are more mindful of fostering diversity, equity, and inclusion – professionally and personally. Respondents commented that they would prefer having ongoing training to ensure their competency was maintained.

Conclusion: In summary, collaboration with external and internal stakeholders, and foregrounding 2SLGBTQIA+ lived experience, led to the development of a comprehensive multi-modal implementation training program which was seen as valuable by participants. The investment in this training helped to support the successful implementation of SBBS.

Auditing of product flow in a new prehospital transfusion program in a helicopter patient transfer service using a hybrid statistical and process mining methodology

Abstract Author Names :

Neal Callaghan [1] ^, Jason Quinn [2], Robert Liwski [3], Natalie Chisholm [4], Calvino Cheng [5] *

Abstract Summary :

Introduction:

Volume management and resuscitation is a critical element of patient care *in extremis*, especially in patients awaiting surgery and/or intensive care. Blood products including packed red blood cell (RBC) units are a mainstay of volume therapy and early transfusion is associated with improved outcomes, including in transit to hospital. In 2020, an existing province-wide helicopter patient transfer service coordinated with a single receiving hub began a program that provides each mission with 2 group O-negative, Kell-negative, packed RBC units in monitored cold storage. We describe an initial hybrid product usage audit of the new transfusion program, and suggest possible avenues of intervention to improve wastage rates.

Design and Methods:

Packed RBC unit transactional data, which included the unit's unique identifier, time stamp, and status descriptor (e.g., received, available, transferred, transfused, disposed), from January 1, 2020-December 31, 2022, was queried from the health care region's laboratory information system. Data was cleaned and visualised using pivot tables (MS Excel) and process mining was performed using Disco v3.3.7 (Fluxicon BV, Eindhoven, NL).

Results:

The program began operations in calendar Q2 2020. After Q4 2022, 1073 unique RBC units had been issued 1709 times total (mean 1.59, median 1, and maximum 6 issuances/unit), 63 had been transfused (3.7% of total issuances; where 11 issuances transfused a single unit, 24 transfused both available units, and one issuance transfused four), and 58 products were destroyed (3.4% of total issuances). Helicopter-bound products were moderately fresher, averaging 32.6 ± 5.9 days before expiry upon receipt vs. 28.3 ± 7.4 in non-helicopter cases. Disposal events increased in Q4 2021 (11), averaging 8 events per quarter until Q4 2022. Reasons for disposal were almost entirely (53 cases) "Monitored Storage Unacceptable", "Improper Packing of Blood Crates", "Security Seal Problem", and "Storage Unacceptable", suggesting that handling logistics were the primary cause of product wastage.

Conclusions:

An early QA audit of a helicopter-based prehospital transfusion program demonstrated slightly higher rates of product waste (3.7%), which were higher than those reported for analogous programs (~0.5-1.9%). Our hybrid methodology has identified usage pathways and patterns associated with high wastage. Together, these insights provide concrete targets for effective intervention for a continued and sustainable transfusion program.

Auditing using a hybrid conventional data analytical and process mining approach uncovers actionable patterns of red blood cell unit wastage in a health care region

Abstract Author Names :

Neal Callaghan [1] ^, Jason Quinn [2], Robert Liwski [3], Natalie Chisholm [4], Calvino Cheng [5] *

Abstract Summary :

Introduction: Red blood cell (RBC) products are a critical resource in health care and minimizing their wastage is important. Given the sheer number of RBC products in the system, conventional manual auditing and data analytics becomes ineffective at scale and is not sufficiently granular to evaluate the complexity of RBC product flow. In this study, we demonstrate the combined use of process mining and conventional statistical methodologies to identify RBC unit wastage patterns in our health administration zone [serving ~424 000 residents (2016)] over 6 years. We noted temporal trends in RBC wastage, and the changing reasons for wastage over time using conventional statistical methods; subsequently we used process mining to visualise and characterise high-wastage pathways for potential intervention. Overall, this study demonstrates the use of a hybrid data analytical strategy to identify areas for potential intervention and improve RBC unit wastage.

Design and Methods:

RBC unit transactional data from January 1, 2017-December 31, 2022 for the health region was queried from the laboratory information system. This included a unique product identifier, time stamp, status descriptor (e.g., received, available, transferred, transfused, disposed), blood type, and special treatments (e.g., irradiation). Data was cleaned and visualised using pivot tables (MS Excel). Process mining was performed using Disco v3.3.7 (Fluxicon BV, Eindhoven, NL).

Results:

Over 6 years, 80 819 non-irradiated and 7 351 irradiated packed RBC units were received into the zone [13 470 +/ 588 units per year]. Disposal of non-irradiated units declined from 254 in 2017 to 161 in 2020, subsequently increasing to 239 in 2022, corresponding to relative wastage rates ranging from 1.33%-1.96%. Non-expiry reasons including "Storage Unacceptable", "Exceeds Time out of Lab", "Broken Post Receipt", Monitored Storage Unacceptable", "Failed Visual Inspection", "Improper Packing of Blood Crates", and "Security Seal Problem accounted for most of the increased wastage frequency. Commonalities between these wastage reasons were identified using process mining. Operating room pathways were associated with high rates of product wastage, especially for reasons associated with storage conditions and timing; other high-volume wards such as MDUs, cath labs, and ICUs were not prominently associated with these mechanisms of product wastage.

Conclusions:

Our study indicates that an actionable cause of increased RBC wastage can be identified using our hybrid auditing approach, and which can then be targeted with a tailored intervention

Transparent Blood Inventory: Supporting planning and informed decision-making in blood shortage situations

Abstract Author Names :

Mandy Feng [1] *^, Aimee Beauchamp [2], Christina Lim [3], Kristin Rosinski [4], Andrew Shih [5], Doug Morrison [6]

Abstract Summary :

Introduction/Objective

Blood components and products play a critical role in the hospital system. Access to timely, accurate, and comprehensive inventory information is crucial during times of blood shortages and pending shortages.

Originally developed as a manual weekly data entry system in preparation for the 2010 Winter Olympics, Transparent Blood Inventory (TBI) 1.0 was redeveloped into a web-based application, TBI 2.0, which employed automated hourly data transfers from health authority (HA) information systems.

As healthcare decision-making processes have become more data-driven, HAs identified the need for utilization data to be linked with inventory data, and the ability to breakdown the information into further components, such as designated Emergency Management (EM) sites versus non-EM sites. The COVID-19 pandemic later served as a catalyst to enhance the TBI dashboard (version 3.0) with utilization data, as well as near real-time inventory data in an interactive, user-friendly data visualization tool.

Design and Methods

A Working Group with representation from medical and technical stakeholders identified potential enhancements and desired features for TBI.

Improving technology provided more options for presenting and analyzing TBI data. An enhanced interactive dashboard was constructed using a data visualization tool (Power BI). The dashboard includes additional filters and navigation elements, as well as utilization data extracted from the Central Transfusion Registry.

Results

TBI 3.0 was developed with enhanced functionality and, significantly, correlation of inventory with

historical annual utilization data. The dashboards present hourly inventory levels and multi-year average daily utilization data at a provincial, HA, and hospital level, from 83 hospitals in BC and Yukon, in a user-friendly manner. The combination of utilization and inventory data addressed both strategic and operational needs in the event of rapid changes in blood supply and demand triggered by the pandemic.

In December 2022, Canadian Blood Services issued an Amber Phase Advisory, which warranted the creation of an additional section, the National Emergency Blood Management Committee (NEBMC) Reporting Page, to provide inventory indices segregated by HA, EM, and Non-EM institutions.

The dashboard is currently accessible to selected key Transfusion Medicine (TM) stakeholders and is in the process of being deployed to all identified users as a more responsive and informative resource that will support patient-centered care in a transparent and collaborative means.

Conclusions

TBI 3.0 can provide valuable information to support contingency planning in the event of a blood shortage, as well as ongoing strategic and operational information relevant to hospital inventory management. TM stakeholders have expressed improved confidence in inventory management as a result of TBI 3.0. The COVID-19 pandemic underscored the utility of TBI 3.0 in the context of complex disruptions of blood supply and demand.

Acknowledgements

- Bobo Yang
- Robby Chen
- TBI Working Group members

Identifying opportunities and challenges in the use of an organizational website: results from a 2022 survey

Abstract Author Names :

Andrew Duyvestyn [1 * ^], Ruth Sebastian [2], Tracy Cameron [3], Stephanie Cope [4], Laurie MacLeod [5]

Abstract Summary :

Introduction / Objective

The provincial transfusion website is an essential tool for the provincial blood coordinating office to provide transfusion medicine (TM) information, resources, and event information to its stakeholders. This study aimed to identify the challenges and opportunities in meeting our website objectives, some of which were focused around:

- Education
- Communication
- Trust and Credibility

Design and Methods

A survey was built using LimeSurvey utilizing question types such as multiple-choice, single-choice, and Likert scale questions. The survey was targeted to professional groups including midwives, nurses, physicians, physician assistants, perfusionists, medical laboratory technologists, other allied healthcare professionals, and students. The survey was disseminated through Twitter, LinkedIn, email, snowball, and a website pop-up between January and March 2022.

Results

A total of 184 participants completed the survey that included technologists (56%), nurses (27%), and physicians (10%), with negligible engagement from other subgroups, highlighting the challenge in engaging other stakeholder professionals in TM. Results revealed digital resources (85%), eLearning modules (80%), and healthcare websites (67%) were the preferred learning formats for respondents. Social media (16%), podcasts (37%), and healthcare forums (46%) were identified as the least preferred learning formats. YouTube (30%) and LinkedIn (17%) received the highest level of positive feedback for receiving information about TM through social media platforms.

Reasons for accessing the website included searching for transfusion information/toolkits (56%) and event information (34%), and to find information about eLearning programs (25%).

Most respondents (80%) would recommend the website to colleagues, indicating high credibility. The likelihood to refer to a colleague increased among those who visited more recently, with those who visited in the past week showing the highest

level of agreement. Ninety-six percent of respondents agreed with the statement "I trust the website".

Conclusions

The findings from this study highlight the value of the website providing relevant and accessible resources. While challenges were identified in meeting objectives, such as reaching all TM professions identified for the purpose of the survey, opportunities for improvement were also identified, such as increasing the navigability of the website (32% said it was difficult to navigate) or seeing more data about TM on the website (80%). The results of this study will inform future efforts to enhance the website's effectiveness in meeting the needs of its stakeholders.

Reflecting on British Columbia Red Blood Cell Inventory Management Perspectives and Experiences Identified from Technologists to Inform a Data-Driven Inventory Model

Abstract Author Names :

Jasdeep Dhahan [1] *^, Alexander Rutherford [2], Doug Morrison [3], Andrew Shih [4], Deb McDonald [5], Robby Chen [6], Danning Hao [7], Kristin Rosinski [8], Sarah Buchko [9]

Abstract Summary :

Introduction / Objective - There is growing concern over the sustainability of O negative supply and managing appropriate RBC inventory, which needs to be balanced against availability for patients. This is a geographical and jurisdictional challenge given British Columbia (BC) has seven health authorities with 83 hospitals, with different inventory management strategies. To minimize waste, BC also participates in a provincial red blood cell (RBC) redistribution program, where RBCs near expiry are sent from smaller to larger sites for use before expiring.

To aid complex decision making, we seek to develop a decision support tool based on modelling from historical data from the BC Transparent Blood Inventory (TBI), with near real-time inventory data to guide RBC inventory management with an emphasis on optimizing O negative RBC use. However, our modelling needs to take into account variables and considerations from blood bank technologists, who often manage inventory day-to-day. Thus, we performed a qualitative study to learn about the current state of BC RBC inventory management practices based on experiences and perspectives from bench techs and technical leads.

Design and Methods - We conducted 9 semi-structured interviews (14 interviewees) with technical leads of each BC health authority and Yukon, plus a Canadian Blood Services (CBS) Distributions lead. Preliminary interviews with blood-bank leaders helped identify key stakeholders to interview and inform our interview guides. Qualitative thematic analysis of the interview transcripts was conducted using NVivo.

Results - We identified: key considerations for RBC ordering including human factors, diverse perceptions of redistribution and its unidentified consequences, lack of proactive inventory management indicators, challenges in O negative RBC inventory management, guidance on appropriate O negative RBC usage and management, variable use of historical data to guide management, and a CBS distributions perspective on RBC inventory management. Our findings were used to construct a qualitative model of a redistribution network of blood banks.

Conclusions - We identified factors to inform a quantitative stochastic simulation model to test scenarios to minimize avoidable use of O negative RBCs balancing shortages, redistribution strategies, and stakeholder definitions of equity. We will use this model to identify potential emerging trends at large versus smaller sites to inform proactive inventory management indicators.

Transfusion Documentation: Where has the "Bridge" taken us over the last year

Abstract Author Names :

Glenyce Gillam [1] * ^

Abstract Summary :

Transfusion documentation:

Where has the "Bridge" taken us over the last year

Introduction:

"Bridge" is a Cerner application that uses bedside scanning of patient and component to electronically document a transfusion. The "Bridge" technology was implemented across an Ontario institution and the regional sites in 2021/2022.

The scanning technology of the "Bridge" program eliminates the need for a second person check. It uses positive patient identification, using the patient armband to verify identity. The scanning of the ISBT label on the component captures: component type, unique identification number, Blood group and RH, and expiry date of the component to the electronic patient record.

We report the uptake of this technology and its effects.

Design and Methods:

The original plan with "Bridge" was to document both components and fractionated products, however it was discovered during the pilot that Fractionated Products were not captured well within the application. "Bridge" was rolled out across LHSC April 2022 to document components only. Training materials were developed and in person support was provided during the go live.

Although "Bridge" electronically captures pre-transfusion checks, component name and ID#, start and stop time and possible transfusion reactions, it is still the responsibility of the health professional to also perform these checks independently.

Vital signs are entered directly into "Bridge" and documentation of transfusion reactions will auto-generate a report to Transfusion Medicine.

Results

Overall, the roll out has been successful, with those using the "Bridge" program, successfully completing documentation within "Bridge" in over 80% of attempted entries.

Transfusion reactions are reported directly into "Bridge" which encourages prompt documentation for immediate follow-up and investigation.

"Bridge" has had its challenges. There have been issues with staff not completing the training, scanner problems, user access, and limited reports that show the compliance for the number of staff using "Bridge" compared to other forms of documentation. Staff have liked the convenience of scanning and not having to get a second person for checks.

LHSC has supports to deal with IT concerns, and user guides, including trouble-shooting tips are available.

Cerner upgrade July 2023 is expected to allow for fractionated products to be documented in "Bridge"

Conclusion

Overall, "Bridge" implementation at LHSC went very well. "Bridge" has provided improved traceability and accessibility for transfusion documentation and reaction investigation. Bar-code technology has added safety with positive patient identification and bar-code scanning of the component.

We have crossed the "Bridge" for safer and more efficient transfusion documentation, but the journey is not done. Next steps are to include Fractionated Products into "Bridge" documentation and to continue to roll out "Bridge" to areas that are currently excluded. We are also working with IT to get more usable reports for measuring compliance and hemovigilance.

Pharmacists in Hemophilia Treatment Centres: A Trusted Partner in Patient Care

Abstract Author Names :

Sarah Jennings [1] *^, Caitlin Jones [2] ^, Elisabeth Smitko [3], Simmi Sidhu [4], Nisha Varughese [5], Alexandre Wong [6], Ivy Lam [7], Robert Klaassen [8], Alan Tinmouth [9], Jerry Teitel [10], Michelle Sholzberg [11], Kathryn Webert [12], Utsav Patel [13], Vahid Hoghooghi [14], Sylvain Grenier [15]

Abstract Summary :

Introduction/Objective

Coagulation disorders such as Hemophilia A and B are complex conditions that often require lifelong therapy with products such as coagulation factors and emicizumab (Hemlibra®). Patients receive treatment in hemophilia treatment centres (HTCs), comprehensive clinics that provide access to hematologists, nursing staff, social workers, physical therapy services, and obstetric and gynecological services. The current HTC model does not include a pharmacist.

Pharmacists are medication experts who ensure that medications are used appropriately and effectively. We hypothesized that adding a pharmacist to the HTC would: provide a dedicated resource to focus on tailoring and optimizing medication regimens, positively impact patient care, and reduce treatment costs.

Design and Methods

In 2020, a pharmacist was integrated into a pediatric HTC in Canada. The pharmacist worked with the patient care team to optimize product selection, assess pharmacokinetics (pK), adjust dosing, reduce wastage, facilitate transition, and provide education on new medications.

In 2021, the project was expanded to 2 adult HTCs. At the same time, emicizumab became available for all patients with severe hemophilia A and many patients transitioned from coagulation factor therapy to emicizumab. The pharmacists focused their attention on optimizing dosing and vial sizes of emicizumab to reduce wastage.

A pre- and post-intervention cost analysis was performed from the perspective of the formulary manager, Canadian Blood Services, with a 1-year time horizon.

Results

As of July 2021, the pharmacist had completed 18 interventions for 15 patients receiving prophylactic coagulation factor therapy. These interventions resulted in product cost savings of $355,069 per year, or more than double the pharmacist's salary. Most patients showed improvements in their annualized bleeding rate (ABR); ABR decreased in 14 patients and was unchanged in 1 patient.

As of December 2022, the pharmacists' interventions related to emicizumab had resulted in product cost savings of more than $2.0 million per year. Of the patients who responded to a satisfaction survey, 100% indicated their experience was

positive.

HTC care teams were satisfied with the addition of the pharmacist. The project received endorsement from the Association of Hemophilia Clinic Directors of Canada (AHCDC), the Canadian Hemophilia Society (CHS), and the Canadian Society of Hospital Pharmacists (CSHP).

Conclusions

The addition of a pharmacist to an HTC is associated with optimized patient treatment plans, patient and care team satisfaction, and a significant reduction in the costs of managing hemophilia.

Acknowledgements

This project was funded through philanthropic funding from Canadian Blood Services.

How Are Plasma Protein and Related Products Added to Canadian Blood Services' Formulary?

Abstract Author Names :

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Abstract Summary :

Introduction/Objective

A formulary is a list of products that are funded ("covered") by a health care payor as well as the policies that govern product coverage. Canadian Blood Services (CBS) manages a national formulary of plasma protein and related products (PPRP) on behalf of the provinces and territories (PTs) excluding Quebec. CBS has implemented a modern, rigorous, evidence-based product selection process (PSP).

Design and Methods

PSP step 1: does a product fall within CBS's scope? A group of experts advise on whether the product is functionally equivalent to a PPRP, and PTs decide whether the product continues through the CBS review process or moves to the process for coverage under Canada's public drug plans.

PSP step 2: does a product offer new benefits? Is it significantly different from products already available on the formulary? If a product has a new indication, dosage form, or other new feature that a vendor believes offers a premium over current options, the product must undergo a full evidence review to confirm the benefits and value of the product. If a product is similar to products already on formulary, the product will be assessed through a Request for Proposal (RFP).

A full evidence review for a single product is conducted through the CADTH-CBS Interim PPRP Review process. CADTH searches, appraises, and summarizes the clinical and pharmacoeconomic evidence. CADTH's Canadian Plasma Expert Committee makes a recommendation on funding. CBS then conducts an Impact Assessment, which includes stakeholder engagement, price negotiation, forecasting and budget impact, eligibility criteria, and other strategies to ensure the product is used in an evidence-based and sustainable manner. A final CBS recommendation is sent to PTs for a final decision on coverage.

RFPs are conducted on a periodic basis and compare multiple products. A group of internal and external stakeholders assess submissions, considering vendor factors, product characteristics, and value-added benefits. After scoring, the cost is considered, and a recommendation is made on the product mix for each category.

Results

Since the introduction of the new process in 2019, four products have undergone full evidence reviews, and three RFPs (including 55 products) have been conducted.

Conclusions

Modern formulary management at Canadian Blood Services contributes to timely, transparent, safe, and equitable access to PPRP for Canadian patients.

Acknowledgements

The authors would like to acknowledge the contributions of Teresa Petch, Elisabeth Smitko, Rim Araia, and Annie Ho as program managers and coordinators.

Impact on Laboratory Operations by Extending On-analyzer Utilization Time of Reagent Red Blood Cells

Abstract Author Names :

Tina Jacobucci [1] *^, Kelly Bizovie [2], Darlene Mueller [3]

Abstract Summary :

Impact on Laboratory Operations by Extending On-analyzer Utilization Time of Reagent Red Blood Cells

Objective: Our workflow was to place antibody identification (AbID) reagent red blood cells (RRBC) on the analyzer when an AbID test was necessary. Our study was to determine the length of time that would allow for extended on-board use while maintaining the integrity of the RRBC to produce accurate results.

Design: A pilot study was conducted at two facilities using the same lot number RRBC panel, testing four different antibodies of approximate 2+ reaction strength (Facility 1: anti-Fy^{a},-c; Facility 2: anti-E,-K), and four negative control samples. The RRBC were capped with an evaporation cap that allowed analyzer access for aspiration. Both facilities loaded a panel upon initial receipt with 4 weeks dating. Then facility 1 loaded a panel the third week of RRBC dating, and Facility 2 the fourth week of dating. Samples were tested over six day periods, until each RRBC panels was depleted. The results were compared with an identical control RRBC panel maintained at refrigerated storage. After these studies were complete, each facility tested an additional protocol: Facility 1 tested with RRBC panel loaded at week 2 that was rotated on and off the analyzer every 12 hours for five days, then refrigerated for five days, and on day 11 reloaded for use. The same process was used with a panel loaded at week 3. Facility 2 RRBC Panels were loaded at week 2, one on day 1 and one on day 2 rotating the panels on and off every 24 hours and tested each day on-board.

Results: The pilot study demonstrated expected and consistent reactivity along with specificity of results out to six days of continuous on-board time. Some very weak nonspecific reactivity was noted at one facility on pooled plasma negative controls with both the continuous on-board panel and the identical RRBC control panel. Testing using the alternating

12-hour on/off at one facility demonstrated expected reactivity with negligible impact on specificity results while the 24-hour on/off at the second facility presented some very weak/indeterminate reactivity impact on specificity particularly at the on-board utilization endpoint times.

Conclusion: Our study demonstrates on-board usability time is assured up to nine days, while seven-day utilization would provide a wider safety margin. The frequency of AbID in our facilities warrants the implementation of this utilization approach and provides enhanced performance and efficiency.

Acknowledgments: Kelly Bizovie, Darlene Mueller

Clinical Validation of the Transfusion Camp Knowledge Assessment Test

Abstract Author Names :

Harley Meirovich [1] *^, Bryan Tordon [2], Katerina Pavenski [3], Amie Malkin [4], Amy Moorehead [5], Nadine Shehata [6], Samia Saeed [7], Lette Ginsborg [8], Jeanne Callum [9], Christine Cserti-Gazdewich [10], Lani Lieberman [11], Jacob Pendergrast [12], Yulia Lin [13]

Abstract Summary :

Introduction: The University of Toronto Transfusion Camp is a novel approach to transfusion medicine education, demonstrating improved transfusion knowledge using a validated test. The purpose of this study was to determine if higher scores on the validated Transfusion Camp knowledge assessment test correlated with transfusion order appropriateness.

Methods: Eligible participants included postgraduate trainees and staff physicians who prescribed at least four transfusion orders in the preceding six months at two hospital sites. Participants did not have to attend Transfusion Camp to participate. Participants completed the test online via Survey Monkey. Their most recent transfusion orders (up to 10) for red blood cells (RBCs), platelets, and plasma were reviewed and dually independently adjudicated for appropriateness based on published adjudication criteria. The primary outcome was the correlation between the score on six questions on RBCs, platelets and plasma from the validated test and the percentage of appropriate transfusion orders. Univariate (prescriber sex, specialty, participation in Transfusion Camp, previous transfusion education, self-rated knowledge) and multivariable generalized linear regression analyses were conducted (R package v4.2.1).

Results: Seventy-four participants (45 trainees, 29 staff) completed the test. Median scores were 65.0% (IQR 55.0,75.0) for the 20 test questions overall, and 66.7% (IQR 50.0,83.3) for the six questions specific to RBCs, platelets, and plasma transfusions. In the multivariable analysis, test scores were higher in staff vs. trainees ($p < 0.0001$) and in participants who attended Transfusion Camp ($p < 0.0001$). Of 546 transfusion orders adjudicated, 417 (76.4%), 114 (20.9%) and 15 (2.8%) were orders for RBCs, platelets and plasma, respectively.

Appropriateness was 90.5% (95% CI 87.7-92.8%) for all orders; 94.0% (95% CI 91.3-96.1%), 80.7% (95% CI 72.3-87.5%) and 66.7% (95% CI 38.4-88.2%) for RBCs, platelets and plasma, respectively. In multivariable analysis, appropriate RBC transfusion was higher in females vs. males (p=0.016) and in those who self-rated transfusion knowledge as beginner vs. intermediate knowledge (p=0.01). We found no significant correlations between prescriber test scores (neither for all 6 or all 20 questions) and percentage of appropriate transfusion orders.

Conclusions: In this study, transfusion knowledge scores did not correlate with transfusion order appropriateness. It is not clear if the high rate of appropriateness (90%) could explain this lack of correlation. Factors associated with higher test scores included: faculty (vs. resident) and having participated in Transfusion Camp. Factors associated with higher RBC transfusion appropriateness included prescriber sex and self-rated transfusion knowledge. Ongoing efforts are required to improve plasma transfusion appropriateness.

Acknowledgements: Thank you to Liying Zhang for statistical support. This project was funded by the University of Toronto, Alexandra Yeo Chair Grant in Benign Hematology, and Canadian Blood Services (Transfusion Medicine Research Program Support Award), funded by the federal government (Health Canada) and provincial and territorial ministries of health.

Health Canada Inspections from a Quality Perspective

Abstract Author Names :

Heather Malcolm [1] *^, Agnieszka Frankiw [2], Joanna McCarthy [3], Konra Mueller [4], Susan Nahirniak [5]

Abstract Summary :

Introduction/Objective

Our Transfusion Medicine service (TTM) along with our Quality, Safety and Education department has been standardizing practices across our province with each launch of our integrated electronic medical record connecting all health information systems within the province. This standardization allows TTM to optimize best practice, be cost-effective and ensure all accreditation and regulatory requirements are met province wide.

Design/Methods

Since the formation of our organization in late 2018, there have been four Health Canada (HC) inspections at registered facilities: two regular inspections (2020, 2022) and 2 focused inspections (2023).

To prepare for inspections, Quality staff reviewed the most recent exit notice for that facility and subsequent corrective actions. They confirmed that the corrective actions were still in place. Observations from each HC inspection are addressed from a provincial perspective to ensure that the solutions proposed are applicable and executable at any of the 113 TTM sites in the province.

A provincial internal audit program was established and modified to be applicable to both registered and non-registered, non-licensed facilities. The audit links the applicable standard or regulation to the activity or documentation required and can then be evaluated for trends at a particular site, zone or across the province.

A standardized approach to reporting errors, accidents and adverse events was also developed including a suite of procedures that utilized an already existing Reporting and Learning System (RLS). Utilizing RLS allows for easy preparation of regular quarterly reports for discipline utilization and of the annual report required by the HC Blood Regulations.

The development of a tracking tool to monitor preparation activities or completion of corrective actions has been invaluable for both internal audits and responses to observations. These are posted in in a provincially shared system to ensure that technical, quality, and medical staff have access to the same information. Improvements to the audit worksheets have evolved with each subsequent audit including ease of use for technical staff, tracking responses for quality auditors and improving the audit itself based on HC observations as well as to meet organizational requirements.

Results

Each successive inspection gets us closer to meeting the regulations at all sites, not just registered facilities. The tools created are increasing the province's 113 sites' ability to respond under inspection pressure but also improve patient safety outcomes and the safety of the blood supply as mandated by the Blood Regulations.

Lessons learned from a hospital-based transfusion-practice education program

Abstract Author Names :

Clare O'Reilly [1] * ^

Abstract Summary :

Introduction: A hospital site that serves Neonatal, Paediatric and Obstetric patients identified the necessity for specialized transfusion-practice education to address the unique transfusion requirements of their patient population. The Transfusion Medicine (TM) Medical Director and Nursing Leadership supported a proposal to develop site-specific education to augment existing educational resources. The hospital developed a series of site-specific transfusion-practice education modules.

Method: Provincial, national, and international transfusion-practice education programs were reviewed but were unsuitable for our site. A software program was evaluated for purpose and purchased, and funding applications were made to create supporting videos. Content aligned with standards was developed and reviewed for compliance in collaboration with educators and nursing/TM leadership. Then a series of short videos were created, and the education modules were built and uploaded into the health authority's web-based education portal. The modules were incorporated into required learning for new and current staff based on their designation. Staff involved in the transfusion process must complete relevant modules on employment and then either yearly or biennially. Content revision is based on learner feedback, audit findings and practice changes. Learners are surveyed at four, 12 and 24-month intervals to determine the impact on practice and knowledge retention. Linking modules to clinical documents and job aids increased availability and maximized their value**.**

Results: Eight modules developed:

- Pre-Transfusion Sample Collection
- Transport of Blood
- Blood Administration:
    - Neonatal Syringe Method
    - Pediatrics Syringe and Volumetric Method
    - Adult Volumetric Method
- How to Pack a Blood Box
- Satellite Fridge Use
- Daily Temperature Reading for Satellite Fridges

To date, 2,000 learners have completed at least one module.

Conclusion: High-quality and engaging transfusion practice education demands support from leadership, and investment, e.g. financial investment in software and human hours to develop, promote and sustain. A team approach with collaboration between the laboratory, practice leads and educators is essential to ensure content is relevant. Respect for learners by giving them control over learning and an opportunity to share feedback supports compliance.

Acknowledgements:

- Transfusion Medicine and Nursing Leadership
- Nurse Educators
- Learners for their feedback
- Learning and Development and Media Teams
- Education Portal Support Team
- Funding Source

Characterizing the Impact of Donor Clinic Consolidation on Blood Product Quality

Abstract Author Names :

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Abstract Summary :

Background & Aim: From February 2012 to July 2012, the production of blood components collected in Southern Ontario (Toronto, London, Hamilton) was consolidated into a large regional manufacturing center (Brampton). Consolidation permitted the introduction of new, scaled manufacturing processes and resulted in changes to the logistics associated with the production and distribution of blood components which might have resulted in changes to blood product quality. This retrospective study compares the in-vitro quality of red blood cells (RBCs), platelet, and plasma products before and after the consolidation of component production. National quality control (QC) data was used to characterize the impact of the facility changes on key product parameters.

Materials & Methods: QC data was obtained for red cell filtered (RCF), whole blood filtered (WBF), plasma, pooled platelet (PP), and aphaeresis platelet (AP) units. Routine QC testing includes hemolysis, hemoglobin, hematocrit, and volume for red cells; count, concentration, pH, and volume for platelets; and Factor VIII, fibrinogen, and volume for plasma. The timeline observed was six months before (August 2011 - January 2012) and six months after (July 2012 - January 2013) the consolidation event (February 2012 - July 2012). Statistical analysis was performed using SAS.

Results: Compared to pre-consolidation quality testing levels, hemoglobin concentrations for red blood products ($p < 0.0001$) significantly increased following consolidation, reaching 190.3 ± 10.4 g/L for RCF and 194.4 ± 9.9 g/L for WBF. However, this increase in concentration returned to pre-consolidation values six months after consolidation (189.1 ± 10.5 g/L for RCF and 190.5 ± 10.3 g/L for WBF). Hemolysis for RCF and WBF was not significantly different over the course of the 18 months examined. Factor VIII concentrations were significantly increased during consolidation for both ACD Plasma and CPD Plasma: these differences persisted after consolidation (p-value< 0.001). The volume of PP changed significantly pre- and post-consolidation (p-value < 0.001). AP pH decreased from 7.22 0.19 prior to consolidation to 7.19 ± 0.18 after (p-value = 0.0013). Similarly, AP yield decreased during consolidation (p-value = 0.0347) but then increased significantly afterwards (p-value < 0.001).

Conclusions: QC data can be used to characterize the temporal impact of large manufacturing changes on product quality. While product quality consistently meet regulatory requirements, this study highlights that changes; both transient and permanent, occur over time in Canada. Understanding the impact of these changes on transfusion patient outcomes is warranted.

Acknowledgements: This research was funded by the Canadian Blood Services Intramural Grant Program.

Validation of an Out-of-Lab Storage Container for Blood Product Access During Air Transport

Abstract Author Names :

Oksana Prokopchuk-Gauk [1] *^, Kim Thomson [2], Paula Lehto [3], Sarah Tehseen [4], Sheila Rutledge Harding [5]

Abstract Summary :

Introduction: Six Canadian provinces have red blood cell transfusion available on-board emergency air transport medical services. To date, coagulation factor therapies have not routinely been available to air transport teams. Recent clinical practice guidelines for managing massively bleeding patients recommend the use of prothrombin complex concentrates (PCC) and fibrinogen concentrate (FC) when plasma is unavailable. We sought to validate an out-of-lab storage container to enable PCC and FC access for use in the management of bleeding patients during air transport.

Design and Methods: The Series 4 CREDO® Promed 4L Payload (Pelican BioThermal; Plymouth, MN) was chosen for out-of-lab blood product storage. The thermal lining was replaced with a 1" foam insert; no cooling packs were used. The CREDO® container was packed with the PCC product Octaplex® 1000 Units (2 boxes) and the FC product fibryga® 1 g (4 boxes) (Octapharma Canada Inc.; Toronto, ON); both products must be stored at 2-25°C. A CREDO® packed with sample products underwent validation at -19°C, 5°C, 22±3°C (room temperature) and 35°C. An internal temperature data logger (UTRED30-16; LogTag, Auckland, NZ) was included within the container during validation.

Results: At an external temperature of -19°C, in-container start temperature was 21.9°C and fell to 5.1°C at 6 hours (h); an out-of-range nadir 0.8°C was recorded at 8h. No out-of-range temperatures were recorded at external temperatures of 5°C over 25h and 22±3°C over 14 days. At an external temperature of 35°C, the in-container start temperature was 20.6°C and rose to 24.9°C at 4h; an out-of-range peak 26.1°C was recorded at 6h. Between July 6, 2022-March 15, 2023 data from in-use validated containers has not yielded any out of range temperatures (range 13.4°C-24.6°C). No product has been wasted due to temperature deviations or improper storage of the containers.

Conclusion: We have successfully validated an out-of-lab storage container with PCC and FC for emergency air transport medical services, demonstrating maintenance of acceptable internal storage temperatures for up to 4h at external temperature extremes. Real-world use of the validated

container and packing configuration has been successful, with data-logger monitoring confirming temperature stability within the container during the first 8 months of use. This enables healthcare team access to blood products for use during emergency air transport in patients with life-threatening bleeding.

Acknowledgements: Special thanks to the Saskatchewan Shock Trauma Air Rescue Service (STARS) and Saskatchewan Air Ambulance (SAA) teams for their collaboration during this process.

Development of Ontario Regional Blood Coordinating Network (ORBCoN) Tech Assess in a Learning Management System

Abstract Author Names :

Alison Wendt [1 * ^], Andrew Duyvestyn [2], Laurie MacLeod [3], Valérie Rhéaume [4], Ruth Sebastian [5], Troy Thompson [6]

Abstract Summary :

Introduction/Objective

Tech Assess is an electronic learning tool comprised of Transfusion Medicine(TM) related questions in both Basic and Advanced levels with an additional Dispensary Site module designed for use by Medical Laboratory Technologists(MLTs). The web-based version originally launched in 2008 required a rebuild due to changes in technology.

Design/Methods

The process to rebuild Tech Assess included the following steps:

1) Extract of questions from the web-based 2020/2021 version were used to develop the question repository for upload to the Provincial Learning Management System(LMS) powered by a Canadian health care focused LMS provider.

2) Critical review of the questions was conducted by an internal working group which included question type, content, accuracy and formatting.

3) Program specific user guide was developed utilizing a standardized template for all provincial blood office LMS programs.

4) Launch communication was developed for stakeholders

Results

Questions were extracted from two sources and entered into the LMS: 113 Basic(web-based); 120 Advanced(web-based); and 20 Dispensary Site(word document).

Questions were reviewed for content accuracy and formatting: 11 questions were reformatted to multiple choice; 18 revised content; 12 added/moved; and LMS provider enhanced and uploaded 4 Basic and 8 Advanced supporting images. 19 questions not meeting criteria were removed.

The LMS platform structure requires course content followed by a test. Tech Assess is comprised of tests only, consequently a workaround of developing a landing page with instructions allowing users to proceed to the test was required.

User guides were developed and distributed following the launch communication to stakeholders December 15, 2022.

Data from the LMS provider portal, January 1 to March 20, 2023 reported 1641 completions: Basic Test(11 modules) 1251 completions(range 87-194); Advanced Test(12 modules) 335 completions(range 16-67); and Dispensary Site Test(1 module)

55 completions.

Conclusions

Two of the provincial blood office's strategic goals focus on the provision of educational resources and quality and safety, facilitating best transfusion practices. The development of the provincial blood office's Tech Assess in the LMS provides MLTs with a mechanism to assess and build on their technical and theoretical knowledge in TM. This user friendly learning tool which includes references and rationale for each question provides additional learning making it a sought after tool for MLT education compliance as well as competency assessment for employers.

Currently only available in province of development with potential to offer to other provinces in future.

Acknowledgements: Ontario Ministry of Health, funding support

Massive Hemorrhage Protocol Quality Metrics: Blood Component Wastage at 11 hospital sites

Abstract Author Names :

Troy Thompson [1 * ^], Daniel Roque [2], Stephanie Cope [3], Jeannie Callum [4], Katerina Pavenski [5], Kimmo Murto [6], Andrew Petrosoniak [7], Dylan Grimm [8], Laurence Delorme [9], Monika Stodulska [10], Artyom Korenevsky [11], Na Li [12], Mark Ly [13]

Abstract Summary :

Introduction: A Massive Hemorrhage Protocol (MHP) is the organized and systematic delivery of blood products to patients with significant bleeding. In 2021, the Ontario Regional Blood Coordinating Network (ORBCoN) released a provincial Massive Hemorrhage Protocol (MHP) toolkit, encompassing evidence-based recommendations developed by experts. By standardizing the care of the hemorrhaging patients, MHP initiation results in numerous benefits including faster time to transfusion and tranexamic acid administration, improved communication, and decreased blood component wastage. Included in the recommendations, were the establishment of 9 quality metrics that could be collected by healthcare facilities to monitor and compare results.

Methods: Retrospective chart reviews were conducted at 15 hospitals from January 1, 2019 to July 31, 2022 on consecutive MHP activations. A web-based portal was developed to capture patient demographics, outcomes and 9 evidence-based quality metrics to evaluate compliance and performance across sites. One quality metric variable captured blood component/product wastage, and if present, the amount of blood component/product wastage including either the number of units per blood component (red blood cells [RBCs], platelets [PLTs], frozen plasma [FP] and cryoprecipitate [Cryo]) or vials of product (Fibrinogen concentrate [FC] and prothrombin complex concentrate [PCC]) were reported.

Results: A total of 1844 MHP activations were analyzed at eleven hospitals. (4 hospitals excluded for low number of activations); a total of 1116 blood components were wasted during 542/1844 (29%) activations. The wastage rate for all hospital sites ranged from 0.2-30.6% (% of MHP activations with wastage). Wastage per blood component (in units) included: 173 (15%) RBCs; 717 (64%) FP; 93 (0.1%) PLTs; 26 (0.02%) cryoprecipitate; 9 (0.01%) PCC (vials of 500 IU) and 98 (0.09%) FC vials (each 1 gram). Forty percent of activations were inappropriate by predefined criteria and accounted for 372 (29%) and 33 (25%) of total blood component and product wastage, respectively.

Conclusions: Wastage of blood components/products varied considerably between the hospitals analyzed, with FP wastage representing 64% of total wastage. Reasons for and strategies to reduce FP wastage should be investigated. Inappropriate MHP activation was common. Additionally, over-activations increase the burden on available health resources and reduce supply of blood components

Acknowledgements: Thanks to all of the participating hospitals and the MOH for continued funding support.

Analysis of staffing shortages using root causes analysis data in the IQMH Discordance Finding Responses process during the period of pre-Pandemic vs Pandemic.

Abstract Author Names :

Chang Keun Lee [1] *^, Melanie Tokessy [2] ^, Akash Gupta [3], Hakan Buyukdere [4], Laura Aseltine [5], Sandra Bakker [6]

Abstract Summary :

Title

Analysis of staffing shortages using root causes analysis data in the IQMH Discordance Finding Responses process during the period of pre-Pandemic vs Pandemic.

Introduction/ Objective

The Covid-19 Pandemic has shaped the healthcare sector in many ways. One of the most severely impacted areas has been staffing in the laboratory. The Institute for Quality Management in Healthcare (IQMH) Transfusion Medicine Scientific Committee reviewed the discordance finding responses (DFR) from Transfusion Medicine (TMED) external quality assurance (EQA) surveys to identify if there was an increase in reported discordant findings due to staffing shortage related root causes from 2018 to 2021. The objective of this study was to analyze the root causes from participants during pre-pandemic vs the pandemic periods to explore how staffing issues in the laboratory community have impacted external proficiency assessments.

Design and Methods:

DFRs of the IQMH TMED surveys, ranging from 2018 and 2021, were selected to compare staffing shortage related root causes between the pre-pandemic (2018,2019) and the during pandemic (2020,2021) periods. Root cause responses from each DFR were sent to committee members, who independently assessed whether it was related to a staffing shortage. The results were collated and 80% or higher consensus from the group was considered a positive adjudication as staffing shortage related root cause. The number of sites that were positively adjudicated were analyzed between pre vs during period of the pandemic to understand the pandemic contributed to staffing rooted discordant finding.

Results

Term	Year	Count of RC*	Count of staffing shortage RC* (> 80% consensus)	Positive Adjudication %
Pre	2018	268	7	3%
	2019	204	10	5%
During	2020	395	14	4%
	2021	153	15	10%
	Total	1020	46	5%

* RC: Root Causes,

The positive adjudication in reports of root causes attributed to staffing shortage more than doubled between 2018 and 2021. This observation aligns with the Medical Laboratory Professionals' Association of Ontario (MLPAO) annual staffing surveys that saw continual increases in shortages of Medical Laboratory Technologists (MLTs). The MLPAO reported a 50% increase of unfulfilled MLT positions between 2019 to 2021.

Conclusions

The MLT shortages in the laboratory community that was exacerbated by the pandemic, has shown to have impacted the discordant submissions for TMED EQA surveys.

Acknowledgements

We would like to acknowledge the IQMH TMED scientific committee for their review and insight as well as MLPAO for sharing MLPAO report on the labor shortages in Ontario.

Reducing outpatient group and screen testing at a regional cancer centre: a quality improvement initiative.

Abstract Author Names :

Heather VanderMeulen [1] *^, Akash Gupta [2], Rena Buckstein [3], James Kennedy [4], Connie Colavecchia [5], Jami-Lynn Viveiros [6], Yulia Lin [7]

Abstract Summary :

Introduction/Objective:

Unnecessary group and screens (G&S) can lead to unnecessary antibody investigations, use of technologist time and laboratory resources. A baseline audit at our institution identified that 20% of G&S from the cancer centre were unnecessary. We aimed to reduce the number of G&S from the cancer centre by 10% (from average 129 to 116 specimens per month) by December 2023.

Design and Methods:

This was an interrupted time series design from November 2022 to March 2023 (ongoing). Root causes for unnecessary G&S ordering included: 1) lack of guidance on when to order a G&S and 2) ordering a G&S 'just in case' to avoid a second blood draw if the CBC indicated a need for transfusion. Further diagnostics identified one physician who accounted for 23% of all G&S orders from the cancer centre.

We updated the institution's lymphoma treatment policies to identify who needs a G&S at diagnosis. We used the "do not test" feature in the electronic order entry system. When this option is selected, the blood bank will only process the G&S sample if specific CBC criteria are met (e.g. Hb < 90 g/L). Educational sessions with clinicians increased awareness of the "do not test" feature and sought feedback from end-users on its usability. With stakeholder feedback, the design was modified to include a modifiable hemoglobin threshold for G&S testing, automatic reselection of the "do not test" feature for future G&S orders, and aesthetic changes to make the feature more visible.

Results:
At baseline, the blood bank processed an average of 131 G&S and 11 antibody investigations per month from the cancer centre. Following implementation of the above interventions, this reduced to an average of 100 G&S and 7 antibody investigations monthly. The ratio of monthly G&S/CBC from cancer centre patients decreased from 0.036 to 0.024. Audits of G&S order appropriateness documented a reduction in inappropriate orders from 20% to 5%. The use of the "do not test" feature increased, selected on 7% of cancer centre G&S samples at baseline and 17% post-intervention.

Conclusions:
We describe an effective strategy to minimize the number of G&S samples processed from our institution's cancer centre. This reduced costs spent on G&S sample processing, antibody investigations and technologist time. Next steps include ensuring sustainability of the initiative and spreading the interventions to other areas of the hospital.

Introduction of an MLA to Transfusion Medicine

Abstract Author Names :

Denise Singh [1] * ^

Abstract Summary :

Introduction of an MLA to Transfusion Medicine

Introduction/Objective:

Due to a lack of qualified medical laboratory technologists (MLTs), the Transfusion Medicine (TM) department started looking at the option of hiring a Medical Laboratory Assistant (MLA) to help bridge the staffing gap. MLAs were not historically hired in TM due to their limited education in this department, so this would involve a ground-up approach to training and implementation

Design and Methods:

Risk Assessment: An assessment was performed to determine the level of risk involved in onboarding an MLA to perform the duties normally performed by an MLT. MLAs receive minimal formal education in the area of transfusion medicine, so areas such as blood product safety, including temperature regulation and visual inspection requirements, were virtually unknown and unfamiliar.

Delineation of Duties: A list of possible tasks the MLA could perform was developed, through discussion and collaboration with TM management. An introductory task list was confirmed, with the plan of adding additional tasks as the employee became accustomed to the environment.

The list of possible tasks included:

· Equipment maintenance

· Inventory control

· Reagent preparation

· Product entry

· Clerical tasks

Training and Implementation: A training manual was developed, outlining the pertinent duties of the MLA within their scope of practice. The employee was hired on a part-time basis, so training was expected to take approximately 6 weeks. Once the MLA was comfortable with performing all required tasks independently, the sign-off process was completed, and the

assumption of duties was transferred

Results:

Despite the learning curve involved for the existing TM staff and the MLA, the process has proven to be overwhelmingly successful. After performing the risk assessment, it was determined that due to the fact that the MLA would be working in a day-shift environment, and would be receiving a formal training process, the risk associated with having an MLA performing the selected duties was no greater than having an MLT performing them. Following the implementation, the MLTs have been able to concentrate their efforts on providing patient care initiatives, while some of the more clerical/non-patient duties have been able to be attended to by the MLA. This has led to an increase in productivity, and overall function in the laboratory.

Conclusions:

The introduction of MLAs in Transfusion Medicine laboratories can help bridge the staffing gap which many institutions are facing, while providing an improved working environment

Acknowledgements: Transfusion Medicine Manager and Senior Technologists

Implementation of an Automated Decapping Instrument in a High-Volume Laboratory

Abstract Author Names :

Lhevinne Ciurcovich [1] *^, Dorothy Lam [2] ^, Connor Chittock [3] ^, Matthew Yan [4] ^

Abstract Summary :

Background:

The BC & Yukon Diagnostic Services laboratory at Canadian Blood Services (CBS) has seen a steady increase in the number of samples, currently around 75,000 annually, translating to approximately 300-450 processed daily.

The process of removing sample lids and transferring to sample racks has always been performed manually.

In recent years, staff have been suffering from repetitive strain injuries (RSI), either caused by or further aggravated by these manual tasks. From an occupational health and safety perspective, it was deemed critical to find an alternative solution to manual decap.

The cobas p312 pre-analytical system was selected as an automated solution. Factors in considering this choice were a favourable pre-existing relationship with the vendor and experience using the p312's higher throughput equivalent (the p612) at the CBS Donor Testing laboratories.

Method:

Process flow for manual sample decapping: a) samples are removed from centrifuge and placed in generic test tube racks, b) samples transferred to biological safety cabinet, c) samples decapped, d) samples placed into NEO Iris racks, with patient labels oriented for NEO Iris barcode scanner readability.

Process flow for the automated decapping: a) samples removed from centrifuge and placed in p312 input racks, b) samples decapped by p312 c) samples placed into NEO Iris racks with barcodes properly oriented by p312.

Time studies were performed comparing average time spent decapping 40 samples manually vs. the p312 throughput. The starting point was defined as when samples were centrifuged and ready to be opened. Endpoint was when samples were placed in NEO Iris racks.

Results:

The manual process takes 3 minutes to process 40 samples, translating to approximately 30 – 35 minutes daily. The p312 takes 7 minutes, approximately 70 – 90 minutes processing time daily.

Conclusion:

While the automated process is longer, during its decapping cycle, staff are free to perform other duties, therefore, increasing overall productivity. Furthermore, the risk of further injury from manual decapping, and human errors in sample processing has been mitigated. Its implementation has been well appreciated by staff. There are also plans to implement it in other DS labs within CBS in the near future.

Towards a Point-of-Care Method for the Detection of Ferritin in Blood Using a Surface Plasmon Resonance (SPR) Sensor

Abstract Author Names :

Caroline Dubois [1] *^, Jonathan Robidoux [2], Jean-François Masson [3], Danny Brouard [4]

Abstract Summary :

Introduction/objective: Pre-donation hemoglobin (Hb) level is measured with in-hand apparatus using blood drops from fingertips puncture. While measuring blood donors' Hb levels is mandatory to identify those with anemia, measuring ferritin levels is not mandated, even though frequent blood donations can cause iron deficiency (ID; i.e., low ferritin levels). This is in part because current ferritin tests are too labor-intensive to be implemented in a point-of-care (POC) setting. Therefore, there is a need to develop a reliable POC technology capable of monitoring pre-donation ferritin levels. Surface plasmon resonance (SPR) is a technology that assesses biomolecular interactions at the surface of a prism. When the molecules interact, the change in the refractive index can be monitored by the surface plasmon. We aimed to develop a POC, SPR-based, microfluidic technology to quantify ferritin in human serum at low concentration ranges (i.e. 15-100 ng/mL).

Design and methods: The following parameters were investigated for their effect on the sensitivity of the detection method : clonality and concentration (5 µg/mL, 10 µg/mL, and 20 µg/mL) of the primary antibody (immobilization step), pH of the immobilization buffer (4, 4.5, 5, 5.5, or 6), clonality and concentration (5 ug/mL, 10 ug/mL, and 20 ug/mL) of the secondary antibody, and the use of metal nanoparticles for signal amplification and detection specificity in complex biological matrices (i.e., serum and plasma). Optimized conditions were used to characterize the detection parameters of the method using commercial ferritin diluted in buffer and serum/PBS-Tween. A calibration curve ranging between 0 and 130 ng/mL of ferritin was obtained.

Results: The optimal parameters included the use of a polyclonal antibody at 10 µg/mL for the immobilization step, a pH of 5.5 for the buffer solution, and the use of a monoclonal antibody at 5 µg/mL for the secondary detection. Gold nanoparticles functionalized with the secondary antibody reduced the background noise, thus lowering the detection limit of the method to 10.5 ng/mL (calculated based on a 0–130 ng/mL calibration curve in diluted serum [R^2=0.98]).

Conclusions: In conclusion, ferritin levels could be quantified in buffer and serum using the herein described SPR-based method. The use of functionalized gold nanoparticles for secondary detection lowered the detection limit below the clinically relevant threshold of 15 ng/mL in a diluted serum matrix. Additional work is underway to optimize the method for direct detection in a more complex matrix.

Flex Capacity – Comparing Performances of Three Platelet Concentrate Production Processes to Meet Inventory Targets in Crisis Situation

Abstract Author Names :

Jonathan Robidoux [1] *, Marie-Pierre Cayer [2], Nathalie Dussault [3], Marie Joëlle De Grandmont [4], Danny Brouard [5] ^

Abstract Summary :

Introduction/objective: "Flex capacity" addresses inventory management challenges by relying on more than one production process for a given product. Platelet concentrates (PCs) can be prepared by apheresis collection (AC_{PC}) or by pooling multiple buffy coats from whole blood donations (BC_{PC}). Because these two processes involve different donor populations, their use can be modulated to achieve inventory targets. The principal objective of this project was to demonstrate how flexible capacity can address variations in the demand for PCs, such as a sudden and large increase in demand during a crisis.

Design and methods: The performances of three PC production processes (AC_{PC}, BC_{PC1} and BC_{PC2}) were compared. BC_{PC1} and BC_{PC2} use an automated process (Reveos, TerumoBCT, Denver, USA) to pool into one PC unit five ABO-matched, Interim Platelet Units (IPU) obtained from whole blood (WB) donations. BC_{PC1} is the current blood bank production line using four automated systems operated by fully trained lab technicians. BC_{PC2} represents a one-time response to a significant increase in demand for platelet products which were produced by unexperienced lab technicians operating one system after a two-day training. For AC_{PC} and BC_{PC1}, performance indicators were extracted from production data. For BC_{PC2}, performance indicators were extracted from the production of 30 PCs. Productivity results for all three processes were normalized to 100 PCs, to ease comparison. For all PC processes, quality markers (platelet concentration, pH, residual white blood cells and sterility) were compared.

Results: The quality control analysis revealed that AC_{PC}, BC_{PC1} and BC_{PC2} respected CSA standards for PC production. AC_{PC} requires approximately 2.25 h for the whole donation and separation process which can produce up to two PCs, for an average of 1.13 h/PC. Steps requiring lab technician assistance for BC_{PC1} and BC_{PC2}, respectively, are WB processing (0.6 h/WB and 0.2 h/WB) and pooling (0.3 h/PC and 0.3 h/PC). Since five WB units are required per PC, the average lab technician time required is 3.1 h/PC and 1.4 h/PC, respectively. To produce 100 PCs, BC_{PC2} is nearly as fast (144 h) per person and apparatus than AC_{PC} (113 h), despite lab technicians being only newly trained. The gap between BC_{PC2} and BC_{PC1} (305 h) indicates that productivity is not limited by lab technician long term experience rather than other quality assurance or process documentation tasks.

Conclusions: AC_{PC} is the most efficient PC production method as it maximizes the number of units per collection and the donation frequency. However, WB-derived PCs are more cost effective and can be rapidly scaled up in response to significant increases in blood product demands.

Porcine Red Cell Concentrate Derived Perfusate has Improved Quality and Function Compared to Whole Blood During Ex Vivo Heart Perfusions

Abstract Author Names :

Kiarra Durand [1 * ^], Sanaz Hatami [2], Celina Phan [3 ^], Nishaka William [4], Jayme Kurach [5], Sanaz Hemmatibardehshahi [6], Mahsa Yazdanbakhsh [7], Rafay Osmani [8], Darren Freed [9], Jason Acker [10]

Abstract Summary :

Kiarra Durand[1,2], Sanaz Hatami[3], Celina Phan[1,2], Nishaka William[1,2], Jayme Kurach[2], Sanaz Hemmatibardehshahi[2], Mahsa Yazdanbakhsh[1,2], Rafay Osmani[2], Darren Freed[3], Jason P. Acker[1,2]

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[3]Department of Surgery, University of Alberta, Edmonton, Alberta, Canada

Background: Ex vivo organ perfusion (EVOP) is a promising technique for increasing the donor organ pool, but current systems using whole blood (WB) have demonstrated declines in blood and organ quality during perfusions. This study aimed to compare the perfusate quality of red cell concentrates (RCCs), rejuvenated RCCs and WB controls throughout a 4-hour heart perfusion and assess their impact on organ functionality.

Methods: Porcine WB was processed to produce leukodepleted RCCs in SAGM, and divided into three experimental groups (n=3 per group): (A) rejuvenated with homemade rejuvesol solution and washed after 14 days and perfused on day 21; (B) rejuvenated then perfused on day 15; (C) non-rejuvenated and perfused on day 14. Perfusate was sampled every two hours for 4 hours, and assessed for: hemolysis, extracellular potassium, osmotic fragility, p50, deformability. Cardiac function was assessed via coronary flow, cardiac index, oxygen delivery and oxygen extraction. Results were compared to previously collected data on WB perfusate using unpaired, two-tailed t-tests.

Results: Increased hemolysis in WB perfusate compared to RCCs at each time point, which was significant compared to group C at hour 4 ($p<0.01$). Oxygen affinity was higher in rejuvenated RCC groups compared to WB at all points ($p<0.01$), and significantly higher in group B compared to group A ($p<0.01$). Deformability and rigidity is lower in group C at hour 4 compared to WB ($p<0.05$). Group C had highest extracellular potassium levels at 2-4 hours ($p<0.01$). Most cardiac functional parameters were higher in RCCs groups compared to WB, however, only coronary flow had significant differences ($p<0.05$), with exception of initial group C values.

Conclusions: Rejuvenated RCCs may offer certain advantages over WB during EVOPs, particularly when rejuvenated closer to the perfusion. Rejuvenated RCCs appear to enhance overall perfusate quality and heart function. However, further testing is required to validate the significance of the results given the small sample size used in this study. These findings offer valuable insights into the potential use of blood products in ex vivo organ perfusion protocols.

Acknowledgements: This research was supported and funded by Canadian Blood Services Intramural Grant Program (IG2020-JA), and made possible with support from the surgical research program at the University of Alberta's Surgical Medical Research Institute.

Hold on to Your Units: Quality of Red Cell Concentrates is only affected after Multiple Transient Warming Events

Abstract Author Names :

Mackenzie Brandon-Coatham [1] *^, Carly Olafson [2] ^, Jayme Kurach [3], Tracey Turner [4], Gwen Clarke [5], Jason Acker [6]

Abstract Summary :

Introduction:

Cryopreserved red cell concentrates (RCCs) glycerolized using a high glycerol (40%) method can be stored below -65 °C for up to 30 years. However, during storage, units may be inadvertently warmed above -65 °C due to freezer failures, human errors, or routine inventory management. Although it has been suggested that high glycerol concentrations may provide protection against these transient warming events (TWEs), this has not been studied extensively.

Design and Methods:

ABO/Rh matched RCCs were pooled-and-split (n=9), glycerolized using the ACP 215 Cell Processor, and frozen in a < -65 °C freezer. Three types of TWEs were then performed: (1) "fast" TWEs (warming at room temperature (RT) to -20 °C) (2) "slow" TWEs (exposure to -20 °C for 2 hours) and (3) "thaw" TWEs (warming to room temperature). Units (n=6) were exposed to 0 (control), 1, 10, or 30 TWEs for both the slow and fast conditions or a single thaw and refreeze TWE. RCCs were deglycerolized and resuspended in AS-3 using the ACP 215, stored hypothermically (2 - 6°C) and tested at 0, 1, 7, and 14 days post-deglycerolization for red blood cell (RBC) quality using an extensive panel of in vitro tests.

Results:

While no significant differences among RCCs over hypothermic storage were found when units were exposed to "fast" or "slow" single or thaw TWEs, a significant decrease in the quality of RCCs was observed when units were subjected to ten or more TWEs either "fast" or "slow". Immediately post-deglycerolization, over 67% of tested units failed to meet the CSA guidelines for hemoglobin content (> 35 g/unit). Regardless of the type of TWE if the number of exposures exceeded ten, more than half of the RCCs failed to meet the CSA criteria for hemolysis (> 0.8%) after one to two weeks of post-thaw hypothermic storage.

Conclusion:

Currently, some blood centers during inventory management commonly expose units to RT for 30-minute intervals. Exposing RCCs to this level of TWE more than 10 times may impact the quality of RCCs. Additionally, RCCs that are known to have experienced storage temperatures warmer than -65 °C are discarded. Our data however, shows single TWEs do not significantly impact the quality of RCCs post-deglycerolization. Based on these observations, blood centers should review inventory management practices to track TWEs which may result in the unnecessary discard of rare RCCs.

Acknowledgements:
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Evaluation of the Red Blood Cell Quality Obtained From Non-Anemic Donors With Signs of Iron Deficiency

Abstract Author Names :

Jonathan Robidoux [1] *, Naderge Ceneston [2], André Lebrun [3], Danny Brouard [4] ^

Abstract Summary :

Introduction/objective: Frequent blood donations can increase the risk of iron deficiency (ID; measured by low ferritin levels). At pre-donation, the hemoglobin (Hb) level is measured to prevent anemic donors from qualifying, but not the ferritin level. Non-anemic ID donors can qualify for blood donation. It remains unknown if the quality of blood components at donation and during storage is affected by the ID status of donors.

Design and methods: Twenty-two donors were randomly selected from a specific population prone to ID. Serum ferritin levels were measured and donors were classified in three groups: <11 µg/L ("severe ID"), 11–25 µg/L ("mild ID") and >25 µg/L ("controls"). Whole blood (WB) was collected in tubes (Vtot = 28 mL) and stored at 4 °C overnight. WB was leukoreduced by filtration and red blood cells (RBCs) were isolated by centrifugation and dispersed in AS-3. Red cell concentrates (RCCs) were stored 42 days in small volume containers designed to mimic biochemical conditions of regular storage bags. Complete blood count, RBC deformability, ATP levels, reticulocyte count and hemolysis were assessed at day 0 and day 42 of storage.

Results: Mean ± standard deviation (SD) ferritin levels were 9 ± 3 µg/L for severe ID, 16 ± 3 µg/L for mild ID, and 66 ± 19 µg/L for controls. The mean ± SD deformability of RBCs was similar among the three groups at day 0 (i.e., severe ID=2.1 ± 0.1 a.u., mild ID=2.0 ± 0.2 a.u., controls=2.1 ± 0.1 a.u.) as it was for mean ± SD relative impairment of RBCs deformability over the storage period (i.e., severe ID=33 ± 4%, mild ID=29 ± 7%, controls=31 ± 6%). Mean ± SD ATP levels were also similar at day 0 and day 42. At day 42, mean ± SD hemolysis levels were 0.5 ± 0.2% for donors with severe ID, 0.3 ± 0.1% for those with mild ID, and 0.4 ± 0.2% for controls.

Conclusions: The quality of RCCs from donors with mild or severe ID did not significantly differ from controls throughout storage. Their RBC deformability and ATP levels lowered throughout the storage period at the same rate seen for the control group. Hemolysis levels at the end of storage suggest the isolation and storage procedure was well tolerated by RBCs. Therefore, overall results suggest that the quality of blood products during storage is not affected by the pre-donation ID status of the donor.

Characterizing the impact of the RNA demethylase ALKBH5 on Hematopoietic Stem and Progenitor cells

Abstract Author Names :

Tanvir Hasan [1] *^, Harinad Maganti [2], Nicolas Pineault [3]

Abstract Summary :

Introduction / Objective: Leukemia is a type of cancer that arises in hematopoietic stem cells (HSCs) and thus HSC transplantation is its only curative therapy. High number of HSCs in the graft increases the transplantation success rate. Therefore, various *ex-vivo* expansion platforms are used to increase the hematopoietic stem and progenitor cell (HSPC) number. RNA-seq data from our *ex-vivo* expanded HSPCs show increased expression of RNA demethylase ALKBH5, a protein which is highly expressed in leukemia. The role of ALKBH5 in the proliferation and maintenance of normal human HSPCs is poorly understood to date.

Design and Methods: We employed shRNA mediated ALKBH5 knockdown (KD) in cord blood derived HSPCs to study the cellular growth kinetics and cell fate decision in wild type (WT) and KD samples. Different HSPC sub-populations, identified by a combination of cell-surface markers, were tracked using flow-cytometry. Colony forming assay was performed to assess the colony forming potential and xenotransplantation was done to assess the transplantation efficiency of WT and KD HSPCs. Impact of ALKBH5 KD on m6A methylation and cell-cycle status was assesses by intra-cellular flow-cytometry.

Results: An increase in cell concentration and fold expansion ($p<0.05$) in KD samples were noted on day 10 of the ex-vivo culture, which declined by day 14. HSC enriched (eHSC) population (CD34+CD45RA-CD90+CD49f+) was depleted by day 14 in KD samples ($p<0.02$). CFU assay produced fewer erythrocyte ($p<0.05$) and granulocyte-macrophage (non-significant) colonies when KD CD34+CD45RA- (represents HSPC) cells were plated. Transplantation of KD HSPCs in immunocompromised mice model had increased human leukocytes percentage (non-significant) but decreased platelet concentration ($p<0.02$). ALKBH5 KD caused increased (non-significant) m6A methylation in HSPCs. Following ALKBH5 KD, more HSPCs were observed to enter the G1 phase, but fewer HSPCs in G2-S phase.

Conclusion: We show that ALKBH5 has significant but transient role in normal human HSPC maintenance, proliferation, and fate decision in both *ex-vivo* culture and *in-vivo* model. Understanding the impact of ALKBH5 in HSPC fate decision may help develop therapies targeting leukemic stem cells.

Acknowledgements: This work was funded, supported and guided by Canadian Blood Services, University of Ottawa, Walter Faigan Kiwanis Club fellowship, Dr. Pineault, Dr. Sandra Ramirez-Arcos, Dr. Maganti and Pineault Lab members.

Impact of Processing Time and Pathogen Inactivation on Apheresis PAS-E Platelets

Abstract Author Names :

Anita Howell [1] *^, Peter Schubert [2], Ken McTaggart [3]

Abstract Summary :

Introduction: Canadian Blood Services is introducing pathogen inactivation technology (PIT) for apheresis platelets to reduce the risk of transfusion transmitted infections. This requires changes to the way these products are produced to ensure they meet PIT requirements, including the use of platelet additive solution (PAS). As pathogen reduced (PR) platelets are contraindicated for some patients, untreated platelets must also be produced.

Design and Methods: A process to collect double apheresis PAS-E platelets (dPLT) was developed with targets: 600 mL volume, 42% plasma 58% PAS, 660 x 10^9 PLTs/unit. 32 dPLT were collected. After ≥ 1h rest, half were processed on D0 and half were processed on D1. dPLTs were tested, split into two single dose (sPLT) units, one was INTERCEPT treated (PR-sPLT) and one was left untreated (UN-sPLT). sPLTs were tested on D2, D6, and D8. PLT count was determined by hematology analyzer, metabolic parameters (pH, glucose, lactate) were determined by a blood gas analyzer, PLT activation and response to ADP (measured via CD62P expression) and Annexin-V binding were determined by flow cytometry.

Results: All sPLTs met INTERCEPT requirements. PR-sPLT had increased glucose depletion, resting activation, and apoptosis markers as compared to UN-sPLT. However, regardless of condition or treatment, sPLT in vitro quality on day 8 (table 1) met Canadian Blood Services' quality control criteria for PR pooled platelets.

	Day 8 *in vitro* quality - Mean (SD)			
	PR-sPLT		**UN-sPLT**	
Production Day	**D0**	**D1**	**D0**	**D1**
Yield (x10^9 PLT/unit)	257 (17)	247 (25)	284 (22)	273 (27)
pH	7.05 (0.19)	7.06 (0.17)	7.44 (0.07)	7.39 (0.09)
Glucose (mmol/L)	1.7 (0.9)	2.5 (1.1)	3.8 (0.7)	4.2 (1.1)
Lactate (mmol/L)	11.9 (2.1)	11.3 (1.6)	8.3 (1.4)	8.8 (1.5)
CD62P (%)	67.7 (8.5)	75.3 (6.9)	47.7 (8.4)	51.8 (8.3)
Response to ADP (%CD62P)	8.1 (4.2)	3.9 (3.5)	14.6 (5.4)	12.7 (6.3)
Annexin V (%)	6.8 (2.6)	8.6 (4.1)	4.6 (2.0)	5.9 (3.8)

Conclusions: A process was developed to manufacture apheresis PAS-E platelets meeting INTERCEPT

requirements and demonstrating acceptable in vitro qualities for PR and untreated platelets throughout 7 days of storage irrespective of processing day.

Acknowledgments: Staff in the Devine Laboratory, netCAD Blood4Research and BC&Y Facilities; Qilong Yi, Chantal Couture, Stacey Hayes and Deborah Mckee; and the apheresis platelet donors who contributed to this study.

Development of a storage solution for granulocyte concentrates used to treat life-threatening infections

Abstract Author Names :

Marie-Michèle Labrecque [1*^], Andréa Murru [2], Guillaume Paré [3], Jason Acker [4], Sylvie Lesage [5], Renée Bazin [6], Mélissa Girard [7], Maria Fernandes [8]

Abstract Summary :

Transfusion of granulocyte concentrates (GC) is a treatment option for neutropenic patients with life-threatening, antimicrobial-resistant infections. It temporarily increases the number of circulating neutrophils to eliminate the pathogens. One of the main challenges of GC transfusions is preserving the long-term viability and antimicrobial activity of neutrophils (>24h). This would reduce the logistical burden on collection centers and facilitate the availability of this cell therapy.

Objective: To extend the ex vivo viability and antimicrobial activity of GC neutrophils from 24h to 72h using additives and solutions approved for clinical use.

Methods: Neutrophils isolated from healthy donors were resuspended in autologous plasma (AP) at the same concentration as in G-CSF-stimulated apheresis-derived GCs and supplemented with Plasma-Lyte and different additives such as SAGM, AS-3 and/or Alburex. The dilution factor was within the maximum transfusion volume of 500 mL. Viability, phagocytosis, and intracellular reactive oxygen species (ROS) were measured by flow cytometry after room temperature storage of neutrophils up to 72h. Extracellular ROS and chemotaxis were measured after 24h of storage using a spectrophotometer and a fluorescence plate reader, respectively.

Results: The additive that best preserved neutrophil viability up to 48h of storage was AS-3. Phagocytosis of opsonized bacteria was maintained in all solutions up to 72h except in AP alone. Compared with fresh neutrophils, only those stored in the presence of AS-3 retained their ability to produce intracellular ROS up to 72h. Extracellular ROS production increased significantly after 24h in all conditions. Neutrophils stored in Plasma-lyte, AS-3, and Alburex migrated significantly more than those stored in AP alone.

Conclusion: Supplementing AP with Plasma-Lyte, AS-3, and Alburex significantly prolongs neutrophil viability ex vivo and preserves phagocytosis and ROS production for 48h and chemotaxis for at least 24h. Our results suggest that the red blood cell solution, AS-3, could also be used for GC storage. The potential negative effects of increased extracellular ROS production during storage on GC cells could be decreased by the addition of antioxidants. We are currently testing this new storage solution in GCs. Preservation of neutrophil function is crucial to optimize the efficiency of GC transfusions. Prolonging room temperature storage of GCs will increase their availability and would facilitate access to this blood product for patients worldwide.

Acknowledgement: Héma-Québec, MITACS, ThéCell.

ROS Inhibitor Rescues CD71+ RBC-Induced Reduction in CD14+ Monocyte Count in Human Monocyte Suspension Assay.

Abstract Author Names :

Wenhui Li [1 * ^], Jason Acker [2]

Abstract Summary :

Introduction / Objective: Circulating immature red blood cells ($CD71^+$ RBCs) have been shown to modulate monocyte differentiation, potentially through enriched intracellular reactive oxygen species (ROS). As $CD71^+$ RBCs are differentially present in male and female blood donors, their immunomodulatory activity may explain the adverse donor-recipient sex-mismatched transfusion outcomes that have been reported. Erythrophagocytosis of RBCs by $CD14^+$ monocyte is used clinically to assess the risk of intravascular hemolysis from incompatible blood transfusions. To investigate how $CD71^+$ RBCs affect erythrophagocytosis, the phagocytosis index and $CD14^+$ monocyte number were determined using a human monocyte suspension assay.

Design and Method: Enriched $CD71^+$ RBCs and $CD71^-$ RBCs were isolated from donated whole blood using Percoll gradient density separation. We incubated enriched $CD71^+$ RBCs and IgG opsonized $CD71^-$ RBCs with allogenic peripheral mononuclear cells (PBMCs) for 4 hours. A phagocytosis index (RBC PI, the percentage of $CD14^+$ monocytes that phagocytose $CD71^{+/-}$ RBCs) was determined using image flow cytometry by surface staining monocytes with CD14 and then intracellularly staining the engulfed RBCs with CD235a and CD71. Antioxidants [apocynin, dimethyl sulfoxide (DMSO), N-acetyl cysteine (NAC)] were used to investigate the role of reactive oxygen species in erythrophagocytosis.

Results: CD71+ RBC treatment significantly reduced the normalized CD14+ monocyte number (48.7 % ± 4.0 %, $p < 0.01$) compared to the CD71- RBC control. The reduction of normalized CD14+ monocyte number was partially rescued in the apocynin-treated group (32.3 % ± 3.8 %, $p < 0.05$), DMSO -treated group (34.3 % ± 4.6 %, $p > 0.05$) and NAC-treated group (46.6 % ± 3.8 %; $p > 0.05$). There was no significant difference in RBC PI between apocynin, DMSO, NAC, and the untreated group ($p > 0.05$).

Summary / Conclusion: Treatment with apocynin rescued CD14+ monocytes but did not affect RBC PI. This work contributes to our understanding of immature CD71+ RBCs' role in post-transfusion immunobiology.

Acknowledgments: We would like to acknowledge the contributions of Sanaz Hemmatibardehshahi for blood collection and Carly Olafson for providing the cryopreserved PBMC. We are grateful to Canadian Blood Services and; the blood donors who made this research possible. The research received funding support from Canada Blood Service (Intramural Grant IG2028 - JA, funded by the federal government (Health Canada) and the provincial and territorial ministries of health. The views herein do not necessarily reflect the view of the federal, provincial, or territorial governments of Canada.

In vitro exposure of whole blood to a cannabinoid mixture impairs the quality of red blood cells and platelets

Abstract Author Names :

Lionel Loubaki [1] * ^

Abstract Summary :

In vitro exposure of whole blood to a cannabinoid mixture impairs the quality of red blood cells and platelets

Background: In a recent study, 13.8% of blood donors had reported cannabis use in the 72 hours preceding their donation, and these donors are not deferred under existing criteria in Canada. This high prevalence raises concerns about the potential impact of cannabis use on the quality of blood products.

Aim: The main objective of this project is to assess the impact of a cannabinoid mixture on the quality of red blood cells and platelets, from the time of collection and processing to their storage.

Methods: To mimic pre-donation cannabis use, whole blood was collected and exposed (in vitro) to varying concentrations (range: 1-24 µg/mL) of a cannabinoid mixture (CM) overnight. Whole blood was then separated into red blood cells (RBCs) and platelets-rich plasma (PRP), which were stored at 4°C (for RBCs) or at room temperature (for PRP). Flow cytometry analyses, hemolysis measurements and biochemical analyses were performed during the processing stage and throughout storage.

Results: In the RBC fraction, free hemoglobin levels were increased in a dose-dependent manner after the addition of a cannabinoid mixture to whole blood. Hemolysis and methemoglobin levels were significantly higher in CM-exposed RBCs than CM-free controls, after processing and throughout storage. Furthermore, platelet counts and CD62P expression (on day 7 post-separation) were significantly lower in CM-exposed PRP than cannabinoid-free PRP controls. The aggregation potential of CM-exposed platelets was significantly lower than that of cannabinoid-free controls, after processing and throughout storage.

Conclusions: An in-vitro exposure to a cannabinoid mixture hemolyzed RBCs, impaired oxygen transport by RBCs, reduced platelet counts, and impaired platelet function. These results suggest that pre-donation cannabis use might impair the quality of blood products.

A Quality Conundrum: Investigating the Unintentional Warming of a Cryopreserved Red Cell Concentrate

Abstract Author Names :

Carly Olafson [1] *^, Jayme Kurach [2] ^, Gwen Clarke [3], Jason Acker [4]

Abstract Summary :

Introduction/Objective: Red blood cell (RBC) concentrates (RCCs) cryopreserved using a high glycerol method (40%) can be stored up to 30 years below -65 °C. However, RCCs may inadvertently be exposed to transient-warming events (TWEs) where units are warmed above storage temperatures. In the case presented here, equipment failure resulted in 23 RCCs exposed to > -65 °C for approximately 2 h (max temperature -55 °C). Current practice would require units to be discarded to prevent potential negative transfusion outcomes due to quality impacts potentially caused by the TWE. This investigation seeks to provide evidence that single TWEs do not significantly impact the quality of cryopreserved RBC units.

Design and Methods: One RCC was thawed in a water bath (37 °C) and deglycerolized using standard protocols on the ACP 215 automated cell processor. The following quality tests were performed at day 1 and 14 post-deglycerolization: RBC hemolysis, RBC indices (mean cell volume [MCV], hemoglobin [MCH], and hemoglobin concentration [MCHC]), extracellular potassium (EP), adenosine triphosphate (ATP) concentration, osmotic deformability, osmotic fragility, and RBC morphology. Due to the small sample size (n=1), statistical analysis was not performed but results were compared with non-TWE post-deglycerolization RCC units.

Results: Increases in hemolysis and EP were observed over 14 days storage along with decreases in ATP and morphology index in both the TWE and non TWE units. This indicates quality degradations are a result of storage lesion and not temperature excursion. Deformability decreased over the 14 day storage period. Osmotic deformability curves displayed a left shift at hypertonic osmolalities, suggesting decreased cell hydration. MCV at both day 1 and day 14 (78.7 ± 0.2 fL and 77.4 ± 0.2 fL, respectively) was lower than expected. Based on the observed microcytosis, it is suspected that a donor related factor may be influencing the quality results.

Conclusions: Our evaluation indicates that RCCs cryopreserved using the high glycerol method are protected from the effects of TWEs. Additional studies investigating the impact of TWEs are being conducted and have shown that units experiencing a single TWE meet quality requirements for transfusion. This work could allow for changes to inventory management practices to prevent unnecessary disposal of units that have experienced TWEs.

Acknowledgments: This research received funding support from Canadian Blood Services (CBS), funded by the federal government (Health Canada) and provincial and territorial ministries of health. We are grateful to CBS donors who made this research possible.

Implementation of New Criteria for Performing MAIPA Test for FNAIT: A Retrospective Analysis

Abstract Author Names :

Lidiya Purtova [1] *^, Jacqueline Wong [2], Akash Gupta [3]

Abstract Summary :

Abstract Summary:

INTRODUCTION:

The monoclonal antibody-specific immobilization of platelet antigens (MAIPA) test is a qualitative enzyme immunoassay designed with high sensitivity and specificity to detect anti-platelet antibodies in serum or plasma samples. In the Canadian Blood Services National Platelet Immunology Reference Lab, a Luminex-based assay (PAKLx) or solid-phase enzyme-linked immunosorbent assay ELISA (PAKPlus) is followed by the MAIPA test, for investigation of possible FNAIT. Until October 1, 2022, MAIPA was performed on all maternal samples for FNAIT regardless of the PAKLx or PAK Plus results. A new algorithm was developed and implemented to optimize the testing requirements for MAIPA.

DESIGN AND METHODS:

The new criteria for performing the MAIPA test for FNAIT is based on HPA genotyping and the PAKLx or PAK Plus results. If a maternal sample is negative on PAKLx or PAK Plus and has heterozygous expression of HPA antigens on glycoprotein (GP) GPIIbIIIa, GPIaIIa, GPIbIX, or CD109 antigens, then no further investigation by MAIPA is required for that GP. If there is a genotype incompatibility between the maternal and paternal or fetal samples, then confirmatory MAIPA is required for the implicated GP. If PAKLx or PAK Plus is positive in GPIIbIIIa or GPIaIIa, then MAIPA is performed to confirm the presence of the antibody. In addition, MAIPA crossmatch (XM) with a paternal sample is only required if a neonatal sample is not available and there is an HPA incompatibility between mom and dad.

RESULTS:

The new algorithm was implemented on October 1, 2022. Data was reviewed from May 1, 2022, to September 30, 2022, and from October 1, 2022, to February 28, 2023. Pre-implementation, 42 MAIPA and 17 MAIPA XM tests were performed for FNAIT as opposed to 30 MAIPA (total of 38 cases received) and 7 MAIPA XM (total of 16 possible XM) tests post implementation. This resulted in a reduction of 21% and of 56% required MAIPA and MAIPA XM testing for FNAIT, respectively.

CONCLUSION:

By utilizing patient's genotype to optimize requirements in MAIPA testing for FNAIT, an improvement in workload for technologists can be observed. Furthermore, as more data is acquired and evaluated in the future, additional enhancements in effectiveness will be realized.

Improving the Droplet Freezing of Red Blood Cells

Abstract Author Names :

Anika Tahsin Rahman [1] *^, Nishaka William [2], Mahsa Yazdanbakhsh [3], Jayme Kurach [4], Rafay Osmani [5], Jason Acker [6]

Abstract Summary :

Introduction / Objective: Droplet freezing permits the storage of red blood cell (RBC) in small volumes (i.e. <1 mL) in order to support serological testing in transfusion medicine. The freezing, reconstitution, and analysis of rare RBCs can be efficiently achieved by thawing small RBC droplets. We aim to improve previously developed RBC droplet freezing methods through modifying formulations of cryoprotectants (CPAs) and dilution factors of RBCs.

Design and Methods: We investigated effects of droplet freezing in RBCs mixed with CPA1 (solution of 10% dextran 40 and 7% trehalose dehydrate) or CPA2 (solution of 7.7% sucrose and 2.97% dextrose monohydrate), with the latter being a conventionally used formulation in RBC droplet freezing. To investigate whether increasing dilution with CPA1 or CPA2 would improve RBC viability, various dilution factors (1:1 and 1:3) of RBCs with CPA1 or CPA2 were studied (CPA1-1:1, CPA1-1:3, CPA2-1:1 and CPA2-1:3). The CPA1 was supplemented with 2.5% glycerol to evaluate whether this improved outcomes (CPA1G-1:1 and CPA1G-1:3). Droplets were dispensed on a rotating copper plate placed directly over liquid nitrogen which were then stored in liquid nitrogen dewar for 48 h. Hemolysis, morphology and indices [mean corpuscular hemoglobin concentration (MCHC)] were assessed post-thaw. To confirm addition of the CPA alone did not cause significant damage, hemolysis was also assessed immediately following CPA addition. Comparison of hemolysis values, morphology indexes and indices following CPA additions to RBCs were done using two-way Anova and unpaired t-tests.

Results: In all cases, freezing significantly increased hemolysis values. Increasing dilution improved post-thaw hemolysis ($p<0.05$ in all cases). Hemolysis values of RBCs with CPA1 and CPA2 were not significantly different. Supplementing CPA1 with 2.5% glycerol did not offer a significant difference in hemolysis. Increasing dilution significantly improved morphology indexes. Glycerol supplementation at higher dilution had significantly improved morphology

index. CPA1 and CPA2 had significant differences in morphology indexes, except the difference acquired between CPA1-1:1 and CPA2-1:1. CPA1-1:1 caused a significantly low MCHC compared to CPA1-1:3 ($p = 0.0324$) and CPA2-1:1 ($p = 0.01$).

Conclusions: Increasing dilution with CPA1 and CPA2 caused improvement in the post-thaw viability of droplet frozen RBCs. Adopting the formulations may provide improved stability and utility of cryopreserved RBCs used for diagnostic purposes.

Acknowledgements: We are grateful to Alberta Innovates and Canadian Blood Services for supporting our work. We thank our research participants who make this work possible.

Comparable bacterial detection in apheresis platelet concentrates suspended in plasma or platelet additive solution E

Abstract Author Names :

Sandra Ramirez-Arcos [1 * ^], Yuntong Kou [2], Dilini Kumaran [3], Anita Howell [4], Ken McTaggart [5]

Abstract Summary :

Introduction/Objective: Canadian Blood Services manufactures platelet concentrates (PC) suspended in 100% plasma (plasma-PC) and is in the process of implementing PC suspended in platelet additive solution E (PAS-PC). Plasma-PC are screened for bacterial contamination with the BACT/ALERT system using a large volume delayed sampling (LVDS) screening algorithm involving PC sampling at ≥36 hours post-collection, inoculation of aerobic and anaerobic bottles, and ≥6 hours post-sampling quarantine. This study was aimed at comparing detection of bacterial contamination in apheresis PAS-PC and plasma-PC using our LVDS algorithm.

Design and Methods: Double apheresis hyperconcentrate units were split into single hyperconcentrates diluted in either PAS-E or concurrently collected plasma. Units were tested for *in vitro* quality markers (eg., volume, platelet concentration, glucose, lactate) and baseline sterility prior to spiking with transfusion relevant bacteria. Units were inoculated at a target load of 30 CFU/unit of facultative *Staphylococcus epidermidis, Staphylococcus aureus, Serratia marcescens,* and *Klebsiella pneumoniae* or 10 CFU/mL of anaerobic *Cutibacterium acnes*. Spiked PCs were stored under standard conditions for 7 days. At 24-, 36-, and 48-hours post-spiking, samples were taken for BACT/ALERT testing and/or determination of bacterial loads. Times to BACT/ALERT detection and bacterial loads were compared between plasma-PC and PAS-PC. N=3.

Results: *In vitro* quality testing showed that while volume and platelet concentration were consistent between PAS-PC and plasma-PC, glucose and lactate were lower in PAS-PC. No differences in times to detection were observed for fast-growing *K. pneumoniae* and *S. marcescens* when PC sampling was done at 36-hours vs 48-hours. However, slow-growing *S. aureus* and *S. epidermidis* were detected faster when sampling was performed at 48 hours.

C. acnes does not proliferate in PC; however, it was detected faster in PAS-PC versus plasma-PC. Importantly, no statistically significant differences were observed in times to BACT/ALERT detection between plasma-PC and PAS-PC at the 36-hour sampling time.

Conclusions: Transfusion relevant facultative bacteria grow in PAS-PC at a similar rate as in plasma-PC, despite the differences of the suspension solutions of the two components (e.g., lower glucose content in PAS-PC). Faster detection of *C. acnes* in PAS-PC may be due to bacteria-platelet aggregation in plasma-PC that reduces the chance for detection. Importantly, this study showed that BACT/ALERT times to detection are not significantly different for any of the bacteria tested when grown in plasma-PC or PAS-PC if screening is done with our current LVDS testing algorithm. Therefore, there is no increase in the safety risk to transfusion patients associated with the change in PC suspension solution from plasma to PAS.

Acknowledgements: Canadian blood donors and Blood4Research Facility.

Sebaceous sanctuary: Cutibacterium acnes displays heightened resistance to blood donor disinfection in the presence of skin sebum components

Abstract Author Names :

Dilini Kumaran [1] *^, Sandra Ramirez-Arcos [2]

Abstract Summary :

Introduction/Objective: Canadian Blood Services employ donor skin disinfection as a strategy to prevent the introduction of bacteria into donated blood. Nonetheless, bacterial contamination continues to occur, with *Cutibacterium acnes*, an anerobic member of the skin flora, being the most isolated bacterial contaminant of platelet concentrates (PCs). *C. acnes* thrives as bacterial aggregates, called biofilms, in the sebum-rich niches of the skin. Biofilm-associated bacteria display heightened resistance to antimicrobials leading to persistence, and these characteristics can be influenced by the environment that the biofilms are formed under. It is therefore plausible that sebum may impact *C. acnes* biofilm formation and/or resistance to donor skin disinfectants leading to its dominance as a PC contaminant. This study aimed to investigate the impact of sebum components on donor skin disinfectant efficacy against *C. acnes* biofilms.

Design and Methods: Four *C. acnes* PC isolates belonging to different phylotypes were used in the study. Biofilms were established (anaerobiosis, 37℃, 7days) in the wells of 48-well plates that were either coated with a mixture of sebum components (squalene, trioleine, olive oil (oleic acid), and jojoba oil), or in uncoated wells that served as controls. Biofilm formation was assessed using a semiquantitative crystal violet assay. Disinfectant efficacy was assessed by exposing biofilms to the standard donor skin disinfectant used at Canadian Blood Services (2% chlorhexidine and 70% isopropyl alcohol) for 30 seconds. Following disinfectant neutralization, biofilms were dislodged and enumerated to assess reduction in total bacterial counts. All experiments were performed three independent times.

Results: No significant difference in biofilm formation of the four *C. acnes* isolates tested was observed between control and sebum coated wells, though biofilms were more resistant to dislodging in coated wells. Importantly, *C. acnes* displayed significantly heightened resistance

to the standard donor skin disinfectant in the presence of sebum components ($p<0.05$), with an average difference in log reduction of ~2.9 Log (colony forming units) compared to the control.

Conclusions: The data indicate that the sebaceous niche that *C. acnes* occupies on the skin may enable the formation of robust biofilms and provide protection against standard donor disinfection, thereby contributing to its dominance as a PC contaminant. Future work will focus on elucidating whether sebum components alter biofilm composition and bacterial cell membrane fluidity influencing the resistance observed.

Acknowledgements: Canadian blood donors and Blood4Research Facility for PC production.

Inhibition of Coronavirus Infection by ABO Isoagglutinins

Abstract Author Names :

Priyal Shah [1] *^, Beth Binnington [2], Martin Olsson [3], Jessica Lam [4], Donald R. Branch [5]

Abstract Summary :

Background: COVID-19, caused by SARS-CoV-2, requires coronavirus Spike (S)-protein, host receptor ACE2 and TMPRSS2 for infection. Emerging progeny virus use host plasma membrane, which may contain ABH(O) antigens, to form envelopes. Multiple studies reported that blood group O protects against severe COVID-19 disease, while group A patients show increased susceptibility. This suggests that anti-A from group O patients could provide natural protection against COVID-19.

Methodology: Cell lines Vero (monkey), HT29 (human) and HEK293T/17 (human) were checked for ACE2 and ABO expression via western blot. HEK293T/17 cells were transfected with CoV2-S lentivirus transferase and ABO/FUT1 glycosyltransferases, to produce CoV2-S lentivirus that expresses ABH antigens on its envelope. Vero cells that expressed TMPRSS2/Cathepsin-deletion (Vero$^{TMP+/CTSL-}$), HT29 cells that expressed TMPRSS2 and human ACE2 (HT-29$^{ACE2+TMP+}$), and 293T/17 cells that expressed human ACE2 (293T/17^{ACE2+}) were generated and checked for permissiveness to CoV2-S lentivirus and/or SARS-CoV-2. Monoclonal anti-A/B were used to determine if ABO isoagglutinins could inhibit coronavirus infection. CoV2-S lentivirus infection was measured using a luciferase assay kit and SARS-CoV-2 infection measured by RT-qPCR.

Results: Vero$^{TMP+/CSTL-}$, HT29$^{ACE2+TMP+}$ and 293T/17^{ACE2+} had a significantly greater CoV2-S lentivirus infection rate compared to their wildtype derivatives. HT29$^{ACE2+TMP+}$ and 293T/17^{ACE2+} were also more permissive to SARS-CoV-2 infection. Immunofluorescence data confirmed HT29 expresses A-antigen on their membrane, thus, producing A-expressing virus. A-expressing CoV2-S lentivirus infection in Vero$^{TMP+/CSTL-}$ was significantly inhibited by anti-A, but no inhibitory effects on wildtype, B-, or H-expressing virus. Similarly, anti-B only inhibited B-expressing CoV2-S lentivirus and showed no effects on other viruses. Anti-A also showed significant inhibition of A-expressing SARS-CoV-2. A post-SARS-CoV-2-vaccinated serum was used as a positive control which inhibited all infections.

Conclusions: Proof-of-concept was obtained with anti-A and anti-B inhibition of A- and B-expressing CoV2-S lentivirus, respectively. Inhibition by anti-A was also observed in SARS-CoV-2 infection. With so many reports about the importance of ABO for COVID-19, our study provides experimental evidence supporting these observations. Our results offer an underlying mechanism for ABO in the pathogenesis of SARS-CoV-2 and may aid in studies of coronavirus epidemiology, especially for understanding why some people are infected while others are not, even when living in the same household.

Acknowledgements: We thank Dr. Hunsang Lee from Dr. Mikko Taipale's lab for providing cell lines Vero^{TMP+} and Vero$^{TMP+/CTSL-}$, Canadian Blood Services for providing funds to Dr. Branch, and the Dr. Edward Ketchum Graduate Student Scholarship for providing graduate student funding to Priyal Shah.

Addressing disparities in blood, stem cell, and organ & tissue donor pools: A mixed- methods evaluation of a workshop to guide medical students' development as health advocates through advancing equity across donation products for racialized peoples

Abstract Author Names :

Sylvia Okonofua [1*^], Murdoch Leeies [2], Matthew Yan [3], Biba Tinga [4], Jennie Haw [5], Warren Fingrut [6]

Abstract Summary :

Introduction:

Health advocacy is an important skill for medical students to develop, but is challenging to teach. Here, we describe the development and evaluation of a workshop to support Canadian medical students to develop as health advocates through advancing health equity across donation products for racialized peoples.

Methods:

We developed a workshop for a Canadian medical school audience, "Addressing racial disparities in blood, stem cell, and organ and tissue donor pools" consisting of an online module followed by a virtual facilitated discussion group. The online module (available at stemcellclub.ca/training) outlined disparities in donor pools across donation products, barriers to donation impacting racialized/ ethnic populations, and structural racism in donation policies (i.e. policies which disproportionately impact racialized/ ethnic peoples). The module also presented content from a national campaign in Canada to engage Black peoples to donation (stemcellclub.ca/BlackDonorsSaveLives). The discussion group supported participants to reflect on how they can help overcome these challenges. Quantitative and qualitative analyses (using a constructivist grounded theory approach) were employed to evaluate participants' perspectives on the impact of the workshop on their development as health advocates.

Results:

From 01/2023-03/2023, workshops were hosted at 9 Canadian medical schools, with 30 medical students participating (80% female; 70% from racialized populations; 66% pre-clerkship). Overall, 97% strongly agreed/agreed the workshop supported their development as health advocates, including the abilities to: advocate for patients beyond the clinical environment (83%); work with patients (87%) and communities (73%) to address and identify determinants of health that affect them; apply a process of continuous quality improvement to health promotion (83%); and contribute to a process to improve the health of a community (100%). All felt the workshop should be incorporated into the medical school curricula. Qualitative analysis identified rich examples of participants' development as health advocates through their participation in the workshop, including through identifying the need to prioritize inclusion; recognizing discrimination; understanding barriers

to change; addressing disparities in collaboration with advocates; and building a culture to support inclusion.

Conclusion: We present the perspective of a national cohort of Canadian medical students that their participation in a workshop on advancing health equity across donation products for racialized peoples contributed to their development as health advocates. This workshop is a model for teaching health advocacy to medical students and is relevant to medical educators and curriculum developers.

Acknowledgements: We acknowledge funding from Canadian Blood Services BloodTechNet Award, Canadian Federation of Medical Students, and Doctors of BC.

RBC alloimmunization risk following transfusion in immune checkpoint inhibitor therapy patients.

Abstract Author Names :

Lianne Rotin [1] *^, Wenzie Ng [2], Bailie Jones [3], Brian Marsell [4], Marcus Butler [5], Christine Cserti-Gazdewich [6]

Abstract Summary :

Introduction:
Immune checkpoint inhibitors (ICIs) are cancer therapies that enable tumour cell targeting by a patient's own immune system. They also trigger non-specific immune system activation with adverse autoimmune events. After identifying 3 RBC alloimmunization events in a 6-month span in ICI recipients at our institution, we noted the absence of evidence on estimates of this particular risk, or guidance on best blood matching practices for this growing population.

Objective:
To systematically evaluate contextual RBC alloimmunization rates in ICI treatment in order to potentially inform prophylactic matching practices.

Methods:
All patients at our academic adult cancer centre, receiving at least one dose of ICI (programmed death 1 [PD1] inhibitors: pembrolizumab, nivolumab, durvalumab, atezolizumab, avelumab, cemiplimab; or cytotoxic T-lymphocyte antigen 4 [CTLA4] inhibitors: ipilimumab and tremelimumab), July 2018-June 2022, were included. Data on date, type, and number of ICI doses for each patient were extracted. Number of RBC transfusions, transfusion dates, antibody screen dates, and antibody screen results (positive vs. negative) were extracted from the laboratory information system (WellSky). Patients with positive screens were grouped based on timing of positive screen in relation to ICI and transfusion exposures. The Z-test was used to compare positive antibody screen rates between transfused and non-transfused ICI patients.

Results:

Over a 4-year period, 2075 unique patients were treated with ICIs. Among these, 1315 underwent antibody screening, 616 (46.8%) of whom received at least 1 RBC transfusion on site. A total of 30 patients had positive antibody screens, with 21 (70%) screening-positive after ICI exposure, and 8 occurring after both ICI and recent RBC transfusion. Another 8 screened positive prior to any ICI exposure, with transfusion history absent in 5 and present in 3. One patient was excluded due to unclear timing of ICI exposure in relation to positive antibody screen. Using a 2-tailed Z-test, there was no significant difference between the proportion of positive screens in transfused vs. non-transfused ICI patients (8/616 [1.3%] vs. 5/699 [0.7%], z=-1.067, p=0.28).

Conclusions:

In this preliminary analysis, there was no statistically significant difference in alloimmunization according to the known transfusion status of patients treated with ICI. A limitation of this low-frequency finding is the assessed sample size to date. While our laboratory policy has not precautionarily changed on its depth-of-matching for this subpopulation, we recommend ongoing surveillance of alloimmunization events to assess for shifts in their scale and significance.

An Epic Save: How a Change to our Hospital's Health Information System Boosted Clinical Trial Enrollment

Abstract Author Names :

Daniel Roque [1] *^, Samia Saeed [2], Jacob Pendergrast [3]

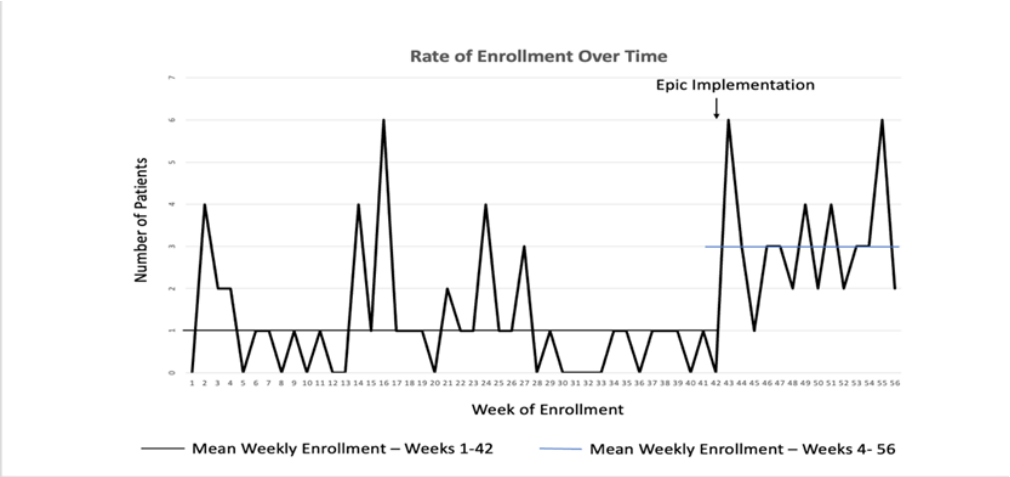
Abstract Summary :

Introduction: Recruitment and enrollment of study participants is imperative for the success of any clinical trial, yet it is known to be one of the most challenging aspects. A myriad of barriers can contribute to low rates of trial participation, including human resource and communication issues. In this study, we describe how a Health Information System (HIS) upgrade presented an opportunity to dramatically increase enrollment in a clinical study of transfusion-associated circulatory overload (TACO).

Methods: We performed a prospective cohort observational study of diuretic response in inpatients at high-risk of TACO, with the purpose of creating a dose-response curve which would inform the design of a later randomized controlled trial. Eligible patients were identified by screening for intravenous furosemide orders and attempting to enroll them prior to furosemide administration. The previous HIS (Quadramed), required reviewing automated email alerts, and then placing phone calls and emails to the patient's clinical team. In the new system (Epic ®), furosemide orders could be identified, eligibility criteria reviewed, and contact with the patient's healthcare team initiated, all within the HIS itself.

Results: Post Epic ® implementation we enrolled a comparable number of study participants (44 vs. 53 patients), screening fewer patients (390 vs. 969 patients) in a third of the time (14 vs. 42 weeks). A run-chart (see Figure 1) demonstrates that average weekly enrollments tripled (3 vs. 1, $p < 0.05$), despite fewer clinical research coordinators (CRC) (1 vs. 3). Furthermore, participant study completion improved markedly (98 % vs. 64 %).

Figure 1: Rate of Enrollment Over Time



Conclusion: While likely assisted by the adoption of other novel strategies, including the hiring of a dedicated CRC, RN

education and maintenance of a constant ward presence, it was nonetheless apparent that Epic ® essentially 'saved' our study. Improved enrollment was largely a result of more efficient patient screening, using the Patient List function, and effective communication with the active clinical team using the Secure Chat function. Notably, as enrollment efficiency was achieved in part by allowing more clinical information to be reviewed prior to seeking patient consent, the change in LIS required a new review of the study protocol by our institution's Research Ethics Board. A hospital's LIS may therefore have both operational and ethical implications on research conduct, and is an important consideration in study design.

Modification of Deglycerolization Procedure Improves Processing and Post-Thaw Quality of Cryopreserved Sickle Trait Red Cell Concentrates

Abstract Author Names :

Celina Phan [1 * ^], Jayme Kurach [2 ^], Megan Foxcroft [3], Carly Olafson [4], Daisy Xu [5], Kiarra Durand [6], Gwen Clarke [7], Jason Acker [8]

Abstract Summary :

Background & Aim: Red blood cell (RBC) transfusion is a critical therapy for sickle cell disease (SCD) patients. However, SCD patients often require RBC products with rare phenotypes, some with SC trait, due to alloimmunization occurring with frequent transfusion. Cryopreservation of RBCs is implemented to ensure the availability of rare blood phenotypes. However, SC trait RBCs often experience "sludging" during deglycerolization, leading to cell loss and decreased RBC recovery. This study proposes a modified deglycerolization protocol using an automated cell processor to mitigate the sludging of sickle trait RBCs.

Materials & Methods: Six red cell concentrates (RCC) from donors carrying SC trait were glycerolized using the ACP-215TM, frozen for a minimum of 7 days (< -65ºC) and then deglycerolized on the ACP-215TM using modified parameters. Modified parameters include a decreased hypertonic solution flow rate (100 mL/min) and hypertonic equilibration delay (120 seconds), and increased NaCl dilution volumes (500 mL), as compared to standard settings. Quality testing post-thaw, 0, 1, 7 and 14 days post-deglycerolization (PDG).included: hematocrit (hct), hemolysis, RBC indices, supernatant potassium, RBC morphology, osmotic fragility, hemoglobin (hgb) and RBC recovery. Group comparisons were completed using Sidak's multiple comparisons test and Mann-Whitney U test.

Results: Canadian Standards Association indicates that acceptable deglycerolized units for transfusion require a hct ≤ 0.80 L/L, hgb ≥ 35 g/unit, and hemolysis < 0.8% in 90% of units tested. At all time points, the units (n=6) met the hct (0.54 ± 0.08 L/L) and hgb (37.98 ± 2.15 g/unit) standards but did not meet the hemolysis standard as 2/6 units were greater than 0.8%. No significant differences in hgb and RBC recovery, and other assays between SC-trait and non-SC trait control units (n=6) were observed. However, significant differences were identified for osmotic fragility ($p < 0.05$) on days 7 and 14.

Conclusions: The modified deglycerolization protocol enabled the cryopreservation of SC-trait RBCs by minimizing the occurrence and extent of RBC sludging. Implementation of this protocol may improve the availability of rare red cell components for transfusion to SCD patients.

Acknowledgements: This research received funding support from Canadian Blood Services, funded by the federal government (Health Canada) and provincial and territorial ministries of health. Views herein do not necessarily reflect the views of the federal, provincial, or territorial governments of Canada. We are grateful to Canadian Blood Services' blood donors who made this research possible.

Using Blood Wisely: Update from a national implementation campaign

Abstract Author Names :

Yulia Lin [1] *^, Doreen Day [2], Andrea Patey [3], Tai Huynh [4], Wendy Levinson [5]

Abstract Summary :

Introduction: Choosing Wisely Canada launched a national strategy called "Using Blood Wisely" in 2020, in collaboration with Canadian Blood Services and Héma-Québec. The aim was to engage hospitals across Canada to audit their red blood cell (RBC) use against a national benchmark and participate in an effort to decrease inappropriate use.

Design and Methods: Using Blood Wisely engaged stakeholders to develop a national benchmark for appropriate transfusion, a measurement strategy, the best available evidence for effective interventions and a plan to motivate and reward participation and success. Sites signed up through the Using Blood Wisely website. Measurement was based on two metrics: the percentage of RBC transfusion episodes that were single unit transfusions and the percentage of RBC transfusions with a pre-transfusion hemoglobin 80g/L or less. Resources to support interventions included educational videos, a planning survey, guideline and order set templates, and examples of provincial transfusion order screening standard operating procedures. The initial goal was to have 50 hospitals participate in the initiative.

Results: From the initial launch in September 2020 to Dec 31, 2022, 169 sites (239 hospitals) participated in Using Blood Wisely: 7 sites in British Columbia, 4 Alberta, 25 Saskatchewan, 10 Manitoba, 79 Ontario, 10 Quebec, 10 New Brunswick, 12 Newfoundland and Labrador, 10 Nova Scotia, 1 Yukon and 1 Northwest Territories. Of these, 155 sites (225 hospitals) submitted a baseline audit with 98 (63%) meeting the single unit transfusion benchmark and 111 (72%) meeting the pre-transfusion hemoglobin benchmark and 80 (52%) met both benchmarks. Up to Dec 31, 2022, 68 sites (111 hospitals) were designated as Using Blood Wisely hospitals based on meeting and sustaining the benchmarks for at least 4 months. Challenges in meeting benchmarks included: data skewing in smaller hospitals or certain clinical units due to single patient episodes and individual clinician practices, lack of staff with expertise to advise others, need for more education about the guidelines, and staffing challenges due to COVID and staff shortages.

Conclusions: Using Blood Wisely has been successful at engaging hospitals to participate in a

national campaign to reduce inappropriate transfusion through auditing metrics against a national benchmark and being recognized for their efforts. Efforts continue to encourage and support hospitals who have not yet met the benchmarks.

Acknowledgements: Thank you to the Using Blood Wisely Steering Committee and the participating hospitals and transfusion services.

Canadian research programs to change the approach to sexual risk screening: what did they accomplish?

Abstract Author Names :

Mindy Goldman [1] *^, Niamh Caffrey [2], Geraldine Walsh [3], Jennie Haw [4], Sheila O'Brien [5]

Abstract Summary :

Introduction: Starting in 2016, the Canadian federal government funded two research programs, administered by Canadian Blood Services and Héma-Québec, to support evidence-based research for alternative screening approaches for blood and plasma donors. The goal was to help evolve the time-based deferral policy for gay, bisexual and other men who have sex with men (gbMSM) while maintaining safety. We evaluated research program outputs and their impact on criteria changes.

Methods: A two-day meeting with key stakeholders was held in January 2017 to develop research themes and strategies, followed by two rounds of competitive funding in 2017 and 2018 and a further grant competition in 2020 focused on source plasma donors. Applicants were asked to address one of the following priorities: informing the development of an individual risk assessment donor policy or strengthening the existing policy, evaluating the operational feasibility and acceptability of alternative policies, risk modeling and surveillance, and the impact of risk reduction technologies. Applications were peer reviewed and projects that addressed the competition guidelines and were thought to have the best chance of success in achieving project goals were funded.

Results: 19 projects were funded, encompassing 13 principal investigators at 11 different research sites. The programs engaged over 100 individual researchers and representatives from academic institutions and blood operators across Canada and internationally and from dozens of stakeholder organizations. To date, there have been 19 peer reviewed publications. Leveraging existing cohort studies with gbMSM yielded relevant HIV incidence data to inform safety modeling studies and provide reassurance that other donor criteria would defer individuals engaged in activities at higher risk for HIV infection. Findings also indicated that sexual behaviour-based screening was acceptable to gbMSM and current donors, donor discomfort with questions about sexual behaviour could be mitigated with clear explanations and capture questions, and donation loss would be tolerable.

Conclusions: The research programs filled critical knowledge gaps and supported successful submissions by Canadian Blood Services and Hema-Quebec to move to a behaviour-based screening approach for all donors. They also facilitated new collaborative partnerships with researchers internal and external to the blood operators.

Reducing unnecessary neonatal cord blood testing: A quality improvement study

Abstract Author Names :

Nicole Relke [1] *^, Omar Hajjaj [2], Aiden Scholey [3], Megan Cooper [4], Andrew Stevens [5], Angela Sirosky-Yanyk [6], Liying Zhang [7], Faiza Khursid [8], Jeannie Callum [9]

Abstract Summary :

Introduction: Cord blood (CB) testing is performed to assess the RhD type of a neonate born to a RhD negative mother for determination of maternal RhD immune globulin eligibility, and to determine the cause of significant neonatal hyperbilirubinemia. Choosing Wisely Canada recommends against routinely performing direct antiglobulin test (DAT) on all neonatal CB samples. Despite this, ABO, RhD and DAT are often ordered routinely on all CB samples. The objective of this study was to determine if a multimodal intervention could safely and pragmatically reduce immunohematology testing on CB.

Design and methods: We performed a prospective quality improvement study at a tertiary-care hospital in Kingston, Ontario. The intervention involved stakeholder education, creation of new judicious/evidence-based CB hospital and laboratory policies, digital order set, and implementation process. All neonates had a CB sample collected and stored for 7 days. Cord testing was activated for alloimmunized mothers, neonates of RhD negative mothers, neonates with bilirubin level in and above the low-intermediate risk zone at time of universal jaundice screening, and neonates receiving phototherapy. Data was collected for 150 consecutive mother-baby pairs before and after policy implementation. Infants were excluded if they were born < 36 weeks gestation. Fisher exact test was used to compare two intervention groups, two-sided p-value < 0.05 was considered statistically significant.

Results: Prior to intervention, testing was done on 100% of cord samples. Post-intervention there was a reduction in CB tests ordered by 62.1%, 77.8%, and 32.0% for ABO, RhD, and DAT respectively. 64.7% (99/153) of cord samples were tested correctly per policy. The most common reason for non-compliance was ordering ABO on infants born to group-O mothers. 4.9% (5/153) of patients had a positive DAT, all of which were attributed to ABO incompatibility, compared to 5.3% (8/150) pre-intervention. 40% (2/5) of patients with a positive DAT received phototherapy, compared to 37.5% (3/8) pre-intervention. No patients (0/10) readmitted with hyperbilirubinemia post-intervention had a positive DAT. Overall, there was no significant increase in RBC transfusion, phototherapy, or readmission for hyperbilirubinemia. The selective cord testing policy saved an estimated $26,890 at our institution over 1 year.

Conclusions: We found that a selective cord blood testing policy reduced use of resources and cost without increased harm. This study provides a framework for implementing a selective cord testing policy at other hospitals. Based on these results, the order set and lab policies were revised to further increase adherence and an updated audit is underway.

Revised NAC-CCNMT Irradiation Recommendations: Proposed Updates and a Summary of Canadian TA-GVHD Hemovigilance Data

Abstract Author Names :

Oksana Prokopchuk-Gauk [1] *^, Nancy Robitaille [2], Dana Devine [3], Vincent Laroche [4], Doug Morrison [5], Charles Musuka [6], Andrew Shih [7], Alan Tinmouth [8]

Abstract Summary :

Introduction: The National Advisory Committee on Blood and Blood Products (NAC) and *Comité consultatif national de médecine transfusionnelle* (CCNMT) collaborated to develop national Recommendations for the Use of Irradiated Blood Components in Canada, first published in 2017. The NAC-CCNMT Irradiation Subcommittee was reconvened in 2022 to update the Canadian recommendations document. Here, we describe the document update process, including a summary of reported Canadian transfusion associated graft vs host disease (TA-GVHD) incidence.

Design and Methods: The Irradiation Subcommittee membership is comprised of representatives from the NAC (5), CCNMT (2), Canadian Blood Services (1) and Héma-Québec (1). Two international guideline documents were sentinel in informing review and update of the NAC-CCNMT Irradiation Recommendations: the Netherlands *Guideline development for prevention of TA-GVHD* (Wiersum-Osselton JC et al, 2021) and the British *Guidelines on the use of irradiated blood components* (Foukaneli T et al, 2020). A literature review searching for reported cases of TA-GVHD published between January 2017 through January 31, 2022 and updated data on the quality of stored red cells post irradiation were consulted. To ascertain the incidence of reported TA-GVHD in Canada, Health Canada – Canada Vigilance (HC-CV), Public Health Agency of Canada - Transfusion Transmitted Injuries Surveillance System (PHAC-TTISS) and Québec Hemovigilance System (QHS) databases were queried.

Results: The negative impact of irradiation on RBC quality is reaffirmed. Proposed revisions to the NAC-CCNMT Irradiation Recommendations include: new recommendations pertaining to pathogen inactivated blood components, TA-GVHD hemovigilance monitoring, and CAR-T therapy; defined criteria for lifting irradiated blood requirements post-bone marrow transplant, following treatment for Hodgkin's lymphoma, and after treatment with certain medications; and removing the recommendation for irradiated blood in very-low birthweight infants requiring top-up transfusion.

HC-CV received 1 adverse reaction report which included GVHD within its coding between October 2015-February 2022; however, case review confirmed that TA-GVHD was not involved. Interrogation of the PHAC-TTISS and the QHS databases between 2010-2020 yielded no reported TA-GVHD cases.

Conclusion: The updated NAC-CCNMT Irradiation Recommendations reflect current literature and practice and should be publicly available by mid-2023. Interrogation of Canadian hemovigilance data yielded no cases of TA-GVHD. Appropriate use of irradiated blood for TA-GVHD prevention is essential in providing optimal patient care.

Acknowledgements: Special thanks to HC-CV, QHS and PHAC-TTISS staff for providing TA-GVHD hemovigilance data. We are grateful to Ms. Harleen Kahlon for her work as the NAC Coordinator.

Under-reporting of transfusion associated circulatory overload (TACO) in cardiology units at a large center

Abstract Author Names :

Natasha Le Blanc 1 * ^, Anne-Sophie Lemay 2 , Benjamin Rioux-Masse 3 , Bertrand Routy 4 , Veronique Cyr 5 , Claudia Bouchard 6

Abstract Summary :

Introduction

The incidence of transfusion-associated circulatory overload (TACO) ranges from 1% to 12% and is the leading cause of transfusion-associated mortality. TACO remains under-reported by medical teams due to lack of recognition, attribution of overload to other patient risk factors or to an alternative diagnosis of volume overload. The aim of this study was to determine the actual incidence of TACO in patients hospitalized in cardiology units.

Methods and Design

A retrospective chart review study was conducted among 161 patients hospitalized in cardiology (cardiac ICU and ward) who received at least one blood component between May 1, 2021, and April 30, 2022. Cryoprecipitates were excluded. The primary objective was to establish the true incidence of TACO according to the ISBT 2018 definition. The secondary objective was to evaluate and compare the prevalence of the various known risk factors of patients that developed TACO.

Results

Among 320 transfusion episodes that occurred in 161 patients included in the study, only one TACO was officially reported while 25 episodes were identified by chart review (incidence by passive reporting 0.3%, actual incidence 7.8%; p = 0.001). Of these TACOs, 5 (20%) were classified as life threatening, 5 (20%) as severe, 15 (60%) as non-severe, and all occurred following transfusion of red blood cell components. In 44% of cases, the nursing staff didn't recognize the signs of TACO nor notify the medical team. Diuretics were prescribed prophylactically in 31% of cases without TACO versus 20% of patients with TACO (p=0.24). In TACO patients, double-unit transfusion occurred in 12% versus 7.5% without TACO (p=ns). Pre-transfusion hemoglobin level was superior to 80 g/L in 24% of TACO patients compared to 17% in patients without TACO (p=ns). We didn't find any statistically significant association between the prevalence of known risk factors including age, heart failure (with or without preserved left ventricle ejection fraction), creatinine, transfusion rate or volume (p =ns) and the occurrence of TACO.

Conclusion

TACO is under-reported in patients admitted in cardiology with an actual incidence reaching 8%. While numerical differences were observed for TACO transfusion-related risk factors (diuretics usage, number of units, lesser restrictive transfusion strategy), none of these were statistically significant, but the study was probably underpowered to evaluate this aspect. Nevertheless, this study will help guide interventions with medical teams to increase awareness, optimize reporting and explore prevention strategies.

An evaluation of platelet transfusion practices: an 8-year multisite study

Abstract Author Names :

Nadia Gabarin [1] *^, Yang Liu [2], Bonnie Liu [3], Nour Alhomsi [4], Kayla Lucier [5], Na Li [6], Michelle Zeller [7]

Abstract Summary :

Introduction: Blood transfusions, while potentially lifesaving, are a costly medical therapy and carry potential risks such as transfusion reactions. The objective of this study was to further characterize platelet utilization trends at a large academic centre.

Design and Methods: This was a retrospective study using a multi-hospital database which includes comprehensive clinical, laboratory, and transfusion data. Patients admitted to one of 3 hospitals in Ontario between January 1, 2013 and December 31, 2020 and received a platelet transfusion during hospital admission were identified. International Classification of Diseases and Related Health Problems 10th Revision (ICD-10) codes were used to obtain the most responsible diagnosis. Canadian Classification of Health Interventions (CCI) codes were used to identify procedures. Collected data included patient demographics, clinical information, and blood product utilization. Patient subgroups, defined by medical category at admission, were Cardiac Surgery, Non-Cardiac Surgery, Medical Intensive Care Unit (ICU), Oncology, and Other.

Results: A total of 12,891 hospital admissions with a platelet transfusion during the study period were identified, representing 10,985 unique patients. The mean age of patients was 57.8 (standard deviation [SD] 22.5) and 4,659 (36.1%) patients were female. With regards to medical subgroups, 5,317 (41.2%) patients were Cardiac Surgery, 3,251 (25.2%) were Oncology, 2,268 (17.6%) were Non-Cardiac Surgery, 1,673 (13.0%) were Medical ICU, and 382 (3.0%) were Other. For the entire cohort, the median pre-first transfusion platelet count was 67 x 10^9/L (interquartile range 17, 117). Of the entire cohort, 33.6% of platelet transfusions were to patients with a pre-first transfusion platelet count of ≤30 x 10^9/L, 9.2% with a count of 31-50 x 10^9/L, 24.4% with a count of 51-100 x 10^9/L, 18.0% with a count of 101-150 x 10^9/L, and 14.7% with a platelet count of >150 x 10^9/L.

Conclusions: 32.7% of platelet transfusions were transfused to patients with a pre-first platelet transfusion platelet count of >100 x 10^9/L. There are few indications where platelet transfusion is considered appropriate with a platelet count above 100 x 10^9/L, such as head trauma, pre-neurosurgery, or bleeding in the setting of platelet dysfunction. Additional research is required to determine whether platelet transfusions given to patients with a pre-transfusion platelet count of >100 x 10^9/L were appropriate or whether additional interventions are required to decrease the number of inappropriate platelet transfusions.

Acknowledgements: This study was funded through Canadian Blood Services Blood Efficiency Accelerator Award Program.

Impact of blood production manufacturing process on transfusion-related immune modulation (TRIM) outcomes

Abstract Author Names :

Shuoyan Ning [1 * ^], Na Li [2], Yang Liu [3], Jason Acker [4], Donald Arnold [5], Chris Hillis [6], Amanda Kauffman [7], Kayla Lucier [8], Bram Rochwerg [9], Summer Syed [10], Michelle Zeller [11], Nancy Heddle [12]

Abstract Summary :

Introduction/Objectives: The immunomodulatory consequences of blood transfusion, known as transfusion-related immune modulation (TRIM), are clinically important outcomes that are often not captured by hemovigilance systems. Changes to blood product manufacturing processes may lead to changes in quality control measures and other patient important outcomes.

Design and Methods: We evaluated outcomes of transfusion recipients before and after consolidation of blood product manufacturing in Ontario (2012) by Canadian Blood Services. We included all hospitalized adults (age ≥ 18 years) from January 1, 2010 to December 31, 2014 who received 1 or more red blood cell (RBC) transfusions in Hamilton, ON Canada in this retrospective study. We excluded patients if they: 1) received autologous, washed, or deglycerolized RBC transfusions; 2) received RBC transfusions manufactured outside of London, Hamilton, Toronto, or Brampton; or, 3) received RBCs manufactured both pre- and post-consolidation. We accessed data through the TRUST (Transfusion Research Utilization Surveillance and Tracking) database, a multihospital database which includes clinical, laboratory, and transfusion data. We captured TRIM outcomes (sepsis, respiratory failure, venous thrombosis, and organ dysfunction) using International Statistical Classification of Diseases and Related Health Problems (ICD-10-CA) codes, Canadian Classification of Health Interventions (CCI) codes, and laboratory parameters. We performed univariate and multivariate logistic regression analyses adjusting for key covariates. Primary outcome was in-hospital mortality, and secondary outcomes included prevalent sepsis, respiratory failure, and organ dysfunction.

Results: During the study period, we identified 9871 pre-consolidation and 7871 patients post-consolidation who received 1 or more RBC transfusion during their index hospitalization. Multivariate analysis demonstrated no change in in-hospital mortality comparing post-consolidation to pre-consolidation (odds ratio [OR]1.003, 95% confidence interval [CI] 0.887-1.135, p = 0.954). There were no important differences between the risks of respiratory failure (OR 0.831, CI 0.650-1.062, p=0.139) or organ dysfunction (OR 0.949, 95% CI 0.836-1.078, p=0.421) comparing post to pre-consolidation. There was a reduction in sepsis diagnoses comparing post-consolidation to pre-consolidation (OR 0.811, 95% CI 0.743-0.886, p< 0.001).

Conclusions: Consolidation of blood production in Ontario was not associated with increased risks of in-hospital mortality, respiratory failure, or organ dysfunction among transfusion recipients, and may have been associated with a lower risk of sepsis. TRIM and the clinical impacts of changes to blood processing require further study.

Acknowledgements: This research was funded by the Canadian Blood Services Intramural Grant Program.

Titration of adult red cell concentrates (RCCs) reduces the oxygen affinity of cord blood from preterm infants

Abstract Author Names :

Mahsa Yazdanbakhsh [1] *^, Haytham Eid [2], Jack Rabi [3], Po-Yin Cheung [4], Jason Acker [5]

Abstract Summary :

Introduction / Objective - Unstable newborns frequently require blood transfusions. RCCs from adult blood donors bind oxygen differently than those from preterm infants. Following a RCC transfusion, a newborn with the same oxygen saturation would have different unbound oxygen (PaO2; represents the free oxygen available to cells). p50 is defined as the partial pressure of oxygen in the blood at which the hemoglobin is 50% saturated with oxygen. "Radical diseases of neonatology" including retinopathy of prematurity is associated with hyperoxia, or overly high levels of free oxygen. Ultimately, SaO2 targets can be customized for infants based on their blood's oxygen-binding properties. This study quantifies the in vitro oxygen affinity shift (p50) of cord blood after titration with adult pRBCs.

Design and Methods - Cord blood samples were collected from discarded placentas of babies born between 24.0 and 32.6 weeks of age (n=7). The cord blood samples were immediately titrated with the O-neg adult packed red blood cell (pRBC) in four different titers. For all titrations, RBC indices, p50 values, as well as fetal hemoglobin (HbF) and adult Hemoglobin (HbA) levels of cord blood and the last titration were measured.

Results - At baseline, there was a significant difference in p50 between pRBCs (19.7 ± 1.8 mmHg) and cord blood (24.8 ± 3.7 mmHg), as measured by the Hemox analyzer (TCS Scientific Corporation)(P-value = 0.0067). The Hb-O2 affinity of cord blood increased with titration with pRBCs in a concentration-dependent manner (P-value= 0.0068). The level of HbF was found to be significantly reduced (0.62-fold) for neat cord blood to the last titration with RCCs.

Conclusions - This study has shown that addition of RCCs can significantly impact the Hb-O2 affinity and HbF levels in the cord blood from preterm infants. The results suggest that by increasing the amount of RCCs transfused to a preterm infant there will be a significant decrease in p50 and HbF levels. These findings might have important implications for the clinical management of preterm infants, particularly in the context of blood transfusion.

Acknowledgments - We are grateful to Canadian Blood Services' blood donors and Royal Alexandra Hospital cord blood donors who made this research possible. This work was funded by the Mallinckrodt Young Investigator Research Fund.

Comparing donor return behaviour at mobile vs. fixed blood collection sites in South Africa.

Abstract Author Names :

Huzbah Jagirdar [1] * ^

Abstract Summary :

Introduction/Objective: Prior studies have found that deferred donors are less likely to return compared to donors who complete a donation, but no study has analysed how donor return dynamics differ between donors giving at a fixed collection site compared to a mobile blood drive. We analysed data from the South African National Blood Service (SANBS) to analyse the time to return for donors to fixed versus mobile collection sites and identify factors that predict return after deferral or completed donations.

Design and Methods: The data consist of 4,286,365 visits from 596,176 donors from 2017 to 2022, of which 556,068 resulted in deferral. We developed Kaplan Meier curves describing the time to return after a completed donation, haemoglobin deferral and other deferrals at mobile versus fixed collection sites for first-time and repeat donors. We developed a LASSO Penalized Cox Proportional Hazard model to analyse the relationship between covariates, including age, sex, race, donation history and time to return.

Results Preliminary: Of all the visits, 48% were to a fixed site and 52% were to a mobile site. 4% of visits to a fixed site result in a haemoglobin deferral, and 6% of visits to a mobile drive. After a completed donation, the median return time from when a donor is first eligible was 70 days at fixed sites and 106 days at mobile drives. After a haemoglobin deferral, the median return time was longer: 138 days at fixed sites and 190 days at mobile drives. For first-time donors, the median return time after a haemoglobin deferral was longer: 225 days at a fixed site and 259 days at mobile drives. In our proportional hazard mode, visiting a fixed collection site was associated with a shorter time to return (log hazard ratio of 0.46) and haemoglobin deferral was associated with a longer time to return (log hazard ratio of -0.44).

Conclusions Preliminary: Mobile donors were slower to return after both a haemoglobin deferral and a completed donation, and the difference was more significant for first-time donors. This suggests that changes to deferral policies, such as recommending longer intervals for donors with low ferritin, may disproportionally decrease collections of mobile blood drives. These insights can be used to project the impact of changes to donor eligibility and deferral policies on blood centre operations.

Acknowledgements: This project is supported by the Association for the Advancement of Blood and Biotherapies (AABB) Foundation.

The Impact of Restrictive Measures on Optimal use of Intravenous Immunoglobulin (IVIg)

Abstract Author Names :

Jean-Nicolas Champagne [1 * ^], Antoine Desilets [2], Guillaume Roy [3], Océane Landon-Cardinal [4], Hugo Chapdelaine [5], Geneviève Matte [6], Claudia Bouchard [7], Benjamin Rioux-masse [8], Anne-Sophie Lemay [9]

Abstract Summary :

Introduction – During the SARS-CoV-2 pandemic, the threat of a national IVIg shortage has been a major challenge in transfusion medicine. In the absence of a local and provincial management plan, strategies had to be implemented to supervise and ensure appropriate IVIg utilization. To date, limited data exist confirming the effectiveness of diverse methods for optimizing IVIg use. This study aims to compare IVIg utilization before and after the implementation of specific restrictive measures at our academic center, which included new standardized order forms, the use of the adjusted body weight, as well as the implementation of a blood bank gatekeeping system plus a local IVIg management sub-committee.

Design and Methods – IVIg administrations from November 26th, 2018, to September 25th, 2022, were categorized according to the level of indication appropriateness (i.e., Recommended, Option of treatment or Not Recommended), primarily based on provincial guidelines and local expert opinions. Data were separated into three phases – reference phase (560 days), transition phase (280 days), and post-implementation phase (560 days), which followed the implementation of restrictive measures. The primary objective was to determine the impact of these restrictive measures on IVIg utilization, especially on unrecommended uses and excessive dosing.

Results – 5461 IVIg doses were administered, accounting for 295 033 g. The most common prescribing specialties were neurology (30.4%), immunology (29.0%) and hematology (17.4%). Between the reference and post-implementation phase, a global reduction of 23.0% was observed (from 131 163 g to 100 936 g). In addition to the absolute decrease in IVIg administrations, a statistically significant decrease in the proportion of unrecommended doses was noted (absolute reduction of 2.1%; p=0.012). Moreover, there was a 75% reduction in the administration of excessive doses according to the recommended dose based on the adjusted body weight (p< 0.0001). A decreased median dose for patients receiving immunomodulation therapy was also noted

from 1.36 g/kg/4wks to 0.98 g/kg/4wks ($p < 0.0001$). Together, the unrecommended and excessive IVIg doses decreased from 19 975 g (15.2%) to 6 670 g (6.6%) from the reference phase to the post-implementation phase.

Conclusions – In this retrospective study, a global reduction in IVIg use and a preferential decrease in the unrecommended prescriptions of IVIg were observed. These changes were most likely attributable to the bundle of restrictive strategies implemented at our institution. This study confirms the effectiveness of these methods, but the magnitude of the impact depends on the initial level of ordering appropriateness.

A Negligible Impact of Real-World Transient Warming Exposures on the Quality of Cryopreserved Red Cell Concentrates

Abstract Author Names :

Jayme Kurach [1] *^, Carly Olafson [2], Mackenzie Brandon-Coatham [3], Tracey Turner [4], Gwen Clarke [5], Jason Acker [6]

Abstract Summary :

Introduction: In North America, red cell concentrates (RCCs) are cryopreserved using a high glycerol (40%) method, which allows for long-term storage (~ 30 years) at temperatures below -65 °C. Freezer failures, human errors, or routine inventory management are all unintentional ways stored units may be warmed above -65 °C. These transient warming events (TWEs) may cause unwanted cell damage due to ice recrystallization. The aim of this study was to assess if cryopreservation protocols, that incorporate high glycerol concentrations, provide protection to cryopreserved red blood cells (RBCs) against instances of RCC unit temperature fluctuations.

Design and Methods: Thirty previously cryopreserved RCCs, documented as having experienced at least one TWE, were selected and classified according to exposure event: (1) > -65 °C for 34 minutes (n=5), (2) > -65 °C for approximately 2 days reaching a peak temperature of -30 °C (n=23), and (3) exposure to both Event 1 and Event 2 (n=2). Ten previously cryopreserved RCCs documented as having no TWE were selected as controls. All RCCs were thawed (37 °C), deglycerolized and resuspended in AS-3 using the ACP 215 Cell Processor. Units were stored hypothermically and tested at 0, 1, 7, and 14 days post-deglycerolization for RBC quality using an extensive panel of in vitro tests, including hemoglobin (Hb) content, RBC hemolysis, adenosine triphosphate (ATP), RBC indices, and RBC deformability. Multiple group comparisons were performed using Sidak's multiple comparisons test.

Results: When compared to RCC units having experienced no TWEs, the quality of RCCs exposed to one or two authentic TWEs was not significantly different over 14 days of hypothermic storage. Furthermore, all RCCs met CSA specifications for transfusion at all time points.

Conclusion: Our results indicate that isolated exposures to genuine TWEs did not significantly impact the quality of RCCs post-deglycerolization. Further assessments and validation will need to be undertaken by blood centers to determine the impact of the frequency and duration of TWEs on product quality to help define more evidence-based criteria. With these criteria, blood centers could retain these valuable and potentially rare RCCs that current blood inventory management strategies require to be discarded after even one exposure to storage temperatures warmer than -65 °C.

Acknowledgments: This research received funding support from Canadian Blood Services Blood Efficiency Accelerator Program. We are grateful to Canadian Blood Services' blood donors who made this research possible.

Mechanism of dengue virus-induced thrombocytopenia: Virus-encoded nonstructural protein 1 is expressed on the infected megakaryocyte and platelet surface.

Abstract Author Names :

Tseday Tegegn [1] *^, Michael Sutherland [2], Kalyan Golla [3], Henry West [4], Ed Pryzdial [5]

Abstract Summary :

Mechanism of dengue virus-induced thrombocytopenia: Virus-encoded nonstructural protein 1 is expressed on the infected megakaryocyte and platelet surface.

Background:

Dengue virus (DENV) infects ~400 million people annually, of which ~half are asymptomatic, posing a risk to global transfusion systems. A common clinical manifestation of DENV is reduced platelet number (thrombocytopenia), which can lead to life-threatening bleeding. However, the mechanism is multi-factorial and incompletely understood. Not yet considered is a direct mechanism, founded on others' and our reports that megakaryocytes and platelets replicate DENV. Here we address the hypothesis that DENV-encoded nonstructural protein 1 (NS1) is presented on the surface of infected megakaryocytes and platelets.

Aims:

1. Demonstrate DENV-NS1 antigen on the surface of infected megakaryocytic cells and platelets. 2. Investigate the distribution of NS1 on infected megakaryocytic cells.

Methods:

A megakaryocytic cell line (MEG-01) or washed platelets were inoculated with highly purified DENV (serotype 2) propagated in African Green Monkey kidney cells (Vero). Flow cytometry, confocal microscopy or western blot were employed to follow NS1. For flow cytometry, cells were simultaneously gated for: 1) NS1 (specific primary and secondary antibodies); 2) the MEG-01/platelet marker, CD61; and 3) surface staining only using a marker for permeability (LIVE/DEAD kit). For confocal microscopy, cells were simultaneously stained for: 1) DNA (Hoechst);

2) the actin cytoskeleton (phalloidin) and NS1. Non-immune IgG and non-infected cells were used as negative controls. DIC microscopy confirmed the intact nature of cells.

Results:

Flow cytometry demonstrated that MEG-01 cells incubated with 1 infectious unit of DENV/cell resulted in surface detection of NS1 by day-7 and maximally by the experimental duration on day-10. These data were confirmed by western blot of total cellular protein. Platelets also expressed surface NS1 as shown by flow cytometry, however expression was maximal by day-3 and subsequently decreased. Investigation of NS1 on MEG-01 by microscopy revealed an unexpected distribution. An NS1 corona surrounding the cell was anticipated, consistent with previous reports of a glycosylphosphatidylinositol post-translational modification. Instead, large "aggregates" of NS1 were seen on the surface of MEG-01 cells, some of which co-localized with extracellular Hoechst-stained material, presumably DNA.

Conclusions:

These data demonstrate that DENV-NS1 is on the surface of megakaryocytic cells and platelets, for the first time suggesting that thrombocytopenia involves direct recognition of these cells by the immune response. These data also indicate a novel interaction between a viral protein and genetic material, possibly involving virus-induced expulsion of DNA from megakaryocytes, like NETs, prompting further investigation.

Freeze-dried plasma or freeze-dried platelet-rich plasma restores hemostasis as effectively as corresponding frozen products in a mouse model of hemorrhagic shock and trauma-induced coagulopathy

Abstract Author Names :

Louise Eltringham-Smith [1], Ishac Nazy [2], William Sheffield [3] *^

Abstract Summary :

Introduction: Traumatic injury leads to life-threatening bleeding and can impair coagulation. Patients with trauma-induced coagulopathy fare poorly. Plasma transfusion seems a logical intervention, but clinical evidence, particularly for pre-hospital administration, is contradictory. Resilient products such as freeze-dried plasma (FDP) or freeze-dried platelet-rich plasma (PRP; FDPRP) would be logistically easier to administer in pre-hospital environments. We developed a mouse model of hemorrhagic shock with liver laceration (HS/LL) (Eltringham-Smith LJ et al, Sci Rep. 2023 Mar 7;13(1):3811), finding that fluid resuscitation with murine fresh-frozen plasma [mFFP] restored hemostasis and eliminated coagulopathy.

Objective: To determine if freeze-drying impaired the ability of murine fresh-frozen plasma (mFFP) or murine PRP to restore hemostasis and eliminate coagulopathy in the HS/LL model.

Design and Methods: Anesthetized male or female CD-1 mice were bled via the carotid artery to an arterial pressure of 35 ± 5 mm Hg. After 60 minutes of shock, mice were fluid-resuscitated by intravenous infusion of treatment fluid equal in volume to the withdrawn blood. FDP and FDPRP were reconstituted with sterile water just prior to use, while mFFP and frozen PRP was thawed. A through-and-through scalpel injury of a liver lobe was performed and shed blood was collected into a tared receptacle and weighed. PTs were determined for plasma sampled before HS (Pre) or after resuscitation and LL (Post).

Results: Sham-treated mice subjected to all procedures except HS lost 90 ± 40 mg of blood (mean of n=6 ± SD is reported throughout). Blood losses were 2.7-fold greater than sham ($p < 0.001$ by ANOVA with post-tests) in HS/LL mice resuscitated with saline (240 ± 40 mg). In contrast, mice treated with mFFP, FDP, frozen PRP, or FDPRP lost amounts of blood that did not differ statistically from sham-treated mice and were significantly less than in the saline-treated cohort (140 ± 40, 130 ± 50, 100 ± 30, and 100 ± 30 mg, respectively, p versus saline < 0.01 in all cases). There was no significant difference between mFFP and FDP or between PRP and FPPRP (by two-tailed Mann-Whitney test [MW]). Pre- and Post-HS/LL PT values did not differ in any group except for saline (Pre-, 9 ± 2 s, Post-, 16 ± 8 s, $p = 0.026$ by MW).

Conclusions: In the HS/LL anesthetized mouse model, fluid resuscitation with FFP or frozen PRP restored hemostasis and eliminated coagulopathy irrespective of freeze-drying. Human-equivalent forms of plasma or PRP could improve outcomes in pre-hospital trauma patients. More research is needed to characterize microparticles in FDPRP and to explore the possibility that lower volumes of FDPRP than FDP would retain efficacy.

Prevalence of weak D phenotypes in the general population of Québec: A focus on weak D type 42

Abstract Author Names :

Mathieu Drouin [1], Samuel Rochette [2], Maryse St-Louis [3], Antoine Lewin [4], Josée Laganière [5] * ^

Abstract Summary :

Introduction/objective: In predominantly White populations, weak D types 1, 2, or 3 are generally the most prevalent weak D phenotypes. One notable exception is the province of Québec, Canada, where weak D type 42 (conferred by *RHD*01W.42*) is overrepresented over other weak Ds. The epidemiology of this phenotype is, however, not well documented in the general population. Therefore, a genetic screening was performed to estimate the prevalence of weak D type 42 and other common weak D phenotypes.

Design and methods: PCRs were performed to screen for *RHD*01W.42* alleles among 1000 participants of CARTaGENE - a population-based cohort representative of Québec adults aged 40-69 years. The prevalence of weak D type 42 was calculated based on the allele frequency of *RHD*01W.42* and d (i.e., all recessive alleles that confer a D- phenotype), assuming a Hardy-Weinberg equilibrium. This prevalence was then leveraged to calculate that of other common weak D phenotypes, using published prevalence estimates among weak D phenotypes.

Results: Two individuals out of 1000 harbored the *RHD*01W.42/RHD*01* heterozygous genotype. Assuming an allele frequency of 38.19% for *d*, the prevalence (95% confidence interval [CI]) of weak D type 42 was 0.08% (0.00%–0.25%) in the overall population, 0.10% (0.00%–0.32%) in White individuals with Canada-born parents, and 0.11% (0.00%–0.37%) in White individuals with Canada-born parents and grandparents (**Table**). The following prevalence estimates (95% CI) were also obtained: 0.44% (0.13% – 1.08%) for all weak D phenotypes; 0.07% (0.00%–0.23%) for weak D type 1, 0.01% (0.00%–0.09%) for weak D type 2, 0.04% (0.00%–0.16%) for weak D type 3, and 0.24% (0.00%–0.55%) for other weak D phenotypes.

Conclusions: Québec has the highest documented prevalence of weak D type 42, which was estimated at 0.08%. The higher estimates among White participants with Canada-born parents and/or grandparents support a founder effect. These results may prove useful to conduct risk analyses that will inform the management of patients with weak D phenotypes.

Acknowledgments: The authors thank Josée Perreault for RHD primers, and Marie-Claire Chevrier and Gabriel André Leiva for their comments.

Table. Estimated prevalence of weak D type 42 in Québec, overall and among subgroups of interest

Genotype	Allele frequency 1 (95% CI) [A]	Allele frequency 2 (95% CI) [B]	Genotype frequency (95% CI) [A × B]
Overall population			

*RHD*01W.42/d*	0.10 (0.00–0.29)	38.19 (35.19–41.19)	0.04 (0.00–0.14)
*d/RHD*01W.42*	38.19 (35.19–41.19)	0.10 (0.00–0.29)	0.04 (0.00–0.14)
*RHD*01W.42/RHD*01W.42*	0.10 (0.00–0.29)	0.10 (0.00–0.29)	0.0001 (0.00–0.01)
		Total:	**0.08 (0.00–0.25)**
White, with Canada-born parents			
*RHD*01W.42/d*	0.13 (0.00–0.38)	38.19 (34.76–41.62)	0.05 (0.00–0.21)
*d/RHD*01W.42*	38.19 (34.76–41.62)	0.13 (0.00–0.38)	0.05 (0.00–0.21)
*RHD*01W.42/RHD*01W.42*	0.13 (0.00–0.38)	0.13 (0.00–0.38)	0.0002 (0.00–0.01)
		Total:	**0.10 (0.00–0.32)**
White, with Canada-born parents and grandparents			
*RHD*01W.42/d*	0.15 (0.00–0.44)	38.19 (34.53–41.85)	0.06 (0.00–0.24)
*d/RHD*01W.42*	38.19 (34.53–41.85)	0.15 (0.00–0.44)	0.06 (0.00–0.24)
*RHD*01W.42/RHD*01W.42*	0.15 (0.00–0.44)	0.15 (0.00–0.44)	0.0002 (0.00–0.01)
		Total:	**0.11 (0.00–0.37)**

Abbreviation: CI = confidence interval

Sex-matched compared to sex-mismatched red blood cell transfusion: a pilot randomized controlled trial

Abstract Author Names :

Michelle Zeller [1] *^, Richard Cook [2], Donald Arnold [3], Jeannie Callum [4], Bram Rochwerg [5], Jason Acker [6], Nour Alhomsi [7], Yulia Lin [8], Yang Liu [9], Kayla Lucier [10], Shuoyan Ning [11], Jungyoon Jane Park [12], John Principato [13], Ziad Solh [14], Theodore Warkentin [15], Kathryn Webert [16], Nancy Heddle [17]

Abstract Summary :

Introduction/Objective: Red blood cell (RBC) transfusions are selected based upon donor/recipient blood group compatibility. Whether RBCs should be selected based on donor sex is uncertain. This pilot randomized controlled trial (RCT) was designed to assess feasibility of a study examining impact of donor and recipient sex-matched RBC transfusions compared to sex-mismatched RBC transfusions on recipient mortality in critically ill adult patients.

Design/Methods: This was an allocation concealed, blinded, pilot RCT with pragmatic features conducted at five Ontario hospitals from January-May 2022. The study was conducted with staggered site activations to identify and overcome potential barriers in the first 130 of 400 patients randomized. We enrolled consecutive hospitalized adult patients (age ≥18) admitted to the intensive care unit (ICU) who were prescribed RBC transfusion for any indication. We excluded patients who required non-standard RBC units (e.g., phenotypically matched, rare blood, washed, complex RBC antibodies, etc.), ≥4 units of blood/massive hemorrhage protocol/urgent request for blood at the time of randomization, sex unknown or intersex. We employed a waived consent model.

Eligible patients were randomized to receive donor sex-matched or sex-mismatched RBC transfusions until hospital discharge or death. Feasibility targets were assessed for the final 270 of 400 patients and included: eligible patients randomized >80%; recruitment compliance >90%; and protocol adherence >90%. We also collected patient-important clinical outcomes such as 30 day in-hospital mortality and hospital length of stay. Post hoc, we conducted quality control assessment of masked (colour-coded) male and female labels for 20% of the RBC units.

Results: We found 79% of eligible patients were randomized, recruitment compliance was 97%, and protocol adherence was 88%. Feasibility metrics varied across study sites and generally improved over time following refinement of protocol exclusion criteria and enhanced training procedures. Forty-two percent of recruited patients were transfused prior to randomization; among those, approximately one-third received their first RBC transfusion in the ICU. Overall, in-hospital mortality rate was 29%. A total of 6,576 units of RBCs were labelled for the study; 1,320 units were checked (20%), with a total of 6 units discrepant (0.5%) across all sites (all discrepancies were corrected prior to RBC issue).

Conclusions: This pilot study demonstrated that a larger RCT examining the role of sex-matching versus sex-mismatched RBC transfusions in critically ill patients is feasible with ongoing efforts to ensure all eligible patients are captured. This pilot trial will inform design of a larger trial.

Acknowledgements: This study was funded through a CIHR Project Grant. The study team recognizes with gratitude support from medical laboratory technologists and research staff at participating centres. We thank members of the Independent Data Monitoring Committee, Technical Resource Committee, and Steering Committee for their contributions.

SARS-CoV-2 seroprevalence in blood donors: Three years of Canada-wide monitoring

Abstract Author Names :

Sheila O'Brien [1] *^, Qi-Long Yi [2], Niamh Caffrey [3], Chantale Pambrun [4], Steven Drews [5]

Abstract Summary :

INTRODUCTION/OBJECTIVE: Blood services world-wide informed pandemic public health policy through sero-surveillance. Data were used to plan and evaluate the impact of interventions (eg. vaccination, restriction implementation/scale-back). By January 2022 with Omicron the dominant variant, public health case/contact testing was scaled back. Waste-water surveillance at sentinel sites indicated increasing infections, but only sero-surveillance could monitor the infection rate. The objective was to monitor infection and vaccination mediated SARS-CoV-2 antibodies in blood donors over the pandemic.
DESIGN and METHODS: From April 2020 to the January 2023 cross-sectional samples of blood donors at all Canadian Blood Services locations were included (all provinces except Quebec). From April to December 2020 the Abbott SARS-CoV-2 antibody assay detected IgG nucleocapsid antibodies (anti-N). From January 2021 onwards the Roche Elecsys anti-SARS-CoV-2 antibody assays detected total antibodies to spike protein (anti-S) and anti-N. Seroprevalence was standardized to population-level demographics and adjusted for assay characteristics using the Rogan-Gladen equation.
RESULTS
Up to January 31, 2023, 695,995 samples were tested. Anti-N seroprevalence was low over 2020 (less than 2%). In 2021 anti-N increased from 2.24% (95% CI 2.08, 2.41) in January to 6.39% (95% CI 6.01, 6.76) in December. With vaccine roll-out the percentage anti-S positive increased from 2.80% (95% CI 2.60, 3.00) in January to 98.58% (95% CI 98.34,98.82) by December 2021. With the emergence of the Omicron variant anti-N seroprevalence increased to 76.72% (95% CI 76.25, 77.19) by January 2023. Anti-N positivity was highest in 17-24-year old's (86.55%; 95% CI 85.46, 87.63), racialized donors (81.95%; 95% CI 80.97, 82.94) vs white (75.44% 95% CI 74.91, 75.98), and those in materially deprived neighbourhoods (78.49%;

95% CI 76.91, 80.07 vs 75.44 95% CI 74.51, 76.38).

CONCLUSIONS

Anti-S seroprevalence reflected high uptake of vaccine in donors. SARS-CoV-2 seroprevalence due to natural infection was low until 2022 but despite vaccination increased rapidly when the Omicron variant dominated. Racialization and material deprivation are important predictors of higher infection rates. Ongoing monitoring of seroprevalence has been important for public health policies over the pandemic. Monthly reports were provided to national and provincial public health departments. A national seroprevalence rate incorporated seroprevalence test results from other studies with the majority of data points from blood donor sero-surveillance.

ACKNOWLEDGEMENTS

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