CSTM 2022 Abstract Booklet

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Abstract ID :

Examining the CONCOR-1 Rollout in British Columbia to Inform Improvements to Clinical Trial Implementation During Pandemics

Type of abstract : Administrative

Abstract Summary :

Introduction

CONCOR-1 was a multicentre randomized control trial assessing the therapeutic potential of COVID-19 convalescent plasma (CCP) in 72 sites, including 4 sites in British Columbia (BC). We sought to reflect on the implementation of the trial in BC, to find successes and areas for improvement that may guide planning for therapeutic trials during pandemics. The main objectives were to: 1) create a process map for the delivery of CCP from donor to bedside, 2) perform semi-structured interviews of key stakeholders and qualitative analyses to derive themes identifying their facilitators and barriers, and 3) produce knowledge translation (KT) outputs to disseminate learnings.

Design and Methods

Our retrospective qualitative study performed process mapping visualized using a Unified Modeling Language (UML) activity diagram; and interviews of key stakeholder groups representing Canadian Blood Services (CBS), clinical trials administration, hospital/community care settings, public health, universities, and patient partners. Interview subjects were identified with guidance from an advisory committee with membership from these groups. Thematic analysis was carried out using NVivo software with two independent investigators where discrepancies were resolved by consensus. A KT expert guided design of outputs.

Results

The UML diagram demonstrated complex and productive interactions between stakeholder groups in implementing CONCOR-1 in BC. Qualitative data from 18 interviews/focus groups was categorized into four themes, each with identified facilitators, barriers, and recommendations: 1) treatment and trial equity, 2) pandemic preparedness, 3) formal and informal collaborations, 4) donor and patient recruitment. Future trial implementation opportunities include improving data sharing with public health, connecting academic committees coordinating research-to-hospital operational approval processes, coordinating contracts between participating sites and the University of BC (UBC), and prioritizing hospital study patient enrollment. Knowledge translation outputs will include: a summary report aimed towards transfusion and academic stakeholders, infographics of recommendations, input into the BC Ministry of Health Rapid Visioning for Clinical Trials process, scientific publications, revising pandemic plans to include implementing therapeutic trials, and a call-to-action proposal for engaging remote and Indigenous communities of care to benefit from therapeutic trials.

Conclusions

CONCOR-1 represented a unique circumstance of implementing research as care during a global pandemic. A reflective approach revealed important barriers and facilitators for clinical trial implementation and will help efforts to improve BC's clinical trial ecosystem, notably for feasibility, treatment equity, and pandemic planning.

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Abstract ID :

A "Bridge" to the future of Blood Administration

Type of abstract : Administrative

Abstract Summary :

A "Bridge" to the Future of Blood Administration

Introduction:

Transfusion Medicine practice is constantly evolving as new technology and evidence-based practice leads the way for safer and more efficient processes.

September 2020, London Health Sciences Centre (LHSC) began a pilot for "Bridge", an electronic scanning process for administration of Blood Components. LHSC saw a significant benefit to patient safety and decreased error rates after the introduction of scanning technology for sample collection in 2018.

"Bridge" incorporates the scanning of both patient and product to ensure safety. Another benefit of the "Bridge" program is that the scanning technology acts as the second check, eliminating the need for a second person.

Design and Methods:

The scanning technology verifies right patient and right product.

It uses positive patient identification barcode scanning of the patient armband to verify patient ID. All patients must have an armband on their person before the application can be used.

The verification of the product is checked through barcode scanning on the blood product label. (checking product type, unique identification number, Blood group and RH, and expiry date of the product)

It is still the responsibility of the Health professional administering the blood to confirm the order, confirm there is a in date group and screen, confirm a consent for transfusion has been obtained, visually inspect the blood for any abnormalities and do all the expected checks of patient and product. There is a prompt when Bridge is accessed to confirm these pre-checks have been completed.

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

The pilot went well. Clinical Informatics team developed training materials, and provided in person support during the go-live. The plan is to roll out the "Bridge" technology to all of LHSC April of 2022. St. Josephs Health Centre (SJHC) went live Nov 2021.

Results

Specimen collect barcode scanning was implemented at LHSC in 2018. Significant improvements have been seen in reduction of errors since its implementation showing that barcode technology improves patient safety and decreases error rate significantly. From the "Bridge" pilot we noted that Transfusion Reaction reporting was also more consistent with more complete documentation.

Conclusion

As technology has improved, Patient safety has improved and the functionality of barcode scanning has introduced a "Bridge" for safer and more efficient blood administration for the future.

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LHSC Bridge working Group

The staff of LRCP Oncology Day Unit

Transfusion Medicine Lab

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Abstract ID :

Current State of Technical Transfusion Medicine Practice for Pre-hospital Transfusion in Canada

Type of abstract : Administrative

Abstract Summary :

Introduction

Pre-hospital transfusion has been associated with improved patient outcomes in major-trauma patients when transport times were greater than 20 minutes. Pre-hospital transfusion programs (PHTPs) are emerging across Canada with a dearth of literature to guide their implementation. We sought to gather technical transfusion medicine (TM) specific practices across Canadian PHTPs for reflection.

Design and Methods

A survey was sent to TM technical practice leads and technologists, from British Columbia (BC), Alberta, Saskatchewan, Ontario, and Nova Scotia in September-January 2021-2022. Data regarding transport, packaging, blood products, and inventory were included; reported descriptively. Survey results were confirmed in two virtual meetings and email communications with TM technical and medical leads. Only practices involving blood on board program blood products for emergency use were included.

Results

PHTPs focus on helicopter emergency medical service programs, with some supplying fixed-wing aircraft and ground ambulances. BC and Ontario PHTPs have potential to expand to multiple bases.

All PHTPs provide 1-3 coolers, with 2 O/K negative red blood cell units (RBCs) per cooler; with BC piloting coolers containing RBCs and 2 units of pre-thawed group A plasma. PHTPs are considering implementing clotting factor concentrates. Inventory exchanges are scheduled and blood products are returned to TM inventory using visual inspection and internal temperature data logger readings. Data loggers with visual displays and external probes in 33% glycerol bottles are used in Alberta, to confirm storage temperatures when the flight crew opens the cooler. All programs audit to manage wastage, though there is no consensus on appropriate benchmarks.

Credo 4L coolers used in all PHTPs, are validated to storage duration range of 72-124 hours. The storage conditions and restrictions for cooler transportation vary, where the majority of coolers are stored at room temperature.

Documentation and training programs vary across PHTPs. All programs have a process for documenting units issued, reconciliation after transfusion, and for transfusion reaction reporting.

Common considerations included: storage during extreme temperature environments, O-negative RBC stewardship, recipient notification, traceability, accreditation standards, clinical practice guidelines co-reviewed by TM, and a common audit framework.

Conclusions

PHTPs have many similarities throughout Canada, where harmonization may assist in further developing standards, leveraging best practice and national coordination. Further work is also needed to harmonize clinical practice, appropriateness, training, and quality benchmarks.

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Abstract ID :

Assessment for Learning: A Realist Evaluation of the Portfolio in the Transfusion Medicine Area of Focused Competence Program

Type of abstract : Administrative

Abstract Summary :

Introduction/Objective:

The Area of Focused Competence (AFC) in Transfusion Medicine was approved in 2011 as a competency-based portfolio for post-residency training. To better understand how the assessment portfolio affects learning outcomes and the achievement of competence in Transfusion Medicine, we performed a realist evaluation of the program.

Design and Methods:

A realist approach to analysis was used to ascertain for whom the portfolio was working, under what circumstances, and why (context, mechanism, outcome). Semi-structured interviews were carried out with 24 individuals. These participants included various stakeholders (current trainees, previous trainees, teachers, and curriculum developers). Interview transcripts were coded thematically using a deductive approach to identify possible contexts, mechanisms, and outcomes.

Results:

Multiple interim program theories were identified amongst the various stakeholder groups. Integrating and refining the interim program theories across stakeholder groups, we obtained the following key program theories (context [C], mechanism [M], outcome [O]):

1. Learners incorporate the feedback provided by faculty [M] through the perspective of their prior experience [C] to increase their knowledge base in the specialty [O]
2. The portfolio promotes the building of a sense of community within the Transfusion Medicine field [O] by enabling learners to work closely with allied health, laboratory personnel, and transfusion medicine specialists [M] at their training institutions [C]
3. Self-directed learners [C] view the portfolio as a valuable resource for future reference [O], as items are created through review of recent literature [M]
4. The portfolio provides a level of standardization and accountability [O] by outlining milestones that trainees are expected to accomplish [M], and this is achievable as there are few transfusion medicine trainees [C]

Conclusions:

The completion of a competency-based portfolio that reflects the actual work of practicing transfusion medicine specialists supports the development of competence. Mechanisms including experiential learning, assessment for learning, and self-determination theory may support the educational value of the portfolio. These findings support the ongoing use of the Transfusion Medicine AFC portfolio, and its use should be evaluated in other programs.

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Abstract ID :

A National Blood Center-based Transfusion Medicine Rotation

Type of abstract : Administrative

Abstract Summary :

Introduction: Post-graduate trainees from several specialties require transfusion medicine (TM) competency as part of Royal College requirements. Residents have traditionally learned TM from hospital transfusion services and Canadian Blood Services centers located in communities across Canada. The educational experience and content varied depending on locally available expertise. With increasing teaching and training constraints arising during the pandemic, a national virtual blood center-based curriculum in TM has been developed. This program brings together trainees from different specialties and universities in a 2-week rotation that provides a collaborative, standardized blood center curriculum that capitalizes on education delivery by experts from across Canada.

Design: Topics were developed from curriculum provided to TM subspecialty trainees and adapted to serve trainees with diverse backgrounds, competency requirements, and with a need for more general TM knowledge. The curriculum was focused on aspects of TM that are unique to the blood center experience and not available as part of hospital TM training. The program is intended to impart understanding of the blood system in Canada and to clarify the ways in which physicians interact with the blood supplier including means of accessing programs, products and expertise, as well as regulatory requirements such as reaction reporting. The topics fit into six broad themes with subcategories:

1. Donor selection and blood collection
2. Donor testing: transmissible disease, blood group serology
3. Specialized products: HLA/HPA platelets, rare blood, stem cells
4. Component production
5. Specialized patient testing: perinatal, immunohematology reference, RBC antigen genotyping
6. Communication with the blood center: national blood inventory, utilization, transfusion reaction reporting

The content is delivered as 19 interactive lectures accompanied by a knowledge translation project directed to a donor or general medical audience.

Results: Over two years, 18 trainees from 6 institutions (9 trainees per year) were enrolled in the program. The specialties included 6 adult/pediatric hematology; 10 hematopathology; and 2 others. All trainees agreed that the rotation increased their awareness of the activities and functions of a blood center, and 89% agreed that the rotation increased their overall TM knowledge.

Conclusions: The program has provided a standardized collaborative learning experience for diverse trainees while maximizing contact with national experts. It serves as a compliment to TM Boot Camp which provides clinical TM training. Future plans include development of a digital library of lectures, performance of a needs assessment, and formal evaluation studies.

Acknowledgements: Julia Gilmore (coordinator) and all of our dedicated program educators.

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Abstract ID :

Reduction of Red Blood Cell (RBC) Storage in Operating Room (OR) Satellite Refrigerators at Foothills Medical Centre (FMC)

Type of abstract : Administrative

Abstract Summary :

Introduction:

FMC Transfusion Medicine (TM) identified >80% of RBC units dispensed to ORs were returned unused. This pre-op RBC ordering practice 'in case of bleeding' resulted in a 'floating'/inaccessible inventory of >30 units daily.

There was a risk to quality of the returned RBC units if they were stored/handled improperly while out of TM. TM was cited in Health Canada (HC) inspections for inadequate documentation/tracking to show RBC units were stored appropriately.

Objectives:

Achieve >10% reduction in overall volume of RBC units dispensed to OR and returned unused; maintain storage of RBC units in TM to reduce 'floating' inventory; reduce incidence/risk of RBC waste/compromise; comply with HC regulations.

Method:

Data for FMC ORs Nov 1, 2018 – Jan 31, 2019 showed 81% of RBC sent to ORs were returned. This data was sent to all OR prescribers in individual-blinded format and in aggregate, enabling assessment of individual practice and comparison to colleagues.

Prescribers were informed of problems/risks related to current practice and the HC citation. Prescribers were asked to examine RBC ordering practice for appropriateness and potential areas of improvement, to achieve overall goal to reduce rate of return by 10%.

Results:

Year 1 (Nov 1, 2018 – Jan 31, 2019):

- 958 cases (893 patients)
- 81% RBC dispensed were returned

Year 2 (Nov 1, 2019 –Jan31, 2020):

- 765 cases (725 patients)
- 819 less RBC ordered overall, 12% reduction in RBC returned
- 69% RBC dispensed were returned
- Cardiovascular (CV) service reduced pre-ordering protocol from 4 RBC to 1 RBC for uncomplicated cases

Year 3 (Nov 1, 2020-Jan 31, 2021):

- 746 cases (706 patients)
- 940 less RBC ordered overall, 8% reduction in RBC returned
- 73% RBC dispensed were returned

Conclusion:

RBC return rate was reduced 12% in Year 2 and 8% in Year 3 of study. CV Service reduced pre-ordering by 75% –gains were impacted by 1 major bleed, but still resulted in 50% overall reduction from original pre-ordering protocol. No other surgical departments engaged in specific opportunities for improvement.

Additional efforts could result in further improvements, sustainability of results, and maintain compliance with HC regulations. Refrigerators with ability to track RBC storage will be implemented 2022/2023. Development of a Maximum Surgical Blood Ordering Schedule to guide prescriber orders could be of benefit.

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Abstract ID :

Implementation of “Blood on Board”: Ontario’s First Pre-Hospital Transfusion Program

Type of abstract : Administrative

Abstract Summary :

Introduction

Blood on Board is a collaborative program between Ornge and Sunnybrook Health Sciences Centre's Transfusion Medicine and Tissue Bank (TMTB). Founded based on the need for pre-hospital transfusion, the objective of the program was the provision of red blood cells (RBCs) in coolers for Ornge air medical transports, allowing RBCs to be taken directly to the scene or sending facility.

Design and Methods

To ensure that the acceptable temperature and the product's integrity are maintained for safe transfusion during storage, a prospective validation was performed on the Crēdo ProMed™ Series 4 472 cooler for storage of two RBCs between 1°C and 6°C. The cooler was validated both closed and with openings at laboratory room temperatures, and in-flight in summer temperatures. The internal temperature of the cooler was continuously monitored using a data logger. The duration of time the cooler was able to maintain storage temperatures was used to determine the appropriate cooler exchange schedule.

The RBC utilization metrics and deviations were gathered and reviewed at the end of each month by TMTB and Ornge as part of the ongoing evaluation of the impact of the program on patient care and RBC usage.

Results

The Crēdo ProMed™ Series 4 472 cooler was validated to maintain appropriate storage temperatures of up to two RBC units for up to 96 hours, allowing coolers to be exchanged on a 3 time-per-week schedule. Unscheduled exchanges are requested by paramedics upon breaking the tamper-evident seal of the cooler.

From the launch of the program on August 31, 2021 to Feb 28, 2022, a total of 33 RBC units have been transfused, 6 RBC units discarded, and no transfusion reactions noted. One discrepancy in reconciliation was noted with a transcription error that was promptly corrected. Deviations early in the program included inaccurate high temperature alerts due to the packaging process. More recent deviations included ensuring patient information is completed and returned.

Conclusions

The implementation of Blood on Board has allowed air transport paramedics to bring two RBCs directly to the scene or sending facility. The ongoing tracking of utilization metrics and deviations ensures 100 % traceability of the RBC units and highlights areas of ongoing improvement. Currently, a validation is being conducted for the use of the cooler under winter temperatures.

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Abstract ID :

Creating a Documented Ongoing Competency Assessment Program in the Transfusion Medicine Laboratory

Type of abstract : Administrative

Abstract Summary :

Background

There are high-risk and/or Health Canada regulated activities in the Transfusion Medicine Laboratory that require routine competency assessment. Clinicians and patients are dependent on technologists performing these procedures in a timely and confident manner with accuracy. In 2014, an annual competency assessment program for high-risk procedures was developed and evaluated procedures for massive transfusion protocols and neonatal resuscitation syringes.

The program involved the following learning activities: pre-assessment survey, reading of the standard operating procedure (SOP), competency questions, direct observations, and post-assessment survey. The surveys confirmed an increased comfort-level in performing these procedures ranging from 20-40% in 2014 to above 95% in 2018. There is a desire to expand this program to include other high-risk procedures.

Methods

- Determine what activities and procedures need to be assessed.
- Determine the frequency of the assessments.
- Create the learning activities including quizzes and direct observations.
- Create an SOP that outlines the necessary steps to maintain and expand the program.
- Review this program regularly to ensure it meets current needs and standards.

Results

The following activities and procedures were identified to be included in the program: massive transfusion protocol, emergency release, neonatal resuscitation syringes, irradiation, reconstitution and pooling of plasma protein products, and transport of blood components and products. An initial decision was made to perform the competencies annually. The number of procedures requires us to spread these out over the year. We will review the feasibility of the intense schedule at year end. The same quizzes and direct observations that are used for the initial orientation will be used in this program as they are updated on a regular basis. An SOP was developed to outline the pillars of the program: schedule, communication, completing the learning activities, and compliance of the transfusion medicine sites.

Conclusion

Annual competency programs are valuable education tools to build confidence and competency. Having a robust program that includes a schedule, learning activities, and a procedure will help maintain a group of confident and competent technologists. Once a high level of competency has been achieved, the frequency in which these specific high-risk procedures are performed should be evaluated. This program complements nicely with our simulation program.

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Abstract ID :

Bloody Easy at 20.

Type of abstract : Administrative

Abstract Summary :

Introduction: Canadian Standards for Blood and Blood Components (CAN/CSA-Z902) state hospitals *shall* provide evidence of ongoing education and competency assessment of all healthcare professionals involved in transfusion activities. Provincial laboratory accreditation programs assess compliance with these standards. A mandate of the Ontario Regional Blood Coordinating Network (ORBCoN) is to provide educational resources to promote patient safety and best transfusion practice, and to support compliance with these standards.

Design: The Bloody Easy handbook, available in print and electronic form, summarizes the evidence and practical information required to guide currently acceptable standards of clinical practice, including pre-transfusion screening of requests for compliance with treatment guidelines. Bloody Easy has been regularly updated with four widely distributed editions appearing over the last 20 years, and 2022 brings a new fifth edition incorporating information on recent advances in transfusion practice.

Results: "Bloody Easy 5" (BE5) is a 145 page handbook available in hardcopy and accessible electronically at www.transfusionontario.org. It incorporates the evolving tenets of "Patient Blood Management" and "Choosing Wisely" campaigns to promote adjuncts and alternatives to blood products, and to eliminate unnecessary testing of patients. In this iteration of Bloody Easy, the following major important updates have been addressed:

- Cryoprecipitate has been eliminated from the inventory of components as it has been effectively replaced with safer, purified products with which more precise treatment and dosages are possible.
- Information on the science behind, and practice changes required for, the use of pathogen-reduced platelets has been added.
- Information on newly available "Solvent Detergent" (SD) plasma has been included.
- Guidelines for prescribing platelet transfusion have been extensively reviewed in conjunction with the analysis of the recent platelet transfusion audit in Ontario.
- Recommendations of the recently published Massive Hemorrhage Protocol (MHP) have been incorporated into the section on massive transfusion.

Conclusions: The field of transfusion medicine is rapidly evolving with new products, updated recommendations defining best practice and evidence that clinical education is needed. Bloody Easy has become a resource for promoting up-to-date transfusion practices and for supporting ORBCoN's mandate to advance the quality of the use of blood components, products and alternatives.

Acknowledgments: The authors would like to acknowledge and thank those individuals who contributed by providing images, technical editing and/or proofreading of this fifth edition.

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Abstract ID :

Plasma Protein Redistribution During Three Lockdowns

Type of abstract : Administrative

Abstract Summary :

Background: Over the last 15 years Ontario has seen great improvement in utilization of blood components and products in the hospital setting. To achieve such a great accomplishment, hospitals need to rely on best practices in utilization and inventory management. Ontario Regional Blood Coordinating Program (ORBCoN) fosters this by providing mechanisms for redistribution to help with inventory management best practices. Due to the pandemic, Ontario dealt with 3 lockdowns that affected the ability for hospitals to redistribute plasma protein and related products (PPRP).

Method: Using the data collected through the PPRP program facilitated by ORBCoN and Factor Concentrate Redistribution Programs (FCRP), trends were analyzed to measure the effect of the lockdowns and the ability to redistribute near to outdating PPRP.

Result: During the initial lockdown between March and May 2020, the redistribution program was suspended, due to restricted access to hospitals for both patients and couriers. Two hundred and sixty-six (266) vials were reported as expired during this time compared to the previous year of 22 vials. During the second lockdown between December 2020 and January 2021, 260 vials were reported as expired and during the third lockdown between April 2021 and May 2021 there were a total of 39 vials expired. We also seen an increase in the amount of product that was wasted (22 vials) due to delays in transit as a result in courier issues. As a result of the lockdowns, it was estimated that the loss of product due to expiry and wastage cost $730,000.

Conclusion: Ontario hospitals saw an increase in the product outdating, as reduction in services required less blood and plasma derivatives. This resulted in less opportunity to redistribute. There was an increase in the amount of homecare products being issued to patients to reduce the patient's exposure to hospital environment. This may have resulted in the decrease in patients' willingness to return to the facility to pick up near to expiring products as they would have pre-COVID. Reliability in courier services was waned during the pandemic. Restricted access to hospital facilities and reduced staffing caused and increase in wastage and increase doubt that products could be delivered in a timely manner. These observations will be shared with the provincial blood shortage contingency plan working group so that consideration for courier issues and issuing increased vials of homecare products be factored in when relying on redistribution initiatives to help with increase access to PPRP.

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Abstract ID :

Website and Digital Engagement

Type of abstract : Administrative

Abstract Summary :

Background: Following the 2020 pandemic, it became imperative to offer all our resources and services through digital means to continue reaching our strategic goals. Social media was identified as one of the potential means of communications and distribution, and so we started incorporating it in our marketing strategy to continue engaging and strengthening relation with stakeholders, providing accessible, relevant learning resources, and reaching the transfusion medicine community in the digital ecosystem that may not have been possible otherwise. Following the implementation phase, data was reviewed to determine effectiveness of the platforms to ensure we continued to meet the needs of the end users.

Method: ORBCoN started investing in digitalization. This included hosting site visits, conferences, and events virtually using Zoom and Microsoft Teams. We partnered with Surge Learning to provide a more secure, accessible, and improved eLearning experience to replace the Bloody Easy Blood Administration (BEBA) and Bloody Easy Lite. We ensured to keep the website updated and its performance was monitored regularly to ensure cyber security. A social media strategy was created and implemented to be used as an efficient alternate for communication to promote our site and resources.

Results: ORBCoN seen an increase in attendance of approximately 32% from 2020 to 2021 in all of the online events held. There has been an increase in number of followers on ORBCoN's social media platforms by over 70% from 2020 to 2021. Participation in annual site visits seen an increase in the number of attendees that included more Transfusion Medicine directors and Canadian Blood Services Medical Directors. By providing resources digitally and implementing an effective social media strategy, ORBCoN has seen an increase in the number of users coming through social channels and organic search.

Conclusion: By focusing more on our online & social media presence and increasing the security of the website, ORBCoN has been able to continue providing educational resources, increase website user retention and customer loyalty on social media. ORBCoN has been able to continue providing educational resources and be accountable to our stakeholders by inspiring and facilitating best transfusion practice in Ontario.

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Abstract ID :

Assessing the impact of donor and manufacturing characteristics on hemoglobin increments following red blood cell transfusion in Canada

Type of abstract : Clinical

Abstract Summary :

Introduction / Objective

Each red blood cell (RBC) unit is a unique biologic product from an individual donor. Differences in manufacturing represent additional factors that add variability among units. Both donor and manufacturing characteristics have been associated with increased mortality in transfusion recipients. The effects of donor and manufacturing characteristics on RBC survival in recipients have not been well studied, and never in the Canadian context. Our study assessed the impact of donor and manufacturing characteristics on post-transfusion hemoglobin increments in patients at a tertiary care Canadian hospital.

Methodology

We performed a longitudinal cohort study linking donor and manufacturing data from Canadian Blood Services to data for inpatients and outpatients receiving a single-unit transfusion (single unit transfused in 24-hour period) at the Ottawa Hospital from 2006-2019. Donor data included age, gender, blood group, pre-donation hemoglobin and number of donations. The manufacturing/component data included production method (whole blood vs. red cell filtered), duration of hold, storage duration, unit volume, bag manufacturer, washing, and irradiation. Recipient data included age, gender, blood group, hemoglobin, diagnosis, and previous transfusions. Our primary outcome was 24-hour post-transfusion hemoglobin increment. Secondary outcomes included changes in hemoglobin (immediate to 7-days) and time to next transfusion. Univariate and multivariable analyses evaluated associations between post-transfusion hemoglobin increments and donor/manufacturing characteristics.

Results

Of 397,507 RBC units transfused at the Ottawa Hospital, 49,242 single-unit transfusions were evaluable. The mean donor age was 48.1 years, 41.8% were female and the average pre-donation hemoglobin was 138 g/L (female) and 152 g/L (male). 85.3% of units were collected in CPD/SAGM, and 57.7% underwent red cell filtration. The mean duration of hold prior to RBC production was 20.3 hours. The mean 24-hour post-transfusion increment was 7.8 g/L. Donor male sex, higher hemoglobin and ABO type were associated with higher 24-hour hemoglobin increments on univariate analysis, but only hemoglobin level and Rh were significant on multivariable analysis. For the manufacturing/component characteristics, longer hold, smaller unit volume, washing, longer storage duration and bag type were associated with lower 24-hour hemoglobin increments on multivariable analysis.

Conclusion

For donor characteristics, only hemoglobin and Rh were associated with changes in 24-hour hemoglobin increments as compared to a number of manufacturing characteristics that were significant. The latter represent important targets to improve the quality of RBC transfusions in Canada.

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Abstract ID :

Validating abstracted transfusion data at a large tertiary care Canadian hospital

Type of abstract : Clinical

Abstract Summary :

Introduction / Objective

The lack of a pan-Canadian transfusion database hinders benchmarking real-world practice, determining areas for improvement, and forecast planning of blood inventory. The Canadian Institute of Health Information (CIHI) collects transfusion data from Canadian hospitals for all abstracted hospital encounters. The accuracy of this abstracted transfusion data needs to be verified to determine whether it may be a worthwhile source of national transfusion information. This study sought to validate the accuracy of abstracted transfusion data at a large academic tertiary care Canadian Hospital.

Methods

All abstracted encounters at the Ottawa Hospital were pulled from the hospital's Health Records abstracting system. For validation, abstracted transfusion data was compared to transfusion data from the hospital's source transfusion information system. Data were pulled from June to August of 2018, 2019, and 2020 to compare the accuracy of abstracted transfusion data over time, including following the adoption of a new electronic medical record (EMR) system at our hospital in June 2019. Sensitivity, specificity, and negative and positive predictive values (NPV, PPV) were calculated to assess the accuracy of abstracted transfusion data, separately for each blood component and product.

Results

For inpatient admissions, the sensitivity of abstracted transfusion data was, on average, 0.98 for red cells, 0.91 for platelets, 0.85 for plasma, 0.53 for cryoprecipitate, and between 0.13 and 0.84 for fractionated plasma products. Specificity and NPV ranged from 0.99-1.00, while PPV varied between 0.06-0.96. For emergency department and day surgery encounters, the sensitivity and PPV of abstracted transfusion data were lower than for inpatient encounters, while the specificity and NPV were similar. The accuracy of abstracted transfusion data was lower immediately after the adoption of a new EMR system but improved by the following year.

Conclusion

The accuracy, particularly the sensitivity, of abstracted transfusion data at our hospital varied greatly by blood component and product, being highest for red cells (for every 100 inpatient encounters with red cells, approximately 98 were correctly classified), significantly lower for plasma (for every 100 inpatient encounters with plasma, about 85 were correctly classified), and lower still for plasma derivatives. Despite being a single-center study, our results provide insight on the validity of CIHI abstracted transfusion data as all hospitals follow the same abstracting manual provided by CIHI.

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Abstract ID :

Patient Characteristics of Transfused HHT Patients: a Single Centre, Retrospective Study

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective: Hereditary hemorrhagic telangiectasia (HHT) is a relatively common genetic blood vessel disorder. Patients require frequent red blood cell (RBC) transfusions for chronic blood loss, however, data on transfusion complications including RBC alloimmunization are sparse. This study describes the characteristics of transfused HHT patients in a single-centre cohort.

Design and Methods: Retrospective chart review was conducted at St. Michael's Hospital (SMH) in Toronto, Canada. All adult patients with diagnosis of HHT and hospital visits between January 1, 2011 and December 31, 2020 were identified using laboratory and hospital information systems. Demographic, disease-specific and transfusion-related data were collected from electronic medical records. Simple descriptive statistics were used to analyze the data. Institutional research ethics board approval was obtained.

Results: We identified 63 patients with a clinical diagnosis of HHT and who received transfusion compatibility testing at SMH. The median age was 70 years (STDV: 14.53) and 35 patients (56%) were female. Forty patients (63%) underwent genetic testing; 17 ALK-1 (42%), 13 endoglin (32%), and 1 SMAD4 (2%) mutation(s) were found. Regarding HHT symptoms, all patients had epistaxis, 62 (98%) had arterio-venous malformations/telangiectasia, and 51 (81%) experienced gastrointestinal bleeding. Iron-deficiency anemia was diagnosed in 61 patients (97%). RBC alloantibodies were found in 23 patients (36%); Anti-E (61%) and Anti-K (43%) being the most common. The number of RBC alloantibodies ranged from 1-6 per patient. Fifty-six patients (89%) received at least one RBC transfusion, with an average of 36.98 (STDV: 94.40) total units per patient. Blood was phenotypically matched for 29 (52%) and genotypically matched for 21 (38%) patients. Of the transfused patients, 6 (11%) experienced at least one transfusion reaction. All were minor and classified as febrile non-hemolytic transfusion reactions (FNHTR).

Conclusions: We describe a cohort of heavily transfused HHT patients in a single centre. We acknowledge that our sample may not be representative of general HHT patients and instead may represent the sickest patients. Alloimmunization rate was 36%, which is significantly higher than the general transfused population (3-5%) and another HHT cohort (15%). Transfusion reactions were uncommon and mild. Prophylactic RBC antigen matching for Rh and Kell antigens was introduced at SMH in 2012. Our results highlight and support this strategy in this highly transfused patient population.

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Abstract ID :

Survey of Plasma Transfusion Practices in Ontario: Transfusion Medicine Laboratory Perspective

Type of abstract : Clinical

Abstract Summary :

Introduction

Frozen plasma is a scarce resource that is inappropriately utilized in Ontario. A 2013 retrospective audit of plasma utilization in Ontario [Tinmouth 2013] revealed that 52% of plasma orders were inappropriate. Reasons for inappropriate orders were: 1) warfarin reversal; 2) patients with International Normalized Ratio (INR) < 1.5; and 3) elevated INR in the absence of bleeding or a planned procedure. Despite educational efforts following the first audit in 2008, there is a lack of measurable plasma ordering behavioral change. This study aims to identify the barriers to appropriate utilization from the laboratory perspective.

Design and Methods

We conducted a survey (using LimeSurvey software) of Transfusion Medicine laboratories at six academic hospitals in Ontario with high plasma use. Survey questions addressed institutional plasma transfusion guidelines, ordering practices/tools/procedures, and processes for dissemination of education and policy change. Questionnaires were disseminated to transfusion medicine physicians who responded with input from laboratory staff where needed. Data were analyzed and compared using graphs and histograms to reveal patterns and site-specific barriers.

Results

Among the six centers studied, 5/6 (83%) had dedicated plasma transfusion hospital guidelines and 6/6 (100%) used paper or computerized order entry. Indication for plasma transfusion and number of units were factors required by 5/6 (83%) centers in their order sets; 4/6 (67%) required INR, and 1/6 (17%) required weight. 2/6 (33%) sites had a systematic method to capture and intervene on inappropriate plasma orders. Prompts to consider plasma alternatives are used by 3/6 (50%) sites. Time constraints, resource availability, INR overuse and interprofessional conflict were institutional barriers identified. 3/6 (50%) sites modified their order set in accordance with ORBCoN toolkit. Committee approval is a barrier for 4/6 (67%) sites to implement a novel order set based on the toolkit. 1/6 (17%) sites had a dedicated error reporting system for inappropriate plasma ordering events.

Conclusions

Site-specific barriers to appropriate plasma transfusion were identified from the laboratory perspective. This is the first step in a knowledge translation approach which will require involvement of plasma stakeholders from non-laboratory disciplines including clinical medicine and surgical specialties.

Acknowledgements

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Abstract ID :

Effectiveness of a Standard Screening Program for Intravenous Immunoglobulin at Community Hospital

Type of abstract : Clinical

Abstract Summary :

Introduction: Intravenous Immunoglobulin (IVIg) are products generated from pooled human donor plasma and administered as a treatment for patients with immunodeficiency or autoimmune disorders. Distributed by Canadian Blood Services, IVIg is a limited and costly blood derived product that is in excessive demand. One of the leading community hospitals in Ontario initiated a quality improvement project with a primary goal of optimizing utilization of IVIg products and increasing patient safety by providing recommended dosage.

Method: In January 2021, a baseline audit was performed on utilization of IVIg in our hospital. Data was collected on the IVIg dose ordered by physicians on 45 patients. The ordered dose was compared to the recommended dose using a weight-dosing calculator. Baseline data shows 22% of patients were administered the correct recommended dose. In April 2021, Transfusion Medicine (TM) Medical Laboratory Technologists (MLTs) started screening IVIg requests from physicians. When the TM lab received a request for IVIg, MLTs ensured physicians used a standard IVIg request form that include patient height, weight, diagnosis and dose in gm/kg according to diagnosis. MLTs would confirm requested dose using an IVIg body weight-dosing calculator and if the recommended dose matched, the requested products were dispensed. If MLTs found any discrepancy, they connected with ordering physicians for approval to adjust the dose to the recommended dose according to the body weight-dosing calculator. When the ordering physician did not approve the recommended dose, it required approval from the TM Medical Director.

Results: Three months of screening process resulted in 71% of patients getting the recommended dose of IVIg and 16% requiring additional TM Medical Director approval. 13% of patients could not be reassessed as they were one time dose.

Conclusion: Introduction and continuation of a standard screening program for IVIG dosage led to increase patient safety, proper utilization of IVIg, and savings of approximately $10,000 within three months. On a positive note, it created an independent double check mechanism to ensure patients are getting the right dose; however, more work is required to provide training to physicians, or creating a system or tool that can provide appropriate guidelines to the physician at the time of ordering to save Transfusion Medicine resources that are currently involved.

Acknowledgements: Dr. Asim Alam, Medical Director Transfusion Medicine, North York General Hospital, Core Lab MLTs – North York General Hospital.

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Abstract ID :

Suspected post-transfusion purpura in a liver transplant patient: more than meets the eye

Type of abstract : Clinical

Abstract Summary :

Introduction: Post-transfusion purpura (PTP) is a rare transfusion complication, where recipient lymphocytes produce antibodies against platelet alloantigens, followed by destruction inclusive of autologous platelets.

Design and Methods:

A 49 year old man with hepatitis C liver cirrhosis received an orthotopic liver transplant. He was transfused peri-operatively with plasma, red blood cells (RBC) and platelets. He had a history of uncomplicated RBC transfusions. On post op day 6 (POD6), his platelet count fell to 15 and then zero. He had epistaxis, subconjunctival hemorrhage, ecchymosis and rectal bleeding. He was not septic, coagulopathic, or microangiopathic, had on-target tacrolimus levels and his liver profile had corrected. A sample was sent to the platelet immunology reference laboratory. Testing showed weak positivity for anti-PLA1 (HPA-1a) and platelet typing was negative for HPA-1a antigen. PTP was diagnosed and he received IVIG and steroids, with platelet count improvement from POD25 (Figure 1). Fifteen years later, he presented for counselling regarding an upcoming renal transplant. Platelet serology and genotyping were performed and were discordant with the historical results. To resolve the discrepancy and provide appropriate counselling, a chimerism study using HLA genotyping was performed, and HPA genotyping was done on patient's and donor's frozen DNA samples from 2004.

Results:

A switch in HPA expression from HPA-1a negative to positive from passenger (liver-source) hematopoietic cells was ruled out by HLA-based chimerism studies. HPA genotyping was concordant between both eras (HPA-1a/1a), ruling out wrong blood in tube. HPA antibodies had evanesced, while HPA genotyping on the donor's DNA sample revealed type HPA-1b/1b. The PTP was thus deduced to have been provoked not by transfusion, but by a passenger lymphocyte response to recipient platelets.

Conclusions:

A correct diagnosis is essential for long term transfusion advice to patients with PTP, and was aided by genotyping in this case. Passenger lymphocyte induced alloimmune thrombocytopenia is on the differential diagnosis in organ transplantation. We suspect an initially misleading seronegative typing due to bound antibodies in retrospect.

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Abstract ID :

Adverse reactions amid a suspension of donor blood pressure measurement: A retrospective, observational study in Québec

Type of abstract : Clinical

Abstract Summary :

Introduction/objective: Measuring the pre-donation blood pressure (BP) is considered best practice to prevent vasovagal reactions (VVRs) and cardiovascular complications, although limited data support this view. Amid COVID-19, Canadian blood operators have temporarily suspended pre-donation BP measurement and have implemented other sanitary measures (e.g., mask wearing, prohibited hydration while donating), which may have impacted the rate of some complications. To determine whether deferring donors with out-of-range BP values prevents adverse reactions, we assessed the rates of VVRs and cardiovascular complications before versus after the suspension of pre-donation BP measurement in Québec, Canada.

Design and methods: Retrospective data from our institution's administrative and clinical databases were analyzed. Deferral rates for out-of-range BP were reported between 01-04-2017 and 31-03-2020. We also compared the rates of on-site VVRs (moderate and severe), off-site VVRs (any severity), and cardiovascular complications (e.g., myocardial infarction) between the "pre-pandemic" and the "post-pandemic" period.

Results: Between 2017 and 2020, the deferral rate for hypotension was 0.11 per 1000 donors and was 3.30 per 1000 donors for hypertension **(Table 1)**. Neither the rates of moderate on-site VVRs (pre-pandemic=2.48 per 1000 donors, post-pandemic=2.15 per 1000 donors; p=0.4179) nor those of severe on-site VVRs (pre-pandemic=0.77 per 1000 donors, post-pandemic=0.62 per 1000 donors; p=0.4902) significantly differed pre- versus post-pandemic (**Table 1**). Similarly, the rates of off-site VVRs (any severity) did not significantly differ pre- versus post-pandemic (pre-pandemic=2.50 per 1000 donors, post-pandemic=3.09 per 1000 donors; p=0.1615; **Table 1**). No donation-related cardiovascular complications occurred pre- or post-pandemic.

Conclusions: Most deferrals related to out-of-range BP in blood donors are due to hypertension. The preliminary evidence suggests that measuring BP before blood donation neither prevents a significant number of VVRs nor cardiovascular complications. Other studies are needed to validate these results and better assess if there is an association between out-of-range BP values and donation-related adverse reactions.

Acknowledgments: We thank Samuel Rochette who critically revised the content.

Table 1 : Deferrals for out-of-range BP and rates of on-site and off-site adverse reactions related to blood donation.

	Between 2017 and 2020	
	n	**Rate (per 1000 donors)**
Deferrals due to hypotension	119	0.11
Deferrals due to hypertension	3593	3.30

	Pre-pandemic period		Post-pandemic period	
	n	**Rate (per 1000 donors)**	**n**	**Rate (per 1000 donors)**
On-site VVRs				

Moderate	821	2.49		516	2.15	
Severe	256	0.77		149	0.62	
Off-site VVRs	720	2.50		1042	3.09	
Donation-related cardiovascular complications	0	0.00			0	0.00

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Abstract ID :

Impact of the SARS-CoV-2 Pandemic on False Positive Rates for Syphilis Screening

Type of abstract : Clinical

Abstract Summary :

Introduction/objective:

Syphilis screening is mandatory in Canada for labile blood components. *Cross reactivity leading to false positive syphilis results using MHA-TP* has been reported in the past with influenza vaccine. At our institution, higher rates of false positives have been observed for syphilis screening since the beginning of the SARS-CoV-2 circulation. We assessed the relationship between pre-donation vaccination history (any vaccine) and false positivity for syphilis testing, and how these variables impacted donor deferrals before and during the pandemic.

Design and methods:

Internal retrospective data were used. Rates of false positive syphilis test results were compared between 01/2018-09/2020 and 10/2020-12/2021, overall and among donors with a vaccination history (any vaccine) within 3 months pre-donation. False positive rates and successful re-entry analysis were compared between periods using logistic regression analysis.

Results:

From 01/2018 to 09/2020, there was a mean of 5.7 false positive syphilis test results/month, with an overall rate of 25,0/100,000 donations. In donors with a vaccination history within 3 months pre-donation, this rate rose to 31.9/100 000 donations. In that same period 39.4% of deferred donors applied for re-entry, and 73% were successful. Between 10/2020 and 12/2021, there was a mean of 28.3 false positive syphilis test results/month, with a rate of 147.23/100,000 donations representing a total of 426 donors. In donors with a vaccination history within 3 months pre-donation this rate rose to 161.56/100,000 donations. In that same period 26,8 % of deferred donors applied for re-entry, and 57,9% were successful., During the pandemic, donors with a false positive syphilis test result were significantly more likely to be permanently deferred than those before the pandemic (odds ratio [95% confidence interval] = 4.2 [1.9-9.2]).However, those with a vaccination history within 3 months pre-donation were significantly less likely to be permanently deferred than those without such history (odds ratio [95% confidence interval]=0.313 [0.15-0.65]).

Conclusions:

The COVID-19 pandemic had unexpected impacts on blood operations; one of those has been higher rates of false positive syphilis test results; similar to what is observed with influenza vaccination. .A second re-entry evaluation might be considered in this context.

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Abstract ID :

Management of Mixed Warm/Cold Autoimmune Hemolytic Anemia: A case report and review of current literature

Type of abstract : Clinical

Abstract Summary :

Background: Mixed warm and cold autoimmune hemolytic anemia (AIHA) is a rare diagnostic entity with limited therapeutic options. Previous literature has described the diagnostic difficulty in this pathology, and a limited response to steroid therapy. Furthermore, there is limited evidence regarding the use of rituximab in this condition.

Objective: The primary objective was to describe a case of severe mixed warm and cold autoimmune hemolytic anemia with a complicated diagnosis and treated with steroids and rituximab with a clinical response evidenced by stability in hemoglobin and improvement in hemolytic indices. The secondary objective was to review the current literature surrounding the management of mixed warm/cold AIHA.

Methods: In addition to our case report, we conducted a scoping review of case reports/case series describing confirmed mixed AIHA, their treatment, and clinical outcomes. Inclusion criteria included a confirmed diagnosis of mixed AIHA (confirmed warm antibodies and cold agglutinins based on DAT).

Case Summary and Results: We present a case of mixed warm/cold autoimmune hemolytic anemia (AIHA) in an 83-year-old female presenting with extensive, bilateral pulmonary embolisms and left renal vein thrombosis. The patient underwent extensive workup with no identifiable provoking etiology. Initial treatment involved prednisone therapy and was transitioned to rituximab upon confirmation of a diagnosis of mixed AIHA. The patient demonstrated a mixed response with stable hemoglobin and transfusion independence, however, there was persistent laboratory evidence of hemolysis following completion of the rituximab treatment course.

Our literature review identified 31 articles, two of which were excluded for unavailable clinical details and one due to the presence of alloantibodies, for a total of 63 patients. The most common associated conditions included autoimmune conditions (n=16, 25%) and lymphoproliferative disorders (n=9, 14%). The most common treatment involved corticosteroids, however, seven case reports involved the use of rituximab.

Conclusion: Mixed warm/cold AIHA represents a complex diagnosis, and the optimal management of these cases has not been well established. In keeping with our case, recent case reports suggest a promising response to rituximab and limited response to steroid treatment. However, given the limited literature surrounding this topic additional studies would be required to further elucidate optimal management of this unique pathology.

Acknowledgement: The authors would like to thank Trillium Health Partners for their support and resources in this study.

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Abstract ID :

Immune globulin indications and utilization in Southern Alberta: Are we following the Clinical Guidelines?

Type of abstract : Clinical

Abstract Summary :

Authors: Emma Holmes, Mahboob Hamidi, Joanna McCarthy, Susan Nahirniak

Objective: Immune globulin (IG) is a costly but scarce resource. In response to concerns about a possible global shortage, provincial screening to ensure compliance with the 2018 Prairie Collaborative Guidelines (*Criteria for the Clinical Use of Immune Globulin)* was mandated. To facilitate this screening, update of transfusion records for patients with already approved criteria and an audit of appropriateness by dose and indication was performed.

Design and Methods: Transfusion records between January 2021-October 2021 were pulled from the Calgary Zone LIS to identify patients receiving Intravenous IG (IVIG). They were compiled into a spreadsheet with each dose of IVIG cross-referenced to the patients' clinical record, indication, dose and manufacturer of IVIG. Two general pathology residents confirmed the medical indication, prescribing provider, and whether the appropriate dosage of IVIG was used. All indications provided were compared to the Prairie Collaborative Guidelines to determine whether they met green (do), amber (do not know), or red (do not do) criteria. Additional indications that were not in the guidelines were categorized as 'not-listed'.

Of the patients that were considered green, their files were updated with approval dosing and duration in the Transfusion Medicine LIS.

Results: A total of 815 patients were identified. There were 602 adult patients that received IVIG in an urban site. Of these, 34 had indications that were 'not listed' in the guidelines, 11 had red indications, 44 had 'amber' indications, 511 had 'green' indications. 328 patients were had approvals updated in the LIS for ongoing IVIG.

A total of 167 pediatric patients were identified. Of these, 10 had indications that were 'not listed', 0 had 'red indications, 50 had 'amber' indications, 62 had 'green indications. 44 patients did not have any indication documented in the medical record.

There were 46 patients that received IVIG at rural sites. Rural records did not have documented indications for why IVIG was given.

Conclusions: This project has allowed streamlining of our screening program by identifying several "pre-approved" patients for IVIG. Further education is required for our pediatric prescribers and those in rural communities to ensure compliance with appropriate ordering. We will also be increasing the scrutiny and request for ongoing evidence of benefit in patients whose indications/dosing are either not addressed in our guidelines, or may be equivocal.

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Abstract ID :

Anti-PP1Pk alloimmunization during pregnancy: A case study with a favorable outcome.

Type of abstract : Clinical

Abstract Summary :

Introduction

Analysis of the P1PK and GLOB blood groups is challenging. Both systems stem from the glycosylation of the lactosylceramide common precursor by different enzymes, resulting in various antigens, such as P1, P^k and P. Patients alloimmunized against P1Pk or GLOB antigens present a transfusion challenge since compatible donors are rare. Few successful pregnancies with anti-$PP1P^k$ were reported, due to the risk of miscarriage, usually during the first half of pregnancy. We describe the analysis and management of an alloimmunized pregnant woman with anti-$PP1P^k$.

Design and Methods

Antibody identification was performed in gel column according to approved techniques. Alloadsorption were performed using papain-treated allogeneic RBCs (R_1R_1, R_2R_2, rr). Sanger sequencing of *A4GALT* and *B3GALNT1* mRNA was also performed.

Results/Case Report

A pregnant Caucasian patient from a family with a known history of anti-$PP1P^k$ was referred to our IRL. She previously had 1 in utero fetal death due to fetal anemia, 1 interrupted pregnancy due to hydrops and 2 miscarriages. Serologic investigation of her fifth pregnancy showed panreactivity against trypsin, papain and DTT treated cells. Negative reactions were observed with alloadsorbed serum and when using p cells (P-, P1-, P^k-), suggesting an anti-PP1Pk. A normal *B3GALNT1* was determined by sequencing, while the *A4GALT* sequencing revealed a homozygous *A4GALT*01N.16* null genotype. Absence of the α4Gal-T enzyme results in lack of P1, P^k antigen and the downstream P antigen, causing the p phenotype and the anti-$PP1P^k$. Plasma exchange (1 volume per week) was performed prior to pregnancy, then from weeks 4 to 10 of pregnancy. IVIg (1g/kg twice a week) and prednisone (1mg/kg PO DIE) were administered starting on week 10. Anti-$PP1P^k$ titer fluctuated between 16 to 64 during pregnancy. Delivery following premature rupture of the membranes occurred at week 32. No transfusion was needed for either mother or newborn, but phototherapy was required. Newborn analysis revealed a heterozygous *A4GALT*01N.16/A4GALT*02* genotype, causing a P+ P^k+ P1+/- phenotype.

Conclusion

We described a favorable outcome for an alloimmunized pregnant women with anti-$PP1P^k$ associated with plasma exchanges, corticosteroids and IVIg treatments, crucial to the success of the pregnancy. The inheritance of the paternal *A4GALT*02* allele could also have contributed to the survival of the fetus, as the expression of the P1 antigen could've been reduced, thus decreasing the risk of immune reaction.

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Abstract ID :

Replacing Iron and Preventing anemia in Pregnant patients of Limited Economic means (RIPPLE): A quality improvement initiative at a high risk obstetrics centre

Type of abstract : Clinical

Abstract Summary :

INTRODUCTION/OBJECTIVE:

Most anemia in pregnancy is attributable to iron deficiency, which disproportionately affects those of low socioeconomic status. We assessed the impact of providing free iron to pregnant patients from low-income households.

DESIGN/METHODS:

The RIPPLE initiative provided free oral and intravenous iron to pregnant patients at our institution from households with an annual income ≤ $50 000. Basic demographics, laboratory parameters and surveys on iron side effects were collected. We defined anemia at delivery as hemoglobin <110g/L. Using postal code data, we performed baseline (100 patients) and monthly (60 patients/month) audits of patients delivering at our institution from low-income and non-low-income neighbourhoods.

RESULTS:

From August 2020 to January 2022, 26 patients participated in RIPPLE: in total 49 doses of iron sucrose were provided (range 1-3 doses per patient). Compared to non-RIPPLE pregnant patients from low-income and non-low-income neighbourhoods treated with antenatal IV iron, RIPPLE patients had lower nadir ferritin values (mean 9.6 ug/L vs. 14.3 ug/L (p=0.037) and 14.3 ug/L (p=0.02)). Nadir hemoglobin value were not significantly different (mean 99 g/L vs. 103 g/L (p=0.17) and 104 g/L (p=0.06). RIPPLE patients were more often anemic at delivery relative to non-RIPPLE patients treated with antenatal IV iron (56% vs. 19% (p=0.02) and 17% (p=0.008)), though hemoglobin levels at delivery increased from nadir in 24 of 26 patients. Although RIPPLE patients received the same number of iron infusions (mean 1.9 vs 2.1 and 2.0), 11 (42%) received their first dose of IV iron within 3 weeks of delivery compared to 24% (low-income) and 9% (non-low-income) in non-RIPPLE patients. One RIPPLE patient received a 2-unit red cell transfusion postpartum. Seventeen patients completed phone surveys: 8 (47%) experienced side effects from intravenous iron, most commonly fatigue (5), headache (4) and light-headedness (3).

CONCLUSION:

The RIPPLE initiative provided access to free iron to low-income pregnant patients. The initiative identified pregnant patients with lower ferritin values than their non-RIPPLE counterparts. All RIPPLE patients received antenatal intravenous iron, though 56% were still anemic at delivery. Despite this intervention, RIPPLE patients received IV iron later in pregnancy with nearly half receiving a first dose of intravenous iron within 3 weeks of delivery. We highlight a vulnerable population and future directions must include earlier intervention to mitigate anemia at delivery.

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Abstract ID :

REDUCING INAPPROPRIATE INTRAVENOUS ALBUMIN USAGE: INTERIM RESULTS OF A SINGLE-CENTRE AUDIT AND MULTIFACETED INTERVENTION

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective: Recent analyses by the Ontario Regional Blood Coordinating Network have found intravenous (IV) albumin use at Kingston Health Sciences Centre (KHSC) to be substantially higher than similar-sized peer centres across the province. In this quality improvement (QI) study, we aimed to characterize patterns of IV albumin use at KHSC and reduce inappropriate use.

Design and Methods: An audit of albumin use in 100 consecutive adult patients at KHSC was conducted via electronic chart review from April 2017 to February 2022. Data were recorded using the REDCap electronic data capture tool and included product formulation/volume, prescriber characteristics, patient characteristics, indication for ordering albumin, and order appropriateness as defined by the International Collaboration for Transfusion Medicine Guidelines for albumin.

Results: 210 unique orders in 100 patients were audited. 55% of patients were male, and the median [IQR] age was 63 [56, 72]. 58% of patients were discharged home, while 18% died, within 30 days of their last infusion. 62% of albumin orders occurred in situations that were not clinically indicated, the most common being fluid resuscitation in patients without cirrhosis. The correct formulation and volume were selected in 25% and 21% of orders, respectively. The physician of record listed on the electronic albumin order and the physician ordering the product on the written order were discordant in 79% of orders. 13% of orders were nurse-initiated based on as-needed order set allowances, all of which occurred in the cardiac intensive care unit. 10% of orders resulted in wastage and 86% of wastage occurred due to inappropriate storage as defined by existing blood bank policy. QI interventions include: formation of an albumin steering committee, an educational campaign, development of standardized hospital clinical practice recommendations, orderset revisions, creation of new albumin ordersets, and revision to return policy. With these interventions, the number of vials administered dropped from 800 per month at the start of the study period to 334 and 451 per month for January and February of 2022, respectively.

Conclusion: At KHSC, IV albumin is frequently ordered without an appropriate clinical indication and in the incorrect formulation. A multifaceted QI intervention including education, standardization of orders, and policy revision reduced albumin use by 50%. Ongoing work will ensure these changes are sustainable.

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Abstract ID :

Reflex Order for Second Blood Group Collection: Meeting Standards with No Impact on Group O Utilization

Type of abstract : Clinical

Abstract Summary :

Background: In 2018, Canadian transfusion standards were revised to include a requirement for two separate determinations of a recipient's blood group prior to providing group specific non-group O red blood cells (RBC). The intent is to reduce the risk of hemolytic reactions from wrong blood in tube errors. However, there is potential for increased group O RBC use if transfusion is required before a second sample is tested.

Island Health implemented two blood group determinations at all transfusing sites in 2021. A reflex order for a second specimen was implemented where the Laboratory Information System (LIS) generates a sample collection order whenever a historical blood group is lacking. The impact on group O blood utilization was assessed.

Methods: Data for all group O RhD negative and O RhD positive RBC transfusions was gathered over a six-month period post implementation of the second sample requirement. This was compared to the group O RBC use in the six-month interval prior to the change in policy. Neonatal transfusions were excluded. To avoid bias due to seasonal variations and potential pandemic influences, post implementation utilization data was also compared to the same six-month time periods in 2019 and 2020.

Results: In the six-month period following the implementation of the new policy, 1440 O RhD negative and 3095 O RhD positive RBC were transfused. 1441 O RhD negative, and 3134 O RhD positive RBC were transfused in the six months immediately prior to implementation representing no difference in group O RhD negative use and a 1% increase in O RhD positive RBC transfusion. In the same six-month time period in 2019, 1244 O RhD negative and 3311 O RhD positive RBC were transfused. In 2020, 1341 O RhD negative and 2708 O RhD positive RBC were transfused. Overall Group O RhD negative red cell transfusions increased 1% per year while O RhD positive red cell transfusions did not increase.

Conclusion: Implementation of a second blood group determination using a reflex collection order for patients lacking a historical blood group has resulted in a successful policy for blood group confirmation while maintaining group O RBC transfusions at baseline levels. While this is reassuring, ongoing monitoring of group O RBC usage is planned, ensuring a full assessment of the impact of this change.

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Abstract ID :

Impact of lowering the minimum hemoglobin threshold and reducing delays between whole blood donations during the COVID-19 pandemic

Type of abstract : Clinical

Abstract Summary :

Introduction/objective: To avoid a shortage of blood products during the COVID-19 pandemic, criteria were temporarily modified to increase the eligibility of whole blood donors. The interval between donations was reduced from 56 to 28 days for men and from 83 to 56 days for women. Furthermore, the minimum hemoglobin threshold for women was reduced from 125 to 120 mg/L. The deferral rate due to low hemoglobin levels was monitored to measure the impact of these changes.

Design and methods: This was a retrospective cohort study which compared the deferral rates of whole blood donors due to low hemoglobin levels between 2017-2019 ("pre-pandemic period") and 06/2020-05/2021 ("pandemic period"). Data were stratified by sex, donor type (new vs repeat), and the number of donations in the past 12 months.

Results: Between the pre-pandemic and pandemic periods, the number of new donors decreased by ~50%, and the number of donations per donor increased from 1.5 to 1.8 per year. Deferrals due to low hemoglobin decreased from 9.2% to 3.4% in women and slightly increased from 1.9% to 2.2% in men. The overall deferral rate remained relatively low for 9 months (2.8%), but gradually increased from 01/2021 and peaked at 5.1% in 05/2021. Deferral rates returned to pre-pandemic levels once the initial criteria were reinstated, without any rebound effect. Frequent donors were more often deferred than new donors due to low hemoglobin during the post-pandemic period: Women who donated 6 times in the past year had a 14.3% deferral rate vs 2.8% for new donors, and men who donated 10 times in the past year had a 14.3% deferral rate vs 1.3% for new donors.

Conclusions: After relaxing donation criteria amid the COVID-19 pandemic, deferral rates due to low hemoglobin levels significantly decreased among women, but not in men. This sex-specific trend suggests the new criteria depleted iron reserves to a greater degree in women than men. A personalized adjustment of inter-donation delays should be considered to allow some women to make more donations while reducing deferrals rates for both women and men.

Acknowledgments: Thanks to Samuel Rochette for helping draft this abstract.

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Abstract ID :

Use of Group A plasma in Emergency Transfusion in a Level 1 Trauma Centre: The First Ontario Hospital Experience

Type of abstract : Clinical

Abstract Summary :

Introduction/ Objective:

AB plasma is a rare resource that is considered the universal plasma donor in patients of unknown blood group. It is stored frozen, which delays availability due to the time required to thaw. The use of group A plasma in trauma and massive hemorrhage protocols (MHP) when blood group is unknown, has been shown to be safe in American hospitals.[1,2,3,4] To achieve faster delivery of plasma to the emergency department, and to reduce AB plasma transfusion to non-AB patients, Transfusion Medicine (TM) at London Health Sciences Centre (LHSC) implemented logistical changes to stock thawed A plasma.

Design and Methods:

Pre-implementation, TM reviewed the proportion of group B and AB patients who received uncrossmatched Red Blood Cells from 2015-2020 and determined that the frequency of potential incompatible plasma transfusions if A plasma is used is 201/1414 (14%).[5] Consultations occurred with emergency/trauma leaders regarding use of thawed group A plasma.

To implement the new process, a policy was developed to guide the Technologist issuing emergency thawed A plasma when the MHP is activated. Four units of thawed group A plasma is issued to patients with an unknown or historical group of A or O, with every MHP pack issued until blood group determined. A notification process was developed to notify physicians if incompatible plasma was transfused, including hemolytic bloodwork for 3 days post transfusion.

Quality metrics were developed to monitor this transition in practice: group A plasma units discarded, number group A plasma utilized for emergency transfusion, number of units for out of group transfusion, and hemolysis markers for incompatible plasma transfusions.

Results:

Data collection period was April 2020-December 2021 (Implementation was May 3, 2021):

Post-implementation 214 AB plasma were saved by utilizing group A plasma.

The number of group A plasma units discard rate increased from pre-implementation 175/1891 (8.9%) to post-implementation 179/1631 (11.3%).

The number of AB plasma units transfused to non-AB patients has decreased by 90 units.

One patient was transfused 2 units of incompatible plasma with no indication of hemolysis.

Conclusion:

Using thawed group A plasma for emergency use at LHSC resulted in improved delivery, significant savings of AB plasma, whilst still providing group compatible plasma transfusions for all but 1 patient. Ongoing safety monitoring of incompatible transfusions and A plasma discard strategies are required.

Acknowledgements:

Transfusion Medicine Laboratory Technologists, Emergency/Trauma Leaders

References: Submitted upon request.

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Abstract ID :

It's All in the History: The Past Unlocks an ABO Mystery

Type of abstract : Clinical

Abstract Summary :

Introduction: A 38-year-old G2P1 female had a prenatal sample typed as O positive. This was discrepant with her historical blood donor typing of B positive. Investigations revealed discordance between her blood group and non-reactivity with anti-H antisera. Suspecting a H-negative phenotype, patient consultation was undertaken that linked the patient to prior family studies conducted 25 years ago for a para-Bombay individual.

Methods: ABO typing and antibody screens were performed on the automated NEO solid-phase analyzer. Additional ABO investigations were performed by manual tube method. Antibody investigations were performed in PEG at different phases. Historical para-Bombay family studies included Lewis typing and inhibition testing using saliva to determine secretor status.

Results:

ABO Investigations: No reactivity was demonstrated on forward typing with multiple anti-A, anti-B and anti-A,B antisera, as well as anti-A1 and anti-H antisera. Reverse typing was 1+ against both A1 and B cells. An adsorption/elution was performed and did not identify any B or H antigen. Ficin-treatment of the patient's RBC enhanced reactivity (weak to 1+) with anti-B and anti-A,B antisera. DTT treatment of the patient's plasma removed reactivity against B cells suggesting an interfering cold IgM antibody.

Antibody Investigations: Screening cells were weakly positive in PEG and 1+ positive in saline 20C. Autocontrol was negative. Prewarmed samples were non-reactive in PEG. Preferential reactivity was seen against adult O cells compared to cord cells suggesting antibody specificity against IH.

Prior Family Studies: The patient typed as Le(a-b-). Inhibition testing confirmed H and B antigen secretions in saliva. The patient's brother (index case) was H-deficient and confirmed to have H and B secretions in saliva. He typed as Le(a-b+). More recent sampling from the brother confirmed past findings.

Conclusion: Our patient is confirmed to be para-Bombay with H and B secretions and an anti-IH antibody. Para-Bombay individuals are H-deficient secretors with RBCs that lack ABH antigens that may instead be secreted and adsorbed onto the RBC surface, explaining her historical B typing. The evolution of her forward typing may be due to the reduced expression of ABH antigens seen in pregnancy. No cases of HDFN have been reported with anti-IH. Recommendations were made to transfuse with H-deficient RBC units if transfusion was required.

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Abstract ID :

Should cell salvage be used in liver resection and transplantation? A systematic review and meta-analysis

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective:
Intraoperative RBC transfusions are common in liver surgery and associated with increased morbidity. IBSA can be utilized to minimize allogeneic transfusion. A theoretical risk of cancer dissemination has limited IBSA adoption in oncologic surgery. The objective of our study was to systematically review existing literature to evaluate the effect of intraoperative blood salvage and autotransfusion (IBSA) use on red blood cell (RBC) transfusion and postoperative outcomes in liver surgery.

Design and Methods:
Electronic databases were searched from inception until May 2021. Studies comparing IBSA use to control in liver resection or transplantation for any indication were included. Screening, data extraction, and risk of bias assessment were conducted independently, in duplicate. The primary outcome was intraoperative allogeneic RBC transfusion. Secondary outcomes included overall survival (OS) and disease-free survival (DFS) for patients undergoing oncologic surgery. Data from transplant and resection studies were analyzed separately. Random effects models were used for meta-analysis.

Results:
Twenty-one observational studies were included (16 transplant, 5 resection, n=3,433 patients). Seventeen studies incorporated oncologic indications. In liver transplant studies (n=10), IBSA was associated with decreased allogeneic RBC transfusion (mean difference –1.81, 95% confidence interval (CI) [-3.22, -0.40], p=0.01, I^2=86%, very-low certainty). Too few liver resection studies reported on allogeneic RBC transfusion for meta-analysis. No significant difference existed in OS or DFS in liver transplant studies (HR=1.12 [0.75, 1.68], p=0.59, I^2=0%; HR=0.93 [0.57, 1.48], p=0.75, I^2=0%) or liver resection studies (HR=0.69 [0.45, 1.05], p=0.08, I^2=0%; HR=0.93 [0.59, 1.45], p=0.74, I^2=0%).

Conclusions:
IBSA may reduce intraoperative allogeneic RBC transfusion without compromising oncologic outcomes. The evidence base supporting these findings is limited in size and quality, and high-quality randomized controlled trials are needed.

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Abstract ID :

Severe Acute Hemolytic Transfusion Reaction Secondary to a Plasma Incompatible Group B Platelet Transfusion

Type of abstract : Clinical

Abstract Summary :

Background

Acute hemolytic transfusion reaction (AHTR) following ABO plasma incompatible platelet transfusion is a rare, but potentially fatal event. This reaction is well documented as a result of transfused group O platelets, and more rarely, group A platelets. We report a rare case of AHTR from a minor ABO incompatible group B platelet transfusion.

Methods

A 34-year-old man, previously blood group B RhD+ , recipient of a group AB RhD+ haploidentical hematopoietic stem cell transplantation (HSCT), was admitted with acute myeloid leukemia relapse and a mixed donor chimerism of 96%. Irradiated group B RhD+ red blood cells (RBC) were transfused on day 9 of chemotherapy. On day 11, a whole blood-derived buffy coat group B platelet pool was transfused. After transfusion, he developed rigors, fever, severe hemolysis, and hemodynamic instability. He required fluid resuscitation, vasopressors, and RBC transfusions.

Results

Pre-transfusion ABO typing by gel was compatible with group AB. There was a mixed-field reaction on forward grouping with anti-A and a 4+ reaction with anti-B. Reverse grouping showed no agglutination. Post-reaction typing showed loss of agglutination on forward grouping with anti-A and a new 4+ agglutination on reverse grouping against A1 cells. Serological investigations revealed evidence of an AHTR with passive transfer of high titer anti-A. Isohemagglutinin titers in the platelet pool were measured at 256 for IgM and 8192 for IgG. Hemolytic parameters normalized after 48 hours, and the patient recovered with no chronic sequelae. Only AB platelets were transfused thereafter. On lookback, no other AHTR had been previously reported from the donors contributing to the pool.

Discussion

Our patient did not express A antigens on his vascular endothelium, given his native group B genotype. This may have prevented isohemagglutinin adsorption on the endothelium and contributed to a severe hemolytic reaction. Conversely, the transfusion of group B red cells two days prior and his mixed chimerism may have had a protective effect. This case highlights the potential risks associated with ABO-mismatched transfusions, and the complexity associated with transfusing HSCT recipients with dual populations of circulating red cells.

Conclusion

Clinicians must maintain a high level of suspicion for AHTR after ABO plasma incompatible platelet transfusions. Patients must be aware of the risks of AHTR, and early recognition and diagnosis of this complication may be lifesaving.

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Abstract ID :

Characteristics of transgender blood donors in Québec and risk of vasovagal reactions

Type of abstract : Clinical

Abstract Summary :

Introduction/objective:

Gender-specific risks (donors or receivers) associated with donations from transgender persons cannot be systematically assessed, since the gender identity of these individuals may differ from the sex assigned at birth. Moreover, gender transition is unique: It can be social, medical (hormone therapy, gender-affirming surgery, etc.) and/or legal. Canadian blood operators use a binary gender scheme to screen transgender donors prior to donation, which leads to challenges considering the possibilities for these gender transitions.

Design and methods:

Donor screening data from our institution were used to describe the transgender donor's population in Québec and included all transgender individuals who went through the donor screening process between August 11th, 2015 and August 25th, 2021.

Results:

The HQ transgender population comprised 134 donors, including 94 (70.1%) transgender men and 40 (29.9%) transgender women. Donors were younger (60.0% aged 18-29 yo) in the transgender group compared to our 2020-2021 overall cohort (24,7%). Fifty-eight (43.3%) were deferred from donating a blood-derived product because of an ongoing gender transition, and the others (76 [56.7%]) were eligible donors. Of these eligible donors, 44 (57.9%) had made ≥1 donation since the end of their deferral. Of 46 transgender men who were asked about their pregnancy history, 3 (6.5%) reported such history. All infectious markers have been negative in the donors who made at least 1 donation.

Vasovagal reactions (VVRs) appeared to occur more frequently among transgender men compared with the overall male donor population (5.3 vs. 1.1 per 100 donations), whereas the converse was observed when comparing transgender women with the overall female donor population (2.6 vs. 3.5 per 100 donations). However, after adjusting for age and donor status, neither the difference between transgender men and the overall male donor population (OR=1.704 [95% confidence interval [CI]=0.880–3.300]) nor that between transgender women and the overall female donor population (OR=1.357 [95% CI=0.410–4.492]) was statistically significant.

Conclusions:

More data is needed on the possible donors and receivers' risks associated with donations from transgender persons. Anemia and RVVs are possible risks for donors while TRALI and HIV transmission are the main risks suspected for receivers. While gender neutral questionnaire might facilitate receivers' risks management, donors' risks still need to be addressed.

Table 1. Rates per 100 donations of vasovagal reactions among donors

Severity	Donors population			
	Transgender men	All men	Transgender women	All women
Mild	4.8	0.97	2.20	3.00
Moderate	0.50	0.13	0.4	0.38
Severe	0.00	0.02	0.00	0.12
Total	5.30	1.12	2.60	3.50
OR (95% CI)[a]	1.70 (0.88–3.30)		1.36 (0.41–4.49)	

[a] Based on logistic regression adjusted for age and donor status (first-time vs. repeat donor).

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Abstract ID :

Characterizing anti-E: Comparison of Manual SIAT vs Automated Solid Phase Methodology for Prenatal Antibody Titration

Type of abstract : Clinical

Abstract Summary :

Background:

Serial prenatal antibody titration is used to monitor alloimmunized pregnancies at risk of hemolytic disease of the fetus/newborn (HDFN). While antibody titration is often performed using a manual saline indirect antiglobulin test (SIAT), an automated solid phase (ASP) method may offer better sensitivity, efficiency, and reproducibility. Preliminary data suggest that a SIAT critical titre threshold of 16 corresponds to an ASP critical titre threshold of 32, however a higher rate of discordance was noted for anti-E (tendency to overcall critical value results by ASP). As anti-E is the most common antibody in pregnancy but only rarely results in clinically significant HDFN, this study was conducted to further compare anti-E titration by SIAT vs ASP and investigate the potential influence of IgG vs IgM components on testing discrepancies.

Methods:

Frozen plasma samples (n=79) with known anti-E antibodies (13 donor and 66 prenatal) were thawed and anti-E titration performed by SIAT and ASP (NEO Iris non-ABO titration assay, Immucor Canada) using commercially available R2R2 cells. 25 samples with titre ≥4 (to avoid confounding dilutional effects) and adequate volume were selected for anti-E titration using DTT treated plasma to assess IgG vs IgM anti-E.

Results:

Titre values ranged from 0-16 for SIAT and 0-64 for ASP. Using a critical value threshold ≥16 SIAT and ≥32 ASP: 67 (85%) matched non-critical values; 7 (9%) met critical value (overall concordance 94%); 3 (4%) were critical false positive (manual <16, ASP ≥ 32) and 2 (2.5%) were critical false negative (manual ≥ 16, ASP <32). Of the 25 plasma samples that underwent DTT treatment: 17 (68%) IgG only; 5 (20%) IgG + IgM mix; 3 (12%) inconclusive; 0 IgM only. No clear relationship observed between IgG/IgM anti-E and SIAT vs ASP titre results in this limited sample set.

Conclusion:

These results suggest that an anti-E critical titre threshold of 32 by ASP is comparable to a manual SIAT titre threshold of 16 consistent with results for other clinically significant antibodies in pregnancy. Despite the recognition that anti-E may be a common naturally occurring antibody, the majority of anti-E antibodies in this study were exclusively IgG subtype. Further studies are required to confirm the relationship between SIAT and ASP titration values.

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Abstract ID :

Massive Hemorrhage Protocol: Quality Metrics Portal Data from 8 Ontario Hospitals

Type of abstract : Clinical

Abstract Summary :

INTRODUCTION

Massive hemorrhage continues to carry a high rate of mortality and is often managed with the activation of Massive Hemorrhage Protocols (MHP). The Ontario Regional Blood Coordinating Network (ORBCoN) developed and released the first provincial evidence-based MHP in May 2021. A Quality Metrics reporting portal has been developed to capture 8 MHP quality metrics as defined in the Provincial Massive Hemorrhage Protocol toolkit. The purpose of the pilot was to assess the feasibility of data collection at hospital sites and to interrogate the MHP Quality Metrics portal to ensure the data entry and reporting mechanism were validated and the results presented would be relevant to assess MHP processes.

METHODS

An electronic reporting tool was developed to capture data collected on 8 quality metrics. Retrospective chart reviews (Jan 2019 - Mar 2022) of MHP were conducted across 8 hospital sites. Standardized quality data was entered into a REDCap data collection tool to capture patient demographics, patient outcomes, and quality metrics.

RESULTS

456 consecutive MHP activations were reviewed for adherence to 8 pre-specified quality metrics: (1) 80% received tranexamic acid (TXA) within 1 hour or TXA not indicated (e.g. gastrointestinal bleed, bleeding secondary to thrombocytopenia); (2) 87% had Red blood cell (RBC) transfusion initiation within 15 min; (3) 93% were transitioning to group-specific blood products by 90 minutes); (4) 80% had core temperature >35°C at protocol termination; (5) 93% had hemoglobin maintained >60g/L throughout the first 24h and 67% below 110 g/L at 24h; (6) 59% met activation criteria (>6 RBC within 24 hours or death from hemorrhage prior to 6th unit); (7) 82% did not result in blood wastage; and (8) 92% had commencement of call for transfer within 60 minutes (or care at definitive hospital).

CONCLUSION

The MHP quality metric reporting tool provided valuable insights on the status of activations and throughout 8 reporting sites. In the next step of the project, a portal and associated dashboard will be implemented so institutions can track and support their quality improvement initiatives. The dashboard will provide a dynamic and interactive tool allowing users to quickly visualize and evaluate their metrics over time as well as against provincial benchmarks.

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Abstract ID :

The Landscape of Maternal Alloimmunization in Saskatchewan: Results of a 2 Year Audit

Type of abstract : Clinical

Abstract Summary :

Introduction: Routine prenatal testing includes an ABO/Rh blood group and antibody screen performed by the transfusion medicine laboratory (TML). When antibodies against red blood cells are discovered in pregnant women, monitoring of antibody titers is required to predict the risk of hemolytic disease of the fetus and newborn. In February 2020, testing of TML-based prenatal samples was repatriated from Canadian Blood Services laboratories into Saskatchewan hospitals within the Prevention of Alloimmunization in Mothers of Saskatchewan (PRAMS) Program. Here, we summarize the first 2 years of data from our program.

Methods: This quality assurance audit was conducted on prenatal TML-based tests performed in Saskatchewan between February 1, 2020 and January 31, 2022. Routine testing was completed within Prince Albert, Saskatoon and Regina hospital laboratories, with centralized antibody identification and titrations at Royal University Hospital. Computer test code builds within the Soft Bank (SCC Soft Computer, Florida, USA) lab information system were utilized for data extraction.

Results: In our study period, 39,224 routine TML-based prenatal samples were tested representing 28,145 patients; 3,425 (12.2%) patients were RhD negative. Genotyping was requested in 476 (1.2%) patients to clarify the RhD status. The antibody screen was positive in 1,518 (3.9%) prenatal samples with 1,534 antibodies identified, including 677 (44.1%) clinically significant antibodies. The most common significant IgG antibodies were anti-E (192;28.4%), anti-M (100;14.8%), anti-K (87;12.9%), anti-c (65;9.6%) and anti-D (58;8.6%). A total of 514 samples underwent titration, 99 of which were critical (≥1:64 by gel method). An additional 21 patients were identified to have a new clinically significant antibody at the time of delivery, most commonly anti-E.

Conclusion: In-province testing of TML-based prenatal specimens at designated hospital-based laboratories within the PRAMS Program enables efficient identification of RhD negative women requiring Rh immunoglobulin (RhIg) prophylaxis and alloimmunized patients requiring specialized care by Maternal Fetal Medicine. Alloimmunization rate tracking will identify areas for care optimization to ensure compliance with prophylactic RhIg administration guidelines and further reduce the rate of anti-D in young women. Additional areas of study include an assessment of RhIg prophylaxis timing by care providers and clinical outcomes of babies born to alloimmunized mothers.

Acknowledgements: Special thanks to the TML Technologists for their diligent work testing prenatal samples, and to our PRAMS Nurses for their involvement in the follow-up of RhD negative and alloimmunized women.

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Abstract ID :

Laboratory characteristics and transfusion requirements in neonates affected by alloimmunized gestation. Results of the PRAMS program.

Type of abstract : Clinical

Abstract Summary :

Background: Maternal red blood cell (RBC) alloantibodies predispose to hemolysis and anemia in the fetus and neonate that persist from early gestation to the first few months of infant's life. The Prevention of Alloimmunization of Mothers in Saskatchewan (PRAMS) program was established to perform prenatal transfusion testing and to coordinate clinical management of alloimmunized patients and infants. This retrospective cohort provides the TML-based characteristics and transfusion requirements in neonates of alloimmunized patients.

METHODS: Prenatal antibody identifications and titrations were performed via automated gel based analyzers. Neonatal ABO, Rh, direct anti-globulin test (DAT), antigen typing and antibody identification were performed manually in saline or gel. Antibody titer of ≥ 64 or anti-Kell were considered significant. Provincial Lab Information Systems were queried for TML-based investigations on alloimmunized pregnancies, affected neonates and for transfusion of RBC or intravenous immune globulin (IVIG) in first 7 days of life.

RESULTS: Between February 2020 and January 31, 2022, 28,154 patients underwent prenatal TML-based testing. Clinically significant alloantibodies were identified in 677 (2.4%) patients; 186 (0.6%) with critical titers or anti-Kell. A positive DAT was identified in 879/8075 (11%) neonates; 644 due to ABO incompatibility (73%), 61 (7%) due to maternal Rh Immune Globulin , 49 (5.6%) due to alloantibodies and 125 (14%) false positive or unidentified etiology. Maternal antibody titers were ≥ 64 in 28/49 neonates with a positive DAT (57%). The maternal antibodies causing a positive neonatal DAT included: anti-E (17; 35%), anti-D (9; 18.3%), anti-c (5; 10%); less frequently, anti-C (4), anti-Jka (4), anti-e (3), anti-Fya (2), anti-K (2), anti-G (1), anti-S (1) and anti-Diego A (1). Eight neonates' with positive DAT (1%) required RBC transfusion: 4 with ABO incompatibility, 1 each with anti-D, c, E and Jka. Six (0.6%) required IVIG: 4 with ABO incompatibility, 1 each with anti-C and anti-Fya. Maternal alloantibody titers were ≥ 64 in all neonates transfused with RBCs' or IVIG.

Conclusion: Anti-E was the commonest alloantibody causing a positive DAT**.** One percent (8/644) of neonates with ABO incompatibility and 12 %(6/49) with maternal alloantibodies required IVIG or RBC transfusion. An antibody titer threshold of ≥ 64 was sensitive for estimation of transfusion requirements in neonates. Subsequent research on course of hemolytic disease (HDN) in the first 6 months of life will inform the management of alloimmunized infants.

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Abstract ID :

The Monocyte Monolayer Assay: Enhancing Care for the "Untransfusables"

Type of abstract : Clinical

Abstract Summary :

INTRODUCTION/OBJECTIVE: Two scenarios of interest may render a patient theoretically "untransfusable." Patients with antibodies to high-frequency RBC antigens (HFA) may face an absence of crossmatch-compatible units. Conversely, patients with a history of hyperhemolysis syndrome (HHS) may suffer relapse if re-transfused despite compatible crossmatches. The monocyte monolayer assay (MMA) is an *in vitro* functional assessment of the clinical significance of a patient's phagocytic response by incubating patient serum with patient monocytes and donor RBCs. This may be more informative than conventional crossmatch in predicting hemolytic transfusion reactions (HTR). DESIGN AND METHODS: This observational study assessed clinical outcomes in HFA and/or history of HHS according to MMA inputs after a previous HTR and/or before ensuing transfusions. The MMA used a 4:1 (patient serum) to (candidate RBC) ratio, incubated at 37°C for 1h. The number of RBCs phagocytosed in 100 monocytes was reported as phagocytic index (PI), with a significance cut-off PI of 5. RESULTS: Twenty-five patients were followed for a median of 108 weeks (IQR 46-245), encompassing 44 MMA test-dates (median 1/patient, range 1-8). In the HHS group (n=10), 2 were transfused with MMA-compatible units; 1 developed a new sensitization (anti-N) and fatal HHS; the other experienced a delayed HTR. Seven patients remained untransfused with death in 1, organ injuries in 2, procedure-disqualifications in 3, and minor morbidity in 2. In the HFA group (n=22; anti-AnWj, c, Coa, e, Fy3/Fy5, Ge2, hrB, Kna, Lub, McCa/Kna, Rh17, Sda, Yta), the HFA was deemed insignificant in 13 patients (59%). Ten (45%) were thus transfused with crossmatch-incompatible antigen-positive units. In total, 397 antigen-positive units were transfused (median 3 among recipients [range 1-230]) over 60 person-years of follow-up in the HFA group (median 1.9/patient). 394 transfusions were successful (99.2%), with 3 units implicated in 2 hemolysis events: the aforementioned HHS, and a delayed HTR with auto-anti-e. CONCLUSIONS: MMA utility is context-dependent and requires careful clinical judgement. The strongest role is to establish HFA significance, potentially re-qualifying antigen-positive units and sparing rare blood. The role of MMA in HHS is more guarded due to breakthrough adverse events. ACKNOWLEDGEMENTS: This work was supported by the Canadian Hematology Society RK Smiley Research Grant and the Canadian Blood Services Program Support Award. We are grateful to the UHN Blood Transfusion Laboratory, Branch Lab, and Canadian Blood Services.

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Abstract ID :

Leading-digit bias in red cell transfusion thresholds among hospitalized in-patients

Type of abstract : Clinical

Abstract Summary :

Background: Cognitive heuristics are common and influence medical decision making under uncertainty. Leading-digit bias is a heuristic whereby humans overemphasize the left-most digit when evaluating numbers (eg 19.99 vs 20). The decision to transfuse RBCs relies on veridical evaluation of pre-transfusion hemoglobin levels by treating physicians. We hypothesized that leading-digit bias may mediate appraisal of hemoglobin values and influence the frequency of transfusions among hospitalized patients.

Study Design/Methods: Retrospective analysis of pre-transfusion hemoglobin levels for RBCs comparing the frequency of transfusion across hemoglobin levels. The primary analysis compared the rate of transfusion at a hemoglobin couplet of 79 versus 80 g/dL in a regression discontinuity design.

Results/Findings: We examined the red cell transfusion database at the University Health Network from January 2016 to December 2021 (n=60,341 units), excluding those transfused on apheresis ward, medical day unit, and operating rooms. Our primary analysis included 2378 red cell units, of which 845 were transfused at hemoglobin of 79 and 1533 at hemoglobin of 80. This resulted in a 1.8 times increased frequency of transfusion at pre-transfusion hemoglobin of 80 compared to 79 ($p< 0.001$). The effect was consistent across all subgroups larger than 50, absent on the apheresis unit, accentuated in the emergency department, and present irrespective of temporal trends.

Conclusions: Our project is the first to demonstrate leading-digit bias in transfusion, introduces a novel target for blood stewardship initiatives, and provides insights on blood transfusion thresholds in clinical guidelines.

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Abstract ID :

The Saskatchewan Immune Globulin Stewardship Program

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective - The Saskatchewan Immune Globulin Stewardship Program aims to ensure that intravenous immune globulin (IVIG) is appropriately prescribed for indication, dose and duration needed to achieve and sustain clinical efficacy. IVIG is an expensive product and a limited resource. In appropriately selected patients and clinical settings, IVIG therapy is life-saving.

There is a strong incentive to ensure that IVIG is prescribed only for appropriate clinical indications for which there is a known benefit.

Design and Methods - IVIG has been an untracked resource in Saskatchewan. With no registry in place, no strategic oversight for orders/renewals, and an anticipated global supply shortage, a dedicated program was initiated to curb inappropriate use and ensure patient follow-up occurs for the duration of therapy.

Previous attempts to reduce inappropriate use in Saskatchewan were region-based without a provincial focus. With Alberta and Manitoba, a tri-provincial committee was created in 2018 to focus on appropriateness criteria for the clinical use of IVIG. This, along with national advisories to preserve IG product, resulted in approval from the Saskatchewan Ministry of Health to formally proceed with a provincial stewardship program in early 2021.

Project goals:

- ensure all orders follow *Criteria for the Clinical Use of IG,*
- *use adjusted body weight dosing,*
- develop patient/provider registry/interim virtual clinic,
- create intervention and shortage strategies.

A provincial adult order set and workflows were developed to screen new IVIG orders. The program launched on November 1, 2021, resulting in new IVIG orders being surveilled through tri-provincial criteria and the new registry. IVIG orders are for a maximum of six months and are reviewed as they come due. Two nurse navigators support providers in their orders, verifying that they meet best practice criteria.

Results - In the programs between November 1 to February 28, 2022, the number of IVIG orders with an inappropriate dose was reduced from 28.6% to 5.4%. An overall savings of 4% was observed.

A patient survey was launched on March 1, 2022 to capture feedback and input.

Conclusions - Initial actions have improved IVIG prescribing practices in Saskatchewan. Additional savings will be realized as renewals are received and reviewed in the future.

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- Analyst Kinsuk Sarker
- Transfusion Safety Managers Elaine Blais, Paula van Vliet
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Abstract ID :

Implementation of Novaclone™ anti-D Testing and Implications for RhD Immune Globulin Eligibility for Prenatal Patients in Western Canada

Type of abstract : Clinical

Abstract Summary :

Implementation of Novaclone™ anti-D Testing and Implications for RhD Immune Globulin Eligibility for Prenatal Patients in Western Canada

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Background: Canadian Blood Services (CBS) Diagnostic Services (DS) performs RHD genotyping on samples with discordant serological RhD results. Automated RhD typing is done on the Immucor NEO analyzer using two anti-D reagents, Immucor Series 4 and 5 (S4 and S5). Rh indeterminate results are further tested by manual tube method using S4, S5 and Dominion Biologicals Limited Novaclone™ Anti-D (ND) in order to determine Rh status and detect weak or partial D antigens that might otherwise type as RhD positive or RhD negative. Patient is reported RhD positive if all RhD antisera reactions are ≥2+ with a ≤ 1 grade difference, RhD negative if all antisera is negative and RhD indeterminate if any antisera is ≤1, or ≥2 grade difference. RHD genotyping is performed on all RhD indeterminate results.

Method: A study was performed in which 59 samples which were RhD negative on NEO testing, and positive on ND, were forwarded for RHD genotyping.

Results: 44 of 59 (75%) samples were identified as either 'Possible D' or weak D types 1, 2 or 3. These patients were reported as RhD positive. The remaining 15 samples were a variety of RHD variants reported as RhD negative. A review of results in Edmonton DS between 2019-01-29 and 2020-01-29, showed that 8,013 RhD negative patients were tested using ND. 145 (1.8%) patients tested positive and were sent for RHD genotyping. Of these, 98 (67.5%) patients were considered Rh Positive (37 weak D type 1, 25 weak D type 2, 10 weak D type 3 and 26 were 'Possible D').

Conclusion: CBS DS sites incorporated routine ND testing into their prenatal RhD algorithm for all patients who test RhD negative on the NEO. ND testing identifies a group of Rh prenatal patients not eligible for RhIG, who might have been typed as Rh negative based on initial NEO testing, resulting in a decrease in unnecessary RhIG prophylaxis.

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Abstract ID :

Patient perspectives on intraoperative blood transfusion: results of semi-structured interviews with perioperative patients

Type of abstract : Clinical

Abstract Summary :

Introduction: Red blood cell (RBC) transfusions are commonly given during major surgery. An understanding of patient perceptions of intraoperative RBC transfusions is lacking. The objective of this work was to understand patient perceptions and priorities regarding intraoperative RBC transfusion and explore their willingness to engage in transfusion prevention strategies.

Design and methods: Semi-structured interviews were conducted with patients before major operations, as well as with other patients who had recently undergone major surgery. Purposive sampling was used to select patients from diverse backgrounds and with varying perioperative courses, including the need for perioperative transfusion and presence of postoperative anemia. Inductive thematic analysis was conducted to identify major themes.

Results: Twenty patients (nine preoperative and eleven postoperative) were interviewed. After analysis, the following themes were identified: risk-benefit perception of transfusion, acceptance of transfusion prevention interventions, communication, transfusion acceptance, trust in professional judgement, and patient involvement in transfusion decisions. Overall, patients perceived transfusions as low-risk interventions, particularly when considered in the larger context of their surgical intervention. Major factors influencing transfusion acceptance included trust in the healthcare system and blood screening process, and the perception of treatability of transfusion-related complications. Many patients preferred to defer intraoperative transfusion decision-making entirely to the surgical team, citing trust in professional judgement and training and a good pre-existing relationship with their surgeon as reasons that they felt comfortable delegating this decision. However, some expressed their desire to have their preferences incorporated into intraoperative transfusion decisions. Some patients expressed the desire for a more detailed preoperative blood consent conversation, and most were open to hearing about and participating in strategies to minimize the risk of intraoperative transfusion.

Conclusions: Perioperative patients consider intraoperative transfusions as low-risk high-reward interventions, and generally trust the healthcare system and surgical team to guide intraoperative transfusion decision-making. However, preoperative blood consent discussions were superficial, brief, and lacked nuance. Targeted strategies are required to improve preoperative blood consent discussions and integrate patient preferences into intraoperative transfusion decisions.

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Abstract ID :

Understanding Intraoperative Transfusion Decision-Making Variability: A Qualitative Study using the Theoretical Domains Framework

Type of abstract : Clinical

Abstract Summary :

Introduction: Red blood cell (RBC) transfusions are commonly given during major surgery. There is evidence of significant variation in intraoperative transfusion practice between clinicians. Although some variation is expected based on case mix, wide variation that cannot be explained by disease severity or patient preference likely reflects unwarranted variation in clinical care. The purpose of this work was to understand the beliefs of anesthesiologists and surgeons that underlie intraoperative transfusion decisions

Design and methods: Twenty-eight physicians (sixteen anesthesiologists and twelve surgeons) were recruited internationally. An interview guide was developed based on the Theoretical Domains Framework (TDF) to identify beliefs about intraoperative RBC transfusion. Content analysis was then performed to group physicians' statements into the relevant theoretical domains. Relevant domains were selected based on the frequency of beliefs reported, the perceived influence on intraoperative transfusion behaviour, and the presence of conflicting beliefs.

Results: Six domains were identified as relevant to intraoperative transfusion. These included 1) *Knowledge* (there is insufficient evidence to guide intraoperative transfusion), 2) *Social/professional role and identity* (both the surgeon and anesthesiologist are responsible for intraoperative transfusion decisions), 3) *Beliefs about consequences* (concerns about both the morbidity associated with transfusion and of anemia when choosing not to transfuse), 4) *Environmental context/resources* (the type of surgery, availability of point of care hemoglobin testing devices, the patient's postoperative level of monitoring, concerns about local blood supply, and the cost of transfusion influencing transfusion decisions), 5) *Social influences* (institutional culture, judgement by peers, relationship with the surgeon or anesthesiologist, and patient preference influencing transfusion decisions), and 6) *Behavioural regulation* (wanting better intraoperative guidelines to guide transfusion, the usefulness of individual audits and educational sessions to guide intraoperative transfusion).

Conclusions: This study identified a range of beliefs that underlie intraoperative transfusion decision-making and likely explain part of the observed inter-clinician variability in transfusion behaviour. Targeted theory-informed behaviour-change interventions can be derived from this work and are likely to reduce intraoperative transfusion variability. These interventions can be integrated into an intraoperative transfusion protocol and tested as part of future clinical trials.

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Abstract ID :

Autopsy studies on COVID-19 patients: A plausible role of immunological markers in pulmonary microthromboses, embolism and pneumonia with deep vein thrombosis

Type of abstract : Clinical

Abstract Summary :

SARS-CoV-2 infection manifest as asymptomatic, symptomatic, and/or with severe symptoms, with or without various complications, particularly in older individuals. Comorbid conditions are major contributing factors in the increased predisposition to SARS-CoV-2 that causes severe infection and death, irrespective of age. Autopsy studies suggests, a majority of terminally ill COVID-19 patients die of pneumonia. Other hematologic complications and the plausible role of immunological markers will be discussed in following case scenarios.

Patient 1: Dense mixed inflammatory infiltrate in the subepithelial layers of the pharynx of an 84-year-old SARS-CoV-2-positive man with bacterial pneumonia and septic encephalopathy. Death two days after hospitalization.

Patient 2: Microthrombosis in the lung of a 75-year-old woman with COVID-19 pneumonia (no pneumonic infiltrates in the section shown). No invasive ventilation.

Patient 3: Small pulmonary embolism in 82-year-old man with COVID-19 pneumonia and deep vein thrombosis of the leg. No invasive ventilation.

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Abstract ID :

Demonstration of genetic blood group transition in patients undergoing ABO-mismatched hematopoietic stem cell transplantation by peripheral blood quantitative polymerase chain reaction targeting the ABO locus

Type of abstract : Clinical

Abstract Summary :

Introduction: ABO-incompatible allogeneic hematopoietic stem cell transplants (ABO-i HSCTs) are frequently done because more necessary aspects of the transplant match, such as HLA matching, are prioritized. However, blood transfusions between myeloablation and complete donor engraftment are challenging due to associated risks. Currently, the recipient's blood group post-HSCT and the timing of engraftment via blood group switching are monitored using insensitive serological methods with challenging interpretations, which often results in unnecessary use of scarce universal donor blood components. RBC antigen genotyping has not been well-studied in the period of HSCT engraftment and blood group switch. Here, we piloted genotyping to confirm blood group more confidently and highlight potential reduction of scarce universal donor product usage in ABO-i HSCT.

Design and Methods: A pilot cohort of 10 adults undergoing related or unrelated, myeloablative or reduced-intensity, peripheral blood ABO-i HSCT with major, minor, and bidirectional mismatches were recruited. Informed consent was obtained and baseline studies were collected pre-transplant including clinical data and baseline ABO type. Post-HSCT blood samples were collected from day 0-120 at 30-day intervals, and routine blood group investigations were processed to prepare plasma and buffy coat cells. DNA extraction was done using standardized methods (QIAsymphony SP), and ABO genotyping was done by quantitative real-time polymerase chain reaction (qRTPCR; ThermoScientific LinkSeq).

Results: ABO genotyping detected genetic blood group transition earlier as all patients had genotypic switch to the donor group by day 30, whereas routine serological testing at day 30 showed mixed field reactions (30%) or recipient group (50%). Two patients subsequently showed reversion of their blood group: 1) to original group BO by day 60 with an anti-A IgM titre of 1:8, due to disease relapse; and 2) to original group OO by day 90 with anti-A and B IgM titres at 1:8 and 1:4 respectively, due to graft failure.

Conclusion: The pilot cohort demonstrated that genotypic switch of blood group can be detected within 30 days after HSCT. The exact timing of the switch is unclear as time points earlier than day 30 were not captured. The findings here provide a foundation for future studies to investigate earlier time points in a larger cohort of ABO-i HSCT.

Acknowledgements: We thank Canadian Blood Services and UBC Pathology and Lab Medicine for their support.

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Abstract ID :

Reducing Unnecessary Transfusions of pRBC in Inpatients Admitted Across Niagara Health Community Hospitals.

Type of abstract : Clinical

Abstract Summary :

Background: Blood products are scarce resources. Audits on the use of packed red blood cell (pRBC) in tertiary centers have repeatedly highlighted inappropriate use outside of guidelines. Earlier local retrospective audit (March 2019) at St Catharines General Community hospital has demonstrated that on average 85% and 54% of all requests met Choosing Wisely Canada (CWC) guidelines for pre-transfusion hemoglobin (hgb) ≤80g/L and single unit, respectively.

Aim: We implemented a multifaceted approach to improve pRBC utilization by 15% over a period of 12 months (meeting CWC criteria of pre-transfusion Hgb ≤80g/L by >80%, and single unit transfusion >65%). Following repeated PDSA cycles, we have implemented educational strategies, prospective transfusion medicine (TM)-technologist led screening of orders (2021), and strict implementation of a pRBC orderset (February 2022).

Results: The three-month median percentages of appropriate pRBC for pretransfusion hgb and single unit (Sept-Nov 2021) across all three hospitals were 90% and 71%, respectively (Table 1). Overall, the rate of appropriate pRBC based on pre-transfusion hgb remained above target (>80%) with minimal improvement across all hospitals (median percentage at pre and post-MLT screening periods of 87% and 90%, respectively). The median percentage of appropriate pRBC based on single-unit transfusion orders has improved across all NH hospitals with sustained targets (three-month median percentage at pre, post-MLT screening and most recent time periods of 54%, 56% and 71%, respectively- Figures 1A-D and 2A-B). Implementation of force function resulted in 50% increase in the utilization of pRBC orderset in February 2022 (in comparison to 0 in February 2021). Two sites had sustained appropriate pRBC utilization based on pretransfusion Hgb and single unit (WHS and GNGH), achieving Using Blood Wisely designation through Choosing Wisely Canada.

Table 1, Figure 1, Figure 2.pdf

Conclusions: We have taken a collaborative, multifaceted approach to optimize the utilization of pRBC across the Niagara Health Hospitals. The rates of appropriate pRBC were comparable to the provincial and national accreditation benchmark standards. In particular, the TM-technologist-led screening was more effective in producing sustained improvement with respect to single unit transfusion. One of the balancing outcomes was increasing the workload on technologists. Local and provincial efforts are needed to facilitate the recruitment and retention of laboratory technologists, especially in community hospitals.

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Abstract ID :

Retrospective Review of Criteria for Clinical use of Immune Globulin

Type of abstract : Clinical

Abstract Summary :

Introduction: The Prairie Collaborative created a framework for appropriate utilization of immune globulin (IG) which outlines appropriate dosage, frequency, and duration of treatment. This quality improvement project aims to assess compliance with these guidelines and identify areas for improvement.

Design and Methods: A retrospective analysis of IVIG use from January 2020 to December 2021 was performed using the 2018 Criteria for Clinical Use of Immune Globulin to assess dosage, frequency, and duration of IVIG administered. The data collected included patient demographics, IVIG indication, dose received, frequency of doses, and date of first and last dose. Weight, height and sex were used to calculate the appropriate dose based on adjusted body weight. The data was anonymized and compared to the guidelines based on the provided clinical indications to determine compliance. The analysis consists of a proportion of patients with appropriate indications and if the dose, frequency and duration met the published guideline recommendations.

Results: The review included 1230 patients with 75 clinical indications for IVIG. Of the records examined, 98.0% of patients had appropriate indications ('green' or 'amber') while 2.0% indications were 'not listed' in guidelines. Indication breakdown was 31.5% Immunology (n=387), 25.7% Neurology/neuromuscular (n=316), 15.2% Hematology (n=187), 11.6% Rheumatology (n=143), with all others making up the remaining 16.0%. Overall dosing compliance was 76.4% with Dermatology was low (35.1%) but immunologists demonstrated 87.3% compliance. Overall compliance with frequency recommendations was high at 86.6%, with the lowest compliance being transplant medicine (74.5%). Infectious Disease had the highest compliance (100%) because of the single course nature. Overall duration compliance was 69.2%, with low Dermatology compliance (51.4%) and Infectious Disease having high (100%) compliance.

Conclusions: This quality improvement initiative identified that specific education needs to be directed to multiple disciplines. The results will be compared with data collected from other provincial jurisdictions and be shared with leadership and the ministry for mandated feedback on IG stewardship. Assessment of compliance with the 2022 guidelines will be required to ensure IG stewardship program effectiveness.

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Abstract ID :

Feasibility Assessment of a Custom Neonatal Transfusion Set

Type of abstract : Scientific

Abstract Summary :

Introduction

Neonates require special considerations for transfusion. The two neonatal transfusion sets we use (Codan B860 and Zoom Co T-152223) have a standard blood filter to the syringe, but not between the syringe and patient. In consultation with our Neonatal Intensive Care Unit (NICU), a proof of principle evaluation was done to examine red cell (RBC) hemolysis with a custom neonatal transfusion set.

Design and Methods

The transfusion set evaluated (ICU Medical C306131) includes a standard 170 µm filter on the bag spike end with tubing to a T-connector with dual back-check valve. One end of the T-connector allows for syringe connection, and the other end has microtubing to the patient. A smaller 200 µm filter just after the T-connector on the microtubing end allows for filtering between the syringe and patient.

Potassium (K^+), hemoglobin (Hb), red cell count (RBC), lactate dehydrogenase (LD), and hemolytic index (H-Index) of RBC aliquots for mock 'transfusions' were measured at baseline (direct from aliquot), after manual push through the transfusion set at 4 mL/min (to simulate rapid transfusion for emergencies in a 3 kg patient with rate provided by NICU clinical nurse educators), and 2 hours post infusion on a Medfusion® 4000 syringe pump at 22.5 mL/h (simulates the fastest infusion on the largest weight patient in our NICU setting).

Results

Overall, RBC push and infusion through the ICU Medical neonatal transfusion set did not negatively affect RBCs compared to baseline. Linear regression analysis showed similar slope patterns for Hb, RBC, and K^+ for push and post 2 h-infusion compared to baseline values regardless of irradiation status. The slopes for LD at push and post 2 h-infusion for non-irradiated and irradiated units were variable, but followed the slopes for hemolytic index in a similar fashion.

Conclusions

There were not enough study points to apply statistical analyses; however, this was a proof of principle feasibility assessment. Confounding variables include: lack of precision of manual push; dilution effects seen in second pass runs through the infusion set; and lack of donor variability due to aliquoting from parent bags to minimize unit wastage. This study was sufficient for our NICU to move ahead with the company to obtain Health Canada approval.

Acknowledgements

Thank you to the Royal Alexandra Hospital Core Lab, Transfusion Medicine labs at the Royal Alexandra Hospital and University of Alberta Hospital, Canadian Blood Services, and the Edmonton Zone NICU Clinical Nurse Educators.

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Abstract ID :

Platelet transfusions in neonatal intensive care decreased significantly following implementation of a local restrictive transfusion protocol

Type of abstract : Scientific

Abstract Summary :

Introduction/Objective: Following the results of the PlaNet 2 randomized controlled trial showing increased survival and decreased major bleeding in neonates transfused at a platelet threshold of 25 versus 50 x 10^9/L, local restrictive platelet transfusion guidelines were established at the CHU Sainte-Justine neonatal intensive care unit in 2019. Primary aims were to: 1) determine the impact of a local restrictive transfusion protocol on the number of platelet transfusions and donor exposure; 2) compare the determinants and justifications of platelet transfusion before and after its implementation.

Design and Methods: Prospective observational cohort study comparing all neonates consecutively admitted to neonatology within 5 months during two periods: in 2021 (N = 400) versus in 2013, prior to protocol implementation (N = 401). Data was collected via chart review. Logistic regressions were performed to assess possible transfusion determinants. Justifications were obtained via a questionnaire.

Results: Demographics were similar between the two cohorts: 48% versus 44% were female; mean gestational age and birth weight were 34.4 versus 34.9 weeks and 2.34 versus 2.49 kg in 2013 versus 2021, respectively. In 2021, 5.0% of neonates received at least one platelet transfusion during their neonatology stay versus 9.2% in 2013. There was a 65% adherence to protocol thresholds. The median platelet nadir prior to transfusion was 57 x10^9/L (min-max 9–285 x10^9/L) in 2013 versus 67 x 10^9/L (18–234 x10^9/L) in 2021. In 2013, 29.7% of transfused infants received ≥ 4 platelet transfusion versus none in 2021, and 21.6% were exposed to ≥ 4 donors versus none in 2021. Low platelet counts and underlying disease were the most frequent justifications for ordering a first platelet transfusion in both cohorts. Respiratory support requirements on admission and lower gestational age, birth weight or platelet count were determinants for platelet transfusion in both cohorts. Higher CRIB and SNAPPE-II scores were determinants for the 2013 cohort, whereas intraventricular hemorrhage, necrotizing enterocolitis and ibuprofen treatment were determinants of platelet transfusion in 2021.

Conclusions: The implementation of restrictive local transfusion thresholds in a NICU decreased the number of infants receiving at least one platelet transfusion by almost half and reduced the total number of transfusions and donor exposure in platelet-transfused patients.

Acknowledgements: Karine Fondrouge for data collection. Miguel Chagnon and Justine Zehr for statistical analysis.

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Abstract ID :

Performance of the Thermo Fisher TSX5030FA holding freezer for source plasma processing

Type of abstract : Scientific

Abstract Summary :

Introduction: According to the World Health Organization (WHO), source plasma should be frozen at ≤-20 °C within 24 hours post-donation to fully recover proteins from apheresis plasma donations. This study aimed to evaluate whether holding freezers (T=-30 °C) are appropriate to meet these WHO criteria for source plasma processing.

Methods: All tests were conducted with saline bags filled at maximum collection volume to reproduce the thermal behavior of plasma units during freezing. Saline bags were initially conditioned at 30 °C, corresponding to the plasma temperature at the end of collection, and were stored at -30 °C in holding freezers (Thermo Fisher TSX5030FA, Waltham, USA), where their internal temperature was continuously monitored. In experiment 1, single-batch loadings of 10, 20 and 40 saline bags were frozen. In experiment 2, batches of 10 saline bags were added to the holding freezer every 1.5 hours, up until the freezer contained 50 saline bags (i.e., five batches in total). In experiment 3, batches of 10 and 20 saline bags were added to the holding freezer every 4.5 hours, up until the freezer contained 30 and 60 bags (i.e., three batches of each).

Results: In experiment 1, the average time required to reach an internal temperature < -20 °C was consistently < 10 hours with single-batch introductions of 10 (mean = 5.3 hours), 20 (mean = 7.2 hours), or 40 units (mean = 9.8 hours), thereby meeting the WHO criteria of 24 hours. In experiment 2, similar delays were observed when up to three batches of 10 saline bags had been added (mean = 9.0 hours), and a delay of < 24 hours was observed when up to five batches had been frozen (mean = 12 hours). In experiment 3, the average time required to reach an internal temperature of ≤-20 °C was < 10 hours (mean = 6.9 hours) for three batches of 10 saline bags every 4.5 hours and < 20 hours (mean = 14.5 hours) when up to three batches of 20 saline bags had been added.

Conclusions: All scenarios considered in this study met the WHO criterion of 24 hours for plasma processing. However, the long-terms impacts of using a holding freezer to process plasma require further investigation in an operational setting, as holding freezers are designed for plasma storage and not plasma processing.

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Abstract ID :

Distribution of Genotype-Predicted Red Cell Phenotype Frequencies per Self-Reported Ethnicity in Canadian Blood Services Donors

Type of abstract : Scientific

Abstract Summary :

Introduction: Blood antigens and their expression are encoded in the human genome. Unique variations in blood antigen expression have been documented across ethnicities and result from underlying genetic diversity. Red blood cell (RBC) genotyping can be used to accurately predict donor antigen phenotypes, identify rare and variant alleles, and aid in the selection of blood products for transfusion. We describe here the genotype-predicted RBC phenotypes of 2720 Canadian blood donors according to self-reported ethnicity.

Design and Methods: A total of 2720 Canadian blood donors were genotyped between April 1, 2018, and January 31, 2022 at the CBS National Immunohematology Reference Laboratory. RBC antigen genotyping was performed with a Health-Canada licensed targeted assay that interrogates 29 polymorphisms in the Rh, Kell, Kidd, Dufy, MNS, Diego, Dombrock, Colton, Cartwright and Lutheran blood group systems. RhD type and ABO group were determined by serological testing. Predicted phenotypes were correlated with self-reported ethnicity at time of donation, and geographical distribution was determined based on the corresponding blood distribution facility. Calculations for predicted phenotypes and allele frequencies were compared with published literature.

Results: The distribution of self-reported ethnicity for genotyped donors was: 31% Indigenous, 26% Black, 22% White, 8% South Asian, 4% Latin American, 3% Asian, 1% other/mixed race, < 1% Arabic, and 4% declined to answer. Black donors had the highest occurrence (47%) of D+ C- E- K- red cells, a phenotype frequently requested for transfusion support of Sickle Cell Disease patients. The majority of Fy(a-b-) and all U- phenotypes were detected in Black donors; this group also demonstrated the highest percentage of hrB- and highest frequency of variant RHCE alleles. A single RzRz phenotype was identified, in an Indigenous donor. The JK*02N.06 allele was found in Latin American (0.83%) and Indigenous (0.48%) donors, while the JK*02N.01 variant was identified in 11 donors of Asian descent.

Conclusions: Phenotype distributions in Canadian donors are concordant with reported antigen frequencies in various global populations, supporting the need for an ethnically-diverse blood donor base to meet the transfusion needs of hemoglobinopathy patients and patients requiring rare blood units. Results from this study will be updated periodically and can be used by the Canadian transfusion community to estimate national donor blood antigen frequencies. Expansion of our donor genotyping assays will allow discovery of novel variant alleles and will strengthen our Rare Blood Program.

Acknowledgments: Canadian Blood Services

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Abstract ID :

Shipment of Glycerolized RBC Segments for RCC Compatibility Testing

Type of abstract : Scientific

Abstract Summary :

Introduction / Objective: Canadian Blood Services cryopreserves red blood cell (RBC) concentrates (RCCs) to maintain a frozen bank of rare units for transfusion. Currently, pre-transfusion compatibility testing requires RCCs to be thawed and deglycerolized, which could result in the unit being discarded if incompatible with the intended recipient. An alternative is to use tubing segments from RCCs. However, thawed segments may require transport from the storage location to the testing lab, leading to extended glycerol exposure that could impact testing outcomes.

Design and Methods: Three RCC units were manually glycerolized (40%) at 21-days post-collection for preparation of frozen segments (< -65 °C). Segment thawing at room temperature (RT) or 37 °C water bath (WB) was completed before RT or 1-6 °C storage for 0, 24, 48, or 72 hours prior to deglycerolization and RBC hemolysis testing. Additional segments were thawed by RT, WB, or without thawing and shipped in temperature-maintained containers at either RT or 1-10 °C for antibody screening.

Results: Hemoglobin (Hb) and RBC recovery for segments stored at 1-6 °C were 78 ± 9 % and 55 ± 4 %, respectively for RT-thawing (n=12) and 82 ± 8 % and 56 ± 5 %, respectively for WB-thawing (n=12). Hb and RBC recovery results for RT stored segments were 76 ± 14 % and 52 ± 4 %, respectively for RT-thawing (n=12) and 78 ± 6 % and 56 ± 3 %, respectively for WB-thawing (n=12). RBC hemolysis for segments stored at 1-6 °C by RT- and WB-thaw, and for RT storage after RT- and WB-thaw were: 0.82 ± 0.26 %, 0.73 ± 0.13 %, 0.66 ± 0.10 % and 0.67 ± 0.13 %, respectively. Antibody screening successfully confirmed the known phenotype of each sample.

Conclusions: Extended glycerol exposure post-thaw did not elicit excessive hemolysis or cell loss regardless of thawing or storage conditions. Shipment of segments had no adverse impact on the accuracy of serological testing.

Acknowledgments: 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.

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Abstract ID :

Validation of the Countess II FL as a Method for Enumeration and Viability Assessment of PBMCs

Type of abstract : Scientific

Abstract Summary :

Introduction / Objective:

Viable cell counts are required to monitor quality of human peripheral blood mononuclear cells (PBMCs) used as cell reagents in research and diagnostic applications. Automated cell counters were developed to improve accuracy and reproducibility of measurements while reducing analysis time (compared to manual methods). We evaluated the error in determining viable cell counts using the Countess II FL, an automated fluorescent cell counter, to support implementation of a reagent cell bank.

Design and Methods:

PBMCs were isolated from (1) whole blood collected in ACD anticoagulant tubes (WB-PBMCs) and (2) buffy coat products separated from CPD-anticoagulated whole blood (BC-PBMCs). WB-PBMCs were analyzed immediately post-isolation, whereas BC-PBMCs were isolated, cryopreserved and analyzed post-thaw/wash. Linearity, accuracy, repeatability, instrument-to-instrument and technician-to-technician error, and cell interference (RBCs/PLTs) are reported for the method using a SYTO 13 and Gel Red Stain combination.

Results: Total cell concentration (TCC) results were linear within $1x10^6$ cells/mL to $8x10^6$ cells/mL and $1x10^6$ cells/mL to $10x10^6$ cells/mL for WB-PBMCs and BC-PBMCs, respectively. Viability was linear from 0% to 100% for TCCs of $2x10^6$, $4x10^6$, and $8x10^6$ cells/mL, except for BC-PBMCs at $8x10^6$ cells/mL where linearity was from 25% to 100%. Imprecision was high for samples with low viability (< 50%), however for TCC of approximately $5x10^6$ cells/mL with high viability (>90%), imprecision was within acceptable ranges with coefficients of variation of 8.2% for TCC and 7.6% for viability. Comparison with manual Trypan Blue exclusion method demonstrated Countess results exhibited a negative bias for both TCC and viability. Variability for TCC and viability was under 15% for instrument comparisons and for technician comparisons ranged from 0.3% to 49.9% and 3.9% to 22.4%, respectively. Interference from RBCs and PLTs was only statistically significant for interfering CCs of $5x10^6$ cells/mL and $2.5x10^6$ cells/mL, respectively, with no significant impact on viability.

Conclusions: Despite limitations associated with accuracy, reproducibility, and technician variability for the Countess, it remains an effective method for rapid measurement of PBMC TCC with viability > 80%.

Acknowledgments: 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.

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Abstract ID :

Comparison of anti-D titre results by conventional tube technique using non-identical versus identical indicator cells through a retrospective review of IQMH surveys

Type of abstract : Scientific

Abstract Summary :

Title

Comparison of anti-D titre results by conventional tube technique using non-identical versus identical indicator cells through a retrospective review of IQMH surveys

Introduction/Objective

There are many variables in antibody titration including a lack of method standardization. IQMH enabled a continuous quality improvement initiative by providing participants with titre indicator cells in Transfusion Medicine (TMED) Proficiency Testing (PT) surveys beginning in March 2021. The objective was to review the survey titre results between non-identical and identical indicator cells to assess the impact of indicator cells provision in conventional tube titration.

Design and Methods

Two TMED surveys from 2018 and 2021 with four anti-D titre challenge samples were selected to rule out high/low titre bias in the pre-implementation phase and to compare titre results between pre- and post-implementation.

Diluted serum ratio, incubation time, and technologists' interpretation bias in the groups were not controlled among survey participants. To assess the statistical significance of indicator cells in titre variability, four one-tailed F-tests were performed between sample titre results after logarithmic conversion. A P-value of <0.05 was considered statistically significant.

Pre-implementation Phase Comparisons			
Survey Year	**Titre**	**N**	**SD***
2018	Low	45	1.18
	High	45	1.32
Pre-/Post-implementation Phase Comparisons			
2018	Low	45	1.18
	High	45	1.32
	All	90	1.95
2021	Low	45	0.84
	High	45	0.75
	All	90	1.57

*Standard deviation

Results

Category	Comparison Groups	F-value	P-value (one-tailed)
Pre-implementation	1 – 2018 Low Titre versus High Titre	1.251	0.230
Pre- versus post-implementation	2 – 2018 Titres versus 2021 Titres	1.535	0.022
	3 – 2018 Low Titre versus 2021 Low Titre	1.978	0.013
	4 – 2018 High Titre versus 2021 High Titre	3.134	0.0001

Overall, based on the P-value, intra-survey comparisons of low/high titre sample results in the pre- implementation phase were not significantly different (comparison group 1) but there was a statistically significant difference in the titre result comparisons between pre- and post-implementation of indicator cells (comparison groups 2, 3, and 4). Implementation of indicator cells provision led to a statistically significant decrease in variation in titre results.

Conclusions

Use of identical zygosity indicator cells in the titration method across laboratories led to a decrease in the interlaboratory variance of the titre results. The decrease in variance allows for better comparison of interlaboratory results when performing peer-to-peer comparisons and assessing laboratory performance.

Acknowledgements

We would like to acknowledge the IQMH TMED scientific committee for their review and insight.

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Abstract ID :

Development and evaluation of a targeted, multi-wavelength, detection method for retinal oximetry using a tissue phantom

Type of abstract : Scientific

Abstract Summary :

Introduction: Directly evaluating blood oxygen saturation (sO_2) in retinal tissues (ocular oximetry) is a promising approach to prevent, diagnose and manage ocular conditions. The development of new tools to measure ocular oximetry has been limited by the lack of a reference method. The objective of this study was to assess the impact of scattering, blood volume fractions, and lens yellowing (i.e., cataract simulation) on the measurement accuracy of an ocular oximetry detection method using a tissue phantom.

Methods: The phantom model is composed of a chamber and an achromatic lens inserted through a circular opening. Distilled water is used in the chamber to simulate the vitreous body. A test tube is inserted vertically into the chamber through a dedicated opening. The test tube was filled with a mixture of phosphate-buffered saline, red cell concentrates and lipid emulsion solution (LES). To mimic differences in fundus microvessel density, liquid phantoms with different blood volume fractions were prepared. Five hemoglobin concentrations (0.25, 0.50, 1.00, 2.25 and 4.50 g/dL, with 0.25% LES) at different concentrations of sO_2 were used. The impact of scattering was evaluated by varying the concentration of LES (0.25%, 0.75%, 1.00%, and 2.00%) at different concentrations of sO_2. The robustness of measurements to lens yellowing was investigated at different concentrations of sO_2 (Hb = 1.00 g/dL and LES concentration = 0.25%).

Results: No correlation was found between the mean absolute error and the hemoglobin concentration (Kendall Tau test: $\tau = 0.2$, $p = 0.817$). For all test conditions, the absolute error compared to the blood gas analyzer measurements (ABL 90 FLEX Plus, Radiometer) was less than 5%. The four LES concentrations yielded consistent results regarding the variability induced by scattering (Friedman statistical test; $p = 0.82$). Measurements of blood sO_2 in the retinal tissue of liquid phantom remained stable with varying levels of lens yellowing, confirming the robustness of the ocular oximetry detection algorithm to cataract.

Conclusions: The herein described optical tissue phantom enabled us to evaluate the analytical performances and robustness of an ocular oximetry detection method by diffuse reflectance spectra analysis.

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Abstract ID :

Novel mechanisms of Thrombopoietin regulation: the required role of Kupffer cells

Type of abstract : Scientific

Abstract Summary :

Introduction/Objective: Thrombopoietin (TPO) is the physiological regulator of the hematopoietic stem cell niche (HSC), megakaryopoiesis and platelet production. Our previous report demonstrated that platelet GPIbα is required for platelet-mediated TPO generation (Blood, 2018). However, the mechanism of the platelet-hepatocyte interaction is unknown since platelets in the vessel lumen are separated from hepatocytes by a fenestrated endothelium. Potential intermediaries for TPO generation include hepatocyte luminal protrusions, and Kupffer cells that reside along the endothelium and mediate desialylated platelet (dPLT) clearance. However, whether Kupffer cells contribute to TPO generation independently or in concert with hepatocellular protrusions has not been explored.

Design and Methods: Murine Kupffer cells were depleted with Clodronate Liposomes. Murine endothelial fenestrations were reduced with treatment of 250ppb arsenite in their drinking water. Kupffer cell depleted and arsenite-treated mice were transfused $3x10^8$ dPLTs. Sera and platelet counts were recorded, and TPO quantified by ELISA. Primary murine Kupffer cells were isolated and cultured alone or with dPLTs, and media supernatant was added to hepatocytes for TPO qPCR analysis.

Results: Kupffer cell depleted mice showed a TPO decrease of 43.6%(±16) 2 days post depletion, which could not be rescued with dPLT transfusion, indicating that Kupffer cells are required for platelet-mediated TPO generation. Arsenite-treated mice had a nadir of 61.3%(±4) baseline TPO levels, and were also non-responsive to dPLT transfusions, demonstrating that Kupffer cells facilitate platelet-hepatocyte luminal protrusion contact for TPO generation. Surprisingly, Kupffer cell depletion in GPIbα-deficient mice, which lack platelet-mediated TPO generation, had a TPO decrease of 22.5%(±5) and *in vitro* Kupffer cell supernatant increased hepatocellular TPO expression by 2.43 fold. These data suggest that Kupffer cells promote baseline TPO production via secretory factor release.

Conclusion: Our data demonstrates that Kupffer cells are essential for platelet-mediated TPO generation and promote constitutive hepatocellular TPO production. These findings have broad impacts for the HSC niche, megakaryopoiesis and platelet generation as well as therapeutic discovery for thrombocytopenia patients.

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Abstract ID :

ANTIGEN DENSITY AND ANTIBODY DOSE CAN TIP THE BALANCE BETWEEN IMMUNE SUPPRESSION AND ENHANCEMENT IN A MOUSE MODEL OF RBC ALLOIMMUNIZATION RELATED TO HEMOLYTIC DISEASE OF THE FETUS AND NEWBORN

Type of abstract : Scientific

Abstract Summary :

Hemolytic disease of the fetus and newborn (HDFN) is a severe neonatal disorder caused by the destruction of fetal red blood cells (RBCs) through maternal alloantibodies. Although HDFN caused by the RhD antigen can be effectively prevented by administering donor-derived anti-D through a process known as antibody-mediated immune suppression (AMIS), failures still occur in the clinic and there is no prophylaxis for other clinically relevant antigens. Consequently, maternal alloimmunization continues to be the leading cause of fetal anemia. To address this, understanding the factors underlying RBC alloimmunization and its suppression is critical. Besides donor and recipient characteristics, intrinsic RBC antigen factors such as antigen density have been shown to play an important role in immunogenicity and immune responsiveness following RBC alloimmunization. Our lab has developed a mouse model that allows the alteration of the antigen density of the model antigen hen egg lysozyme (HEL) on the surface of mouse RBCs. Using this model, we have previously shown that antigen density can significantly alter the immune response of the transfused recipients. We hypothesize that antigen density also alters the requirements for AMIS-inducing antibodies. RBCs decorated with medium levels of HEL (HEL^{med}) and high levels of HEL (HEL^{hi} RBCs) were transfused into C57BL/6 mice followed by different concentrations of an anti-HEL polyclonal antibody injection. HEL-specific IgM and IgG responses were measured every week for a total of four weeks. An effective AMIS response required an antibody concentration that caused saturation of the RBCs and there was a clear correlation between the dosage of the injected antibody and AMIS effect size. The latter also correlated to the amount of RBC phagocytosis in vitro, with a maximal AMIS effect in vivo causing the largest amount of phagocytosis in vitro. Interestingly, an insufficient dose of antibody caused enhancement of the response in vivo but did not cause phagocytosis in vitro indicating that phagocytosis was not required for enhancement. Overall, these results may have important implications for the clinic where anti-D administration is based upon the volume of the fetal bleed rather than fetal antigen density. The work presented here suggests the possibility that administering insufficient amounts of anti-D could enhance the maternal immune response rather than suppress it and that the fetal antigen density should be considered.

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Abstract ID :

An OMICs approach to increasing the shelf life of cord blood units

Type of abstract : Scientific

Abstract Summary :

An OMICs approach to increasing the shelf life of cord blood units

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Introduction: Cord Blood (CB) banks can store cord blood units (CBU) at room temperature (RT) up to 48 hours before cryopreservation. One of the factors that may contribute to low cell numbers and engraftment is processing delay. However, the extent to which processing delay impacts Hematopoietic stem cells and progenitors (HSPCs) biology is not well understood. We previously reported that CBU stored at RT for >43 hours had significantly fewer number of colony-forming-unit colonies and reduced human bone marrow engraftment in primary and secondary xenotransplants (*P< 0.05). However, the molecular programs driving these functional changes are not known.

Study design: We exposed CD34+ cells to fresh serum (~4 hours) and old (~43 hours) UCBs for 20 minutes and up to 4 hours at RT and collected RNA from live cells for next generation sequencing analysis. The RNA seq analysis was done using 2 independent donors.

Results: Greater percentage of apoptotic $CD34^+$ cells (Annexin V^+ $7AAD^-$) were observed when $CD34^+$ cells were exposed to fresh vs old plasma for 20 minutes (18% vs. 36%, P< 0.05). At 4 hours, the percentage of apoptotic HSPCs in the fresh and old plasma were 24% and 33% respectively (P>0.05). Time course transcriptomic analysis of the RNAseq data revealed that the CB CD34+ cells exposed to old plasma expressed a unique transcriptional profile compared to those exposed to fresh plasma. Interestingly, we noticed that the CB HSPCs exposed to old plasma had increased (>2 fold) expression of cyclin kinase inhibitors CDKN1B (p21KIP), CDKN2A (p14ARF) and down regulation of cyclin dependent kinase genes that promote cell cycle and DNA repair. Importantly, these genes were not overexpressed within the cells expressed to fresh plasma.

Conclusion: We have identified that delay in CBU processing triggers a unique transcriptional profile within HSPCs that may promote cell cycle arrest and senescence. CDKN1B overexpression is known to promote senescence and cell cycle arrest within HSPCs that leads to reduced long-term chimerism. Reversal of this program may help increase the shelf life of CBU at RT prior to processing.

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Abstract ID :

A broad-spectrum molecular basis for hemostatic disease in transfusion-transmissible enveloped viruses: HIV and dengue virus

Type of abstract : Scientific

Abstract Summary :

Background:

Numerous viruses modulate blood clotting and may cause hemostatic pathology. This is caused by virus-host interactions involving plasma clotting factors, cells and complement proteins. A precise molecular explanation for these events does not currently exist. Our objective is to fill this knowledge gap and unify the molecular basis. We will focus on two viruses that affect hemostasis and put a strain on global transfusion systems: HIV and dengue virus (DENV).

We have observed the host-encoded coagulation initiator, tissue factor (TF), on the surface of various purified herpes viruses. Common to these viruses is an envelope, a membrane obtained from the host cell that can retain host proteins like TF. Since TF is widely expressed on infectible cell types, **we hypothesize that TF is ubiquitous on the surface of envelope viruses and plays a role in viral pathology.**

Aims

1. **Demonstrate TF antigen on the envelope of HIV and DENV**
2. **Demonstrate TF coagulation activity associated with HIV and DENV**

Methods:

Immunogold electron microscopy was performed to show the presence of TF and a viral protein on HIV (gp120) and DENV (E protein). Non-immune isotype antibodies were used as negative controls for specificity. A chromogenic assay probed the TF-dependent activation of coagulation factor (F) X to FXa. Recalcified plasma clotting assays were also conducted with purified virus. In both functional assays, the virus was the only source of TF as the initiator of activity. Anti-TF antibodies or a specific peptide inhibitor (NAPc2) was used to support TF-dependence.

Results:

TF was detected on DENV, which co-stained for virus-encoded E protein, confirming virus identity. TF was found on virus-like particles in purified HIV samples, but these were not co-identified by our current panel of anti-gp120 antibodies. Particles in HIV-infected patient plasma that were morphologically similar to HIV were positive for TF and gp120. Greater DENV or HIV concentrations resulted in a shorter clotting time and increased FXa generation. These were inhibitable by TF-specific agents and like the physiological TF mechanism, were dependent on FVIIa and calcium, indicating TF activity associated with both viruses.

Conclusions:

These data support the ubiquity of TF antigen and activity on the surface of enveloped viruses, which can affect pathology during infection.

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Abstract ID :

Strategies to Meet CBS’s IVIg Market Brand Share Targets

Type of abstract : Scientific

Abstract Summary :

Introduction/Objective

In December of 2020, Canadian Blood Services (CBS) issued a customer letter outlining expected short and long term challenges with the national IVIg supply. To mitigate the impact of this shortage, CBS requested that hospitals review their IVIg issuing policies and adjust usage of the different types of IVIg products to match CBS's IVIg market brand shares.

Design and Methods

IVIg issuing practices at Sunnybrook Health Sciences Centre were reviewed for the period of September to November 2020. The current policies allow for brand switching, and stocking of all available IVIg brands. During the review period it was found that approximately 55% of the IVIg issued was Gammagard Liquid, approximately 37% was Privigen, and the remaining 8% was distributed amongst other available brands. Further evaluation of usage practice was undertaken to review patient infusion location (inpatient/outpatient), stock inventory levels, and MLT product selection practices. It was found that MLTs were preferentially choosing certain brands because of the availability of certain vial sizes and uneven inventory stock levels. It was also found that one brand was preferred due to room temperature storage, in a location closer to the laboratory workspace.

Results

In January 2021, adjustments were made to inventory stock levels for all IVIg brands to align with the CBS brand share targets. Staff education was held in the form of morning huddles and posting information near the IVIg storage locations. Staff was asked to use Privigen for the inpatient population only, and reduce the use of Gammagard by half. These changes lead to small improvements. In June 2021, a more stringent plan was implemented. This plan included switching our inpatient population to Gammagard Liquid, primarily using IGIVnex/Gamunex for our outpatient population, and using all other brands under specific situations. All IVIg was also relocated to a central location. With the implementation of this plan, the usage at Sunnybrook aligned with the CBS share splits by August 2021.

Conclusion

With continued monitoring and buy-in from staff, adjustment of IVIg brand usage was possible. This plan will need continued monitoring and adjustment as our patient population changes and the CBS brand shares change.

Acknowledgments

The staff of the Sunnybrook Transfusion Medicine and Tissue Bank

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Abstract ID :

Porcine Whole Blood Processing, Storage, and In Vitro Quality Assessment Over 42-day Period

Type of abstract : Scientific

Abstract Summary :

Background & Aim: The quality of red cell concentrates (RCCs) deteriorates during hypothermic storage post-production for both human and porcine products. Understanding these changes is important for assessing porcine RCCs used in *ex vivo* organ perfusion (EVOP) research, where RCC products may improve organ survival. This research aimed to develop a whole blood processing method to produce porcine RCCs with comparable quality characteristics to human products assessed over 42-day storage.
Materials & Methods: Porcine whole blood was collected from domestic pigs into CPD coated bags. Within 20 h of collection a buffy-coat/red cell filtration method was used to produce a leukoreduced RCC in SAGM (total n=6). The RCCs (n=4) were then evaluated weekly for hematocrit (hct), hemolysis, oxidative hemolysis, extracellular potassium, osmotic fragility (MCF), oxygen affinity (p50), deformability (EI_{Max} & KEI), RBC indices (MCV, MCH, MCHC), and ATP concentrations. Results were compared with previously published data on human RCCs and regulatory requirements.
Results: Units met regulatory requirements for hct (≤ 0.8L/L) and only surpassed the (≤ 0.8%) hemolysis standard on day 42. Extracellular potassium increased across the storage period, remaining comparable to human values ($p< 0.01$). ATP dropped substantially in the first week from 38.0 ± 15.4% to 4.4 ± 9.3%, but remained comparable to human values at day 7. Fresh (between day 0-7) porcine RBC p50 and MCF was significantly higher than human values ($p< 0.01$). On the other hand, porcine MCV and MCH values were significantly lower across the entire storage period ($p< 0.01$). Fresh porcine RCC cell elongation was comparable to human cells, but upon expiry (day 42), decreased significantly ($p< 0.01$) to an EI_{Max} of 0.35 ± 0.03 compared to human values (0.55 ± 0.05) at expiry.
Conclusions: Differences in porcine RBC quality across storage may be attributed to differences in cell size and membrane fragility compared to human RBCs. Regardless, fresh porcine RBCs are comparable to their human counterparts and may benefit EVOP research, especially within the first week of storage.

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Abstract ID :

Barriers to blood donation for young adults of African ancestry in Canada

Type of abstract : Scientific

Abstract Summary :

Introduction / Objective: In Canada, approximately 5-6,000 people live with sickle cell disease (SCD). A hereditary condition that causes sickling of red blood cells, SCD is more prevalent amongst people from tropical regions including Africa, the Caribbean, Middle East, Southeast Asia, and South/Central America. Most SCD patients in Canada who require regular transfusion require blood group combinations that are most frequent in people of African ancestry. Currently, <1% of blood donors identify as Black raising challenges for meeting the needs of people with SCD and increasing the potential for health inequities. This project aims to identify barriers to blood donation for young adults of African ancestry to facilitate blood donation by this population.

Design and Methods: This presentation reports results from a community-based qualitative study. Leaders of sickle cell community organizations and researchers co-constructed study design and all aspects of the research project. A Community Advisory Committee (CAC) made up of members from diverse communities of African ancestry was formed to provide guidance and assist with participant recruitment. Purposive and snowball sampling strategies were applied. Inclusion criteria included: 1) between 19-35 years (inclusive); 2) self-identify as African, Caribbean, or Black; 3) comfortable in English; and 4) living in Canada. In total, 22 young adults participated in a focus group or semi-structured interview (Nov. 2021 – Mar. 2022). All focus groups and interviews were conducted by videoconference, audio-recorded, transcribed, and thematic analysis was conducted.

Results: (preliminary)

1. Slightly more participants were female (n=14) than male (n=8) and 50% (n=11) had donated blood previously.

2. Participants identified multiple barriers to donation: *personal* (fearing needles), *socio-cultural* (cultural views on blood, family views on donation), *organizational* (location of donor centre, hours of operation, limited representation of diverse staff, negative experiences with donation, lacking knowledge of donation process, lacking awareness of the need for blood), and *systemic* (experiences with medical racism, lacking trust in health and blood systems).

3. All participants expressed the view that donating blood is a valuable contribution.

Conclusions: (preliminary)

Addressing barriers to donation may increase donation by young adults of African ancestry. Blood operators should consider how they can reduce organizational and systemic barriers to encourage this population to donate blood to better meet the needs of everyone in Canada.

Acknowledgements:

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Abstract ID :

Finding Platelet Antibodies That May be Missed by Pak Lx

Type of abstract : Scientific

Abstract Summary :

INTRODUCTION:

Pak Lx is a qualitative test kit used to detect and identify IgG platelet antibodies, if present, in patient sera. Test results are analyzed using the correlating MATCH-IT! software designed by Immucor specific to this test kit. Results for the various antibody targets are reported as either "Positive", "Reactive", or "Negative". In the Canadian Blood Services (CBS) National Platelet Immunology Reference Lab, there have been cases in which the Pak Lx algorithm reported a certain antibody target as negative, but a closer examination of the Mean Fluorescence Intensity (MFI) suggests the possible presence of an antibody. Further testing in these cases utilizing Monoclonal Antibody-specific Immobilization of Platelet Antigen (MAIPA) testing led to the identification of platelet specific antibodies that would have otherwise been missed.

DISCUSSION:

The Pak Lx antibody kit is routinely used for investigation of alloimmunized patient samples and maternal samples for Fetal and Neonatal Alloimmune Thrombocytopenia (FNAIT) to identify platelet specific antibodies. The test is a Luminex based assay with the data analysis performed by the MATCH IT! Platelet Antibody Software. The bead reactivity is interpreted as either "positive" or "negative". However, we have recognized that on rare occasions the software interprets the bead reactivity as "negative", but the MFI values appear to be notably elevated.

RESULTS:

Four patient samples were identified to have elevated bead reactivity noted on the Pak Lx antibody kit with a negative interpretation. Subsequent testing by MAIPA identified the presence of anti-HPA antibodies corresponding to the patterns suggested by the Pak Lx bead reactivity. The antibodies identified were anti-HPA-1b in three cases, and anti-HPA-3b in one case.

In addition to the discovery of these antibodies detected by MAIPA, it was noted that the Pak Lx kit lot number did not have any role in the matter. Each patient mentioned in this abstract was tested on differing kit lot numbers.

CONCLUSION:

Careful review of Pak Lx MFIs and bead reactivity patterns by technologists led to the identification of four anti-HPA antibodies that would have otherwise been missed by routine testing. Laboratory personnel should ensure that the automatic interpretation provided by testing kits correlates with the reported pattern of bead reactivity. Patterns suggestive of an underlying antibody should be forwarded for additional confirmatory testing.

ACKNOWLEDGEMENTS:

National Platelet Immunology Reference Laboratory medical laboratory technologists for their combined work on the testing of these patient samples.

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Abstract ID :

Adult Platelet Utilization Review Pre and Post Implementation of a Computerized Physician Order Entry in a Tertiary Care Center

Type of abstract : Scientific

Abstract Summary :

Introduction

The use of platelet transfusions varies widely in tertiary care. To increase education about need for platelet transfusion and to reduce wastage, computerized physician order entry (CPOE) is often used. The intent of this review was to determine whether indications for platelet transfusion to guide platelet transfusion decisions reduced the frequency of platelet transfusion and aligned transfusion with indication.

Design and Methods

A retrospective study was conducted from June 2017 to June 2021 comparing adult platelet transfusion utilization 2 years before implementation and 2 years after implementation at a tertiary care center in Toronto. Utilization based on clinical service, the pre-transfusion platelet count, the clinical indication, and whether clinicians requested according to criteria were compared.

Results

The CPOE was implemented in June 2019. Data were reviewed from June 2017 to May 31, 2019 and June 2019 to May 31, 2021. Pre-implementation, 1331 units of platelets were transfused and 1057 units of platelets post implementation. This resulted in a reduction of 20.6%. Comparing pre and post implementation, the intensive care unit (ICU) transfused 1049 units (78.8%) vs. 798 (75.5%), General Medicine 54 units (4.1%) vs. 33 (3.1%), Operating Room (OR) 47 units (3.5%) vs. 28 (2.6%), Emergency (ER) 40 units (3.0%) vs. 41 (3.9%), and Obstetrics/Gynaecology (OBGYN) 35 units (2.6%) vs. 34 (3.2%), respectively. The remainder of the services transfused at rates less than 2%. 21.6% vs. 15.1% were requested for active bleeding, 4.4% vs. 3.0% during surgery, 43.7% vs. 36.8% for counts < 10 x 10^9/L, 14.9% vs. 19.1% for counts 10 – 20 x 10^9/L, 8.5% vs. 12.3% for counts 20 – 30 x 10^9/L, 5.5% vs. 8.8% for counts 30 – 50 x 10^9/L, and 1.4% vs. 4.9% for counts 50 - 100 x 10^9/L, respectively. The mean pre-platelet count was 23 x 10^9/L vs. 44 x 10^9/L. Categorization by clinical indications were as follows: prophylaxis, periprocedure or surgery, bleeding with normal platelet function, and other-requiring approval which accounted for 30.9%, 14.5%, 25.1%, and 0.8%, respectively. 304 units (28.8%) were transfused without using the CPOE.

Conclusions

Implementation of CPOE declined usage by 20.6%. By comparing clinical service and clinical indications, platelet utilization will be monitored more closely which is an effective tool in reducing inappropriate platelet transfusions and continuously improving practice guidelines.

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Abstract ID :

Plasma donors, payment and the emerging commercial plasma sector in Canada

Type of abstract : Scientific

Abstract Summary :

Use of plasma protein products has expanded significantly, and Canada is increasingly dependent on the US to collect plasma for these products mainly from commercial facilities that pay donors. To address a national concern over the sufficiency of plasma, Canadian Blood Services (CBS) initiated three new source plasma collection centres based on voluntary non-remuneration. At the same time, there is an emerging commercial plasma sector in Canada, opening plasma collection centres and paying donors. This qualitative study investigates source plasma donor perspectives on payment for plasma, and the introduction of a commercial plasma industry in Canada. This investigation is part of a broader ethnographic process evaluation of the CBS plasma proof-of-concept program. Source plasma donors from the three proof of concept centres in Sudbury, Lethbridge and Kelowna were recruited through purposive sampling, and 101 semi-structured one-on-one interviews were conducted by videoconference or telephone between December 2020 and October 2021. Participants were asked about their perspectives on payment for plasma donation, and the role of commercial plasma collection centres in Canada. Interview data were analyzed using thematic analysis informed by grounded theory and abductive analysis, which move between gathering and analyzing data. This study indicates that some source plasma donors are personally not interested in payment, but not opposed. Some are opposed because donation should be to help people, and donors who rely on payment may lie on the questionnaire or put their health in jeopardy. Some participants are open to CBS paying donors if it is necessary to increase national sufficiency of plasma. Most participants are opposed to commercial plasma collection in Canada, claiming that it could undermine Canada's public healthcare system. They raise critical questions about transparency and accountability of the commercial plasma industry. This study identifies key public policy questions related to publicly collected source plasma, the emerging commercial plasma sector, and the role of the donor as a social actor in a complex political system.

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Abstract ID :

THP-1 cells transduced with FcgRIIIA: a tool to study Fc receptor functions and phagocytosis

Type of abstract : Scientific

Abstract Summary :

Introduction: Fc gamma receptors (FcγRs) are critical immune effector receptors for immunoglobulin G (IgG) antibodies. On macrophages, FcγRs mediate multiple effector functions such as phagocytosis, antibody-dependent cellular cytotoxicity, and antibody-dependent inflammation. Consequently, macrophage FcγRs have been associated with protection against infectious diseases but also pathogenicity in several antibody-mediated inflammatory disorders. While important primary human macrophage populations such as splenic macrophages can express FcγRI, FcγRIIA, and FcγRIIIA, there is currently no widely available macrophage cell line expressing all these receptors.

Design and Methods: Here, we designed a lentiviral system for the expression of FcγRIIIA on the monocytic cell line THP-1. The genes encoding for human FcγRIIIA and the FcRγ chain were amplified by PCR and then introduced into the lentiviral vector pVLX-puro as a bicistronic sequence, with the two genes separated by a 2A peptide element.HEK-293T/17 cells were transfected with the lentiviral system to produce the viruses that were later used for the infection of THP-1 cells. The expression of the receptor on transduced cells was followed by flow cytometry and the functionality of the cells was evaluated by phagocytosis.

Results: The transduced cells (THP-1 CD16A+ cells) maintained stable FcγRIIIA expression after repeated passaging, and lentiviral transduction did not alter the expression of other FcγRs for both unstimulated and phorbol 12-myristate 13-acetate-stimulated cells. THP-1 CD16A^{+} cells utilized FcγRIIIA in the phagocytosis of anti-D-opsonized human red blood cells and antibody-opsonized human platelets.

Conclusion: These transgenic cells constitute a valuable and convenient tool for further studies of macrophage FcγRIIIA as well as other FcγR effector functions.

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Abstract ID :

Comparison of Methods to Determine the Concentration of Fibrinogen in Plasma and Cryoprecipitate

Type of abstract : Scientific

Abstract Summary :

Introduction: As part of their quality control, blood centers routinely measure the concentration of fibrinogen in cryoprecipitate. Various commercial kits can be used to measure fibrinogen concentration; most are based on the prothrombin time-derived fibrinogen (PT-Fib) method or the Clauss method. A laboratory using the PT-Fib method ("Laboratory A") appeared to systematically obtain higher fibrinogen content than another one using the Clauss method ("Laboratory B"), in spite of having very similar procedures for preparing cryoprecipitates. We investigated whether the choice of fibrinogen quantification method might explain this apparent discrepancy.

Methods: The study consisted of an inter-laboratory part (*part 1*; involving laboratories A and B) and a single-laboratory part (*part 2*; involving laboratory A). In part 1, laboratory A prepared 15 whole-blood-derived cryoprecipitates, which were homogenized, split into two samples, redistributed into two new storage bags, and frozen at -20 °C. Products were shipped on dry ice to laboratory B. Both laboratories thawed the products at 37 °C, added 10 ml of 0.9% saline, and measured fibrinogen concentration in plasma and cryoprecipitate following their respective standard operating procedures (SOPs; Laboratory A: PT-Fib method with the ACL Elite analyzer [Laboratory Instrumentation, Bedford, USA]; Laboratory B: Clauss method with the STA Compact Max analyzer [Stago, Parsippany, USA]). In part 2, laboratory A prepared 10 cryoprecipitates from whole blood donations (Haemonetics, Boston, USA) according to SOPs. Fibrinogen concentration was then measured using the PT-Fib and Clauss methods with the ACL Elite analyzer.

Results: In part 1, laboratory A (PT-Fib) fibrinogen levels were 31% higher than those of laboratory B (Clauss) for plasma (931 ± 206 mg/unit vs 712 ± 143 mg/unit; i.e., +219 mg), and 29% higher for cryoprecipitate (471 ± 113 mg/unit vs 366 mg/unit; i.e., +98 mg). In part 2, the Clauss method yielded 30% higher (441 mg/unit vs 339 mg/unit; i.e., +101 mg) fibrinogen levels than the PT-Fib method.

Conclusions: Part 1 results suggest that the difference in testing methods might explain the discrepant fibrinogen levels between both laboratories. However, part 2 results are not consistent with the choice of method driving this discrepancy. Other factors – possibly related to the analyzer – are likely involved.

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Abstract ID :

Longitudinal Analysis of the Humoral Response to SARS-CoV-2 in Non-hospitalized Individuals With COVID-19 and Cross-Reactivity of Antibodies Against Variants of Concern

Type of abstract : Scientific

Abstract Summary :

Introduction: The development of portable and rapid detection technologies has become essential to document population- and individual-level immunity amid the COVID-19 pandemic. Serological assays, including some based on surface plasmon resonance (SPR), have been developed to monitor SARS-CoV-2 humoral responses induced by vaccination or infection. We used a recently developed, portable, SPR-based assay and an enzyme-linked immunosorbent assay (ELISA) to assess neutralizing antibodies against the native and variant spike proteins among non-hospitalized individuals with COVID-19.

Methods: Blood samples were collected over a 6-month period from 32 participants who received a diagnosis of COVID-19 (PCR-confirmed) and had mild or moderate symptoms. Antibody levels were analyzed, and pseudo-neutralization assays of the spike/ACE-2 receptor interaction were performed with the native, B.1.351, B.1.617.2 and P.1 spike proteins. Semi-quantitative ELISA was performed to detect total immunoglobulins (Ig), IgG, IgA, and IgM. SPR sensors were prepared by surface immobilization of recombinant SARS-CoV-2 proteins on a gold-coated glass prism. Serum samples were diluted in the running buffer and injected onto the SPR sensor. Secondary antibodies against the different Ig classes were used to detect and amplify the SPR shift.

Results: Antibody levels of all Ig classes assessed decreased over time and increased with age. Antibodies in the sera of variant-naïve individuals cross-reacted with the B.1.351, B.1.617.2 and P.1 spike proteins. Antibodies effectively inhibited the interaction between recombinant human ACE-2 and the native or variant spike proteins up to six months after the initial COVID-19 diagnosis. ELISA results correlated with the degree of inhibition, suggesting that high antibody levels are needed for optimal pseudo-neutralization. Vaccination increased antibody levels and significantly improved the inhibition of the spike-ACE-2 interaction.

Conclusions: The SPR-based method used in this study could help identify individuals immunized against SARS-CoV-2, which may enable the targeting of future vaccination efforts to SARS-CoV-2-naïve individuals.

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Abstract ID :

Donor faint reactions and injuries during the COVID-19 pandemic

Type of abstract : Scientific

Abstract Summary :

Introduction: Due to concerns about COVID-19 transmission, Canadian Blood Services instituted donor room policy changes including stopping on site consumption of water and snacks. We followed donor reaction and non-venepuncture related injury rates to assess possible impact of these measures.

Design and methods: Donor vasovagal reactions with loss of consciousness (faint reactions) that occurred on site or were reported post-donation were assessed in our operational database, donor reaction and incident forms were reviewed, and rates calculated using the National Epidemiology Donor Database; p values were calculated for trends.

Rates were assessed in 3 periods: Period 1, (10/2018-3/2019), donors encouraged to stay in the refreshment area post-donation and consume liquid refreshments and snacks; Period 2, (4/2019-3/2020), additionally, donors encouraged to move muscles in their legs at the end of donation, (applied muscle tension, AMT), and provided with water and a salty snack to consume pre-donation, part of a donor wellness initiative; Period 3, (4/2020-12/2021), pre-donation water and salty snack stopped, AMT continued, donors encouraged to sit in the refreshment area post-donation, but provided with refreshments to consume off site.

Results: Overall faint reaction rates were 19.1, 14.7, and 16.2 per 10,000 donations in the 3 periods, respectively ($p<0.001$). Rates for first time female donors, (5% of all donations), are highest and showed the largest changes: 85.5, 70.7, and 84.3 per 10,000 donations in the 3 periods, respectively. Rates for repeat male donors (50% of all donations), were lowest and changed the least: 7.0, 4.7, and 6.0 per 10,000 in the 3 periods, respectively. Overall injury rates declined from Period 1 to Period 2 from 1.08 to 0.72 per 10,000 donations ($p=0.001$) and rebounded to levels seen in Period 1 in Period 3 (1.28 per 10,000 donations, $p=0.32$ between Periods 1 and 3); most injuries were mild in all time periods.

Conclusions: Donation remained extremely safe for most donors. However, donor reaction and injury rates which had decreased with the donor wellness initiative returned to earlier levels, likely reflecting the importance of hydration and salt intake before and after donation. Compliance is likely poorer with refreshment consumption before and after donation off site than when consumption was encouraged on site. Reassessment of donor policies will occur as potential risks of COVID-19 transmission evolve.

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Abstract ID :

Measurement of Heavy Metals in Donor Blood in Canada

Type of abstract : Scientific

Abstract Summary :

Introduction / Objective

Fetal and neonatal exposure to lead is associated with irreversible adverse effects on neural development. There is no reliable threshold for lead effect so limiting the exposure is recommended. A significant positive correlation between post-transfusion infant blood lead level and the transfused RBC unit lead level has been reported. This study measured levels of lead along with two other toxic heavy metals, mercury and cadmium, in Canadian donor blood to investigate if blood transfusion can be a considerable source of exposure to heavy metals for premature and low-birth-weight infants.

Design and Methods

Whole blood samples (n=2529) were shipped at 1-6 °C to our lab within 7 days of donation and kept frozen for analysis. We obtained at least 35 samples from all 34 permanent donation clinics across Canada. Twelve permanent clinics and 8 mobile clinics with a greater potential for having higher heavy metal levels, e.g., close to mines or in areas of high seafood consumption were oversampled (at least 80 samples each). Lead, mercury, and cadmium levels were measured by inductively coupled plasma mass spectrometry. Parametric and non-parametric statistics were performed. $p < 0.05$ was considered significant.

Results

Of all donations, 2.2% (lead) and 0.4% (mercury) had levels higher than the recommended thresholds for safe transfusion to neonates. Blood lead levels were higher in male donors ($p < 0.0001$), but there was no significant difference in the blood mercury levels of males versus females. There was a significant positive correlation between donor age and levels of heavy metals, with lead having the strongest correlation ($r=0.47$, $p < 0.0001$).

Of 42 clinics in the study, 8 had significantly ($p < 0.05$) higher lead levels than at least one of 4 clinics with the lowest lead levels. Five were near mines or metal shredding facilities. Mercury levels varied more among clinics, notably 5 out of 6 Prairie clinics had significantly lower mercury levels than at least one clinic in British Columbia. Cadmium data analysis is in progress.

Conclusion

Our data on donor blood heavy metal levels supports discussion of the relevance of considering blood transfusion as an exposure source to heavy metals and encourages informed selection of blood units for transfusion to neonates or any vulnerable group.

Acknowledgments

We thank Brampton and Calgary testing centres for providing us with the required Retention Samples.

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Abstract ID :

Performance Evaluation of the Trima Accel® Technology Following Recent Upgrades (v7.0)

Type of abstract : Scientific

Abstract Summary :

Introduction: Migration of the Trima Accel apheresis technology from v6.0 to v7.0 is currently underway at Héma-Québec's fixed centers. In addition to changes in the management software, a new collection kit and a Vista platform upgrade were implemented. The objective of this study was to compare the performance of the collection process before versus after the migration, focusing on donor safety, operational productivity, and product quality.

Methods: Twenty-nine platelet concentrates (PC) were collected from frequent apheresis donors with the Trima Accel v7.0 system (TerumoBCT, NJ, USA). All PC quality markers stipulated by the Canadian Standards Association (CSA) were measured, including platelet concentration, platelet count, residual leukocytes, pH and sterility according to current quality control (QC) standard operating procedures (SOPs). Metabolites, platelet activation, and ATP consumption were also evaluated on days 1, 5 and 7 of storage. The PC quality markers obtained with v7.0 were compared to those obtained with v6.0 (i.e. historical data) for the same donors. The productivity (collection time, processed blood and anticoagulant volumes, etc.) of v7.0 collections was also compared with that of v6.0 collections.

Results: The mean±standard deviation platelet count was 2.7±0.3 x 10^{11}/unit with v7.0 and 2.9±0.5 x 10^{11}/unit with v6.0. For the platelet dose, the rate of compliance with the CSA criterion was 83% with v7.0 and 95% with v6.0. All v7.0-collected units met the CSA criteria for residual leukocyte counts and pH at expiration. Platelet activation and functionality markers were equivalent between v6.0 and v7.0. All v7.0-collected plasma units met the CSA criterion for factor VIII concentration. None of the productivity parameters significantly differed between v7.0 and v6.0, except for total blood volume (v6.0 = 4092 ± 1229 ml; v7.0 = 3857 ± 1017 ml), anticoagulant volume (v6.0 = 386 ± 168 ml; v7.0 = 294 ± 98 ml), and collection time (v6.0 = 76 ± 28 min; v7.0 = 65 ± 18 min).

Conclusions: Evidently, donor safety, operational productivity, and product quality were not significantly impacted by the migration from v6.0 to v7.0 of the Trima Accel managing system.

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Abstract ID :

Trends in detection of Treponema pallidium (Syphilis) among whole blood donors at Canadian Blood Services

Type of abstract : Scientific

Abstract Summary :

Introduction

Treponema pallidum is the causative agent of syphilis, a sexually transmitted bacterial infection. *T. pallidum* is generally not transmissible via whole blood donation due to the inactivation of the organism in refrigerated blood components. However, rates of other infectious diseases have been shown to be higher among syphilis-positive donors therefore it is considered as a useful marker for sexual risk behaviours indicative of transfusion transmissible infections. Canadian Blood Services (CBS) asks all potential donors if they have had a syphilis infection in the previous 12 months and a positive response would lead to a temporary deferral from donation.

Design and Methods

All blood donations are screened for syphilis using a micro-hemagglutination assay for *T. pallidum*. Confirmatory testing using *T. pallidium* particle agglutination test, rapid plasma reagin, or fluorescent treponema antibody absorption is dependent on the reference laboratory site and initial/follow-up results. The frequency of syphilis positive donations and rate per 100,000 donations from 1995-2021 was calculated. Age, sex, and region were used to describe demographic differences in the positivity rate.

Results

The number of positive donations ranged from a low of 27 in 2007 to a high of 79 in 2020 (2.8 and 10.1 per 100,000 donations respectively). In 2021 the rate per 100,000 was highest in persons 17-29 years (11.7) and 30-39 (10.7) compared to 40-49 (5.2) and 50+ (3.5). The rate was higher among male donors compared with female donors (8.2 versus 4.6). The rate was highest in Alberta (11.7) followed by BC & Yukon (10.3), the Prairies region (5.9), Ontario (4.4), and the Atlantic region (2.5). The rate among first-time donations ranged from 17.3 in 2018 to 55.8 in 2021. The rate among repeat donations ranged from 0.22 in 2008 to 5.2 in 2020. In 2021 the rate was 2.2 per 100,000 repeat donations. There has been no increase in the rate of other transfusion transmissible infections in the same time period.

Conclusions

Ongoing routine syphilis testing indicates that the rate of syphilis is increasing among CBS blood donors, a trend that is also evident in general population data from the Public Health Agency of Canada. Syphilis rates are higher among males, and regionally we observe higher rates in western Canada. Given that HIV-positive donations are very rare, continued monitoring of syphilis cases by blood agencies may be useful as an indicator of sexual risks when donor selection criteria are modified.

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Abstract ID :

ASSESSMENT OF IMPACT OF CHANGE IN ELIGIBILITY CRITERIA FOR DONORS WITH TYPE 1 DIABETES

Type of abstract : Scientific

Abstract Summary :

Introduction: In the past, type 1 diabetics were deferred due to concerns for the donor's health and theoretical risks of vCJD from bovine insulin. On March 15th, 2021, donors with type 1 diabetes became eligible to donate blood provided they meet all other criteria. The objective of this study was to compare vasovagal reaction rates in whole blood donors with type 1 diabetes with demographically similar donors without diabetes.

Design and Methods: All donors are asked if they have diabetes on the Donor Health Questionnaire (DHQ) each time they donate. Donors are also asked if they have taken any medications in the last 3 days (excluding birth control and vitamins). DHQ data were obtained from all successful donations in 2021. These data were extensively cleaned (90% accuracy) using the statistical software 'R' with regular expressions. A subset was created for type 1 diabetics, for which the criteria were donors who had insulin listed as a medication without a hypoglycemic agent. The Reaction Incident Report (RIR) database was then used to identify any reactions. The comparison group included all other donors in 2021. Reaction rates and 95% Exact confidence intervals were calculated for first time type 1 diabetic and nondiabetic males and females.

Results: Following the policy change there were 179 first time donors with type 1 diabetes of which 38% were male, 62% were female, and the median ages were 34.5 (Inter Quartile Range (IQR) = 28-51) and 31 (IQR = 26-41), respectively. Of the diabetic donors, one male (31 years old) had a moderate vasovagal reaction, and no injuries were reported. This results in a moderate/severe vasovagal reaction rate within type 1 diabetics of 147/10,000, (95% CI = 4-792) for males and 0/10,000 (97.5% CI = 0-327) for females. The rate for nondiabetic first time donors is 71/10,000 (95% CI = 62-82) for males and 93/10,000 (95% CI = 82-105) for females over the time period considered in this study.

Conclusions: It appears as though this policy change has been successful in its goals thus far. It will likely result in around 200 new donors a year, and early indications are that the safety risk for donors with type 1 diabetes is not higher than nondiabetic donors. However, longer-term follow up is required to confirm this finding.

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Abstract ID :

RBC Biological Age at the Time of Donation Contributes to Variation in the Quality of RBC Concentrates

Type of abstract : Scientific

Abstract Summary :

Red blood cell (RBC) biological age, defined as the ratio of young versus senescent RBCs, contributes to variation in the quality of RBC concentrates (RCCs) for transfusion. We hypothesized that increased concentration of senescent RBCs in fresh RCCs is positively associated with the RBC storage lesion, and that donor characteristics, such as age and sex, are determinants of RBC biological age. To test this hypothesis, we estimated the senescence level of RBCs in RCCs over a storage period and assess the contribution of senescent RBCs to the deformability properties of the final RBC products, with the respect to donor sex and age.

Sixty CPD/SAGM RCCs from young and senior, female and male donors were Percoll -separated at days 5, 14, 21, 28 and 42 post-collection. Estimated median densities (EMDs) of RCCs were determined based on a 1:1 separation ratio of young/less dense (Y-RBCs) and old/dense RBCs (O-RBCs). Deformability of RBCs under shear stress (rigidity) and an osmotic gradient (O-hyper) was assessed using LORRCA ektacytometry.

The senescence level of RBCs in RCCs (EMD), was associated with donor sex ($p=0.0006$), being higher for male donors, while changes in EMD over time were associated with both donor sex and age ($p\leq0.05$). The changes in rigidity of unseparated RBCs (U-RBCs) over the storage period were different from both isolated RBC subpopulations ($p< 0.0001$), being higher for O-RBCs. The increased rigidity of U-RBCs ($p=0.0116$) and Y-RBCs ($p=0.0075$) was additionally associated with younger age, while O-RBCs were comparable between different donor groups. Osmolality corresponding to 50% of the maximum RBC elongation in the hypertonic region (O-hyper parameter), demonstrated a difference in the ion channel function of different RBC subpopulations ($p< 0.0001$) and was the highest for Y-RBCs and the lowest for O-RBCs. For U-RBCs and Y-RBCs, O-hyper was associated with both donors' sex and age ($p\leq0.05$).

The fraction of senescent RBCs in RCCs significantly contributes to the overall RCC rigidity and RBC ion channel function and demonstrates an association with male sex and younger donor age, which also explains donor-to-donor variation in RBC storage lesion and frequency of adverse transfusion outcomes.

We are grateful to Canadian Blood Services' blood donors who made this research possible. This work received funding support from Canadian Blood Services (2018IG-JA). The views herein do not necessarily reflect the views of the federal, provincial, or territorial governments of Canada.

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Abstract ID :

ABO Isoagglutinins may Inhibit Coronavirus NL-63 infection of ACE-2 Expressing Cell Lines

Type of abstract : Scientific

Abstract Summary :

Introduction: The COVID19 virus, termed SARS-CoV-2, belongs to the coronavirus family. Infection initiates as the coronavirus Spike (S) protein attaches to the host ACE2 receptor. The S-protein abundantly expresses glycan epitopes structurally similar to ABO antigens, allowing our natural ABO isoagglutinins to neutralize the S-protein. Multiple studies have reported that blood-group-O is protective against severe COVID19 disease, while blood-group-A patients have an increased susceptibility to COVID19. This suggests that anti-A antibodies from blood-group-O patients could provide natural protection against COVID19. The structural and functional properties of the S protein are mutual between SARS-CoV-2 and the endemic strain, NL63. Thus, NL63 may be useful for investigating the role of ABO isoagglutinins in coronavirus infection, acting as a surrogate for SARS-CoV-2 because it can be used under standard laboratory conditions.
Methods: Monkey cell line, LLC-MK2, was used to propagate NL63 and optimize RT-qPCR for detecting early infection (cellular subgenomic RNA) or virus production (supernatant). Various human cell lines were stained with anti-A and anti-B antibodies to determine ABO expression via immunofluorescence. ACE2 expression was detected by western blot. Cells that don't express A or B will be transfected with ABO transferases to produce virus with A/B-glycosylation on its S-protein. Plasma from different ABO blood donors will be tested for the ability to neutralize A/B-expressing virus.
Results: MK2 cells were found to be permissive to NL63 infection, showing cytopathic effect and productive infection. HT29 and CALU3 cells were A positive, while Caco2 cells did not react with either anti-A or anti-B. Despite substantial ACE2 expression, none of the human cell lines were infectable with NL63. We are pursuing the creation of ACE2/TMPRSS2 transduced cell lines and will transfect ABO transferases into these cells as needed to obtain A or B positive NL63 cells.
Conclusions: We could not identify a cell line with both robust A/B-expression and permissiveness to NL63 infection**.**The next step is to generate these cell lines by ACE2/TMPRSS2 transduction and ABO transferase transfection. This study is significant as it would provide evidence for blood-group-O patients having a protective effect against COVID19 disease severity and provide rationale to use convalescent plasma from blood-group-O donors to treat hospitalized patients.

Acknowledgements: Warm thanks to Azmiri Sultana of the Viral Core Facility, University of Toronto, for providing the NL63 virus.

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Abstract ID :

NEW CRYOSOLUTIONS FOR CORD BLOOD UNITS PRESERVATION

Type of abstract : Scientific

Abstract Summary :

Introduction / Objective: Cord Blood (CB) is an important source of hematopoietic stem cells (HSC) used in transplantation for patients with rare human leukocyte antigen type. Cryopreservation is applied to preserve HSC grafts however, freezing and thawing induce loss of function due to cell lesion. We recently showed that new dimethyl sulfoxide (DMSO)-free freezing media can efficiently cryopreserve CB cells, while others did not. To understand why some like CryoProtectPure-STEM (CPP-STEM) do well and others like CryoNovo not, we set to compare the impact of the different freezing media on selected biochemical parameters.

Design and Methods: The lactate dehydrogenase (LDH) assay will be used to determine the impact of the CPA on the HSPC's membrane leakiness. The Lipid Peroxidation (LP) Assay will measure the oxidative damages to the cell membrane. Autophagy, a cellular stress response, will be detected using dye Cyto-ID. To investigate the impact of cryoprotectants (CPAs) on cellular respiration of HSC and progenitor cells (HSPC), CD34+ enriched cells will be placed in the presence of a variety of CPAs, followed by metabolic activity characterization using seahorse technology. Clinical grade DMSO cryosolution will be used as baseline control and the experiments will be done using KG1 cell line and eventually with CD34+ enriched cells.

Results: The LDH assay revealed that DMSO (OD=0.38±0.2) and CPP-STEM (OD=0.35±0.2) (n=3) affect the cellular membrane integrity and leakiness of KG1 cells in similar fashion. Surprisingly, the LP assay revealed that KG1 cells exposed to DMSO had a lower amount of oxidative stress levels compared to CPP-STEM at different time points. Preliminary results have detected similar number of autophagic vacuoles/flux in KG1 cells exposed to DMSO (MFI=355) or to CPP-STEM (MFI=415) (n=3). The impact of CPA on energy metabolism is ongoing.

Conclusions: Studying the impact of CPAs on CB cell's biochemical activity will shed new knowledge regarding why some CPAs provide better cryoprotection in CB HSPC than others and perhaps contribute to the development of new alternatives to storage of CB units.

Acknowledgements: This work would not have been possible without the funding and resources provided by Canadian Blood Services, my supervisor Dr. Nicolas Pineault, and his research team continuous guidance and support throughout this research work.

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Abstract ID :

THE (NZW × BXSB) F1 MOUSE MODEL OF SPONTANEOUS LUPUS AND PRELIMINARY RESULTS USING IMMUNOGLOBULIN-BASED THERAPEUTIC INTERVENTION

Type of abstract : Scientific

Abstract Summary :

Introduction/Objective:

Systemic lupus erythematosus (SLE) is a chronic autoimmune/inflammatory disease. The heterogeneity and complexity of clinical presentation has made it difficult to study or to treat this syndrome. The (NZW×BXSB) F1 lupus-prone male mouse model of this disease is potentially useful to study mechanism and treatment modalities, but there is lack of information about the characterization and disease progression of this model. We aimed to examine the physical/clinical disease presentation and the immunological status of this model and investigate the impact of potential therapeutics.

Design and Methods:

Clinical and physical status were observed in 8- and 16-week-old male (± 1 week) and female (NZW/LacJ x BXSB/MpJ) F1 mice (n= 8 per group). Young male (8 ± 1 week) without disease and female mice served as controls. Physical changes as well as quantitative values of autoantibodies, and blood cell parameters were determined. Necropsy and post-mortem histopathology were also performed.

Eighteen mice (13-week-old) were divided into 6 groups (n= 3/group). Each group were treated 3 times/week with intravenous immunoglobulin (IVIg; 3 g/kg), recombinant human IgG1 fragment-crystallizable (rFc) hexamer (rFc; 200 mg/kg), small molecule phagocytosis inhibitor Kotra-Branch-208 (KB; 500 µL/mouse), and controls: human serum albumin (3 g/kg), phosphate buffered saline or DMSO (500 µL/mouse). Mice were monitored daily.

Results:

Significant increases in anti-dsDNA compared to female or young male mice was seen, but levels of anti-cardiolipin and –ANA were below detection levels. Old mice developed immune thrombocytopenia compared to female (p= 0.0056) and young male (p= 0.0007) mice. Anti-platelet was detectable in old sick mice. With aging (≥ 12 weeks), significant increases in severe abdominal distension/swelling, inability to walk, paleness of paws and significant weight increase was observed compared to controls (p< 0.05). The necropsy examination and histopathology showed abdominal distension associated with severe edema and multi-organ abnormalities (spleen, lymph nodes and kidney). Mortality rate increased with aging; more than 35% of male mice died during this study between the age of 13-18 weeks. Treatment with IVIg, rFc and KB was ineffective.

Conclusions:

We found the (NZW/LacJ x BXSB/MpJ) F1 male mouse model of lupus to be, unexpectedly, extremely severe and seemingly impossible to treat with immunoglobulin-based approaches. This model may be too severe to be useful in the investigation of potential therapeutics for the treatment of SLE.

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Abstract ID :

Accuracy of point of care testing devices for hemoglobin in the operating room: a systematic review and meta-analysis

Type of abstract : Scientific

Abstract Summary :

Introduction and Objective: Point-of-care testing for hemoglobin (POCT-Hb) is increasingly used in clinical settings to guide transfusion, including the operating room. The accuracy of POCT-Hb in surgery is however unclear, and inaccurate devices could lead to over- or under-transfusion. The objective of this work was to conduct a systematic review and meta-analysis of method comparison studies assessing the accuracy of POCT-Hb versus central laboratory testing in patients undergoing surgery.

Design and Methods: EMBASE, Ovid MEDLINE, and EBM Reviews were searched from inception to April 2020. Method comparison studies that compared hemoglobin measurements between POCT-Hb devices and the central laboratory in patients undergoing any surgery in the operating room were included. The primary outcome was the hemoglobin mean difference (MD) between POCT-Hb and central laboratory (with standard deviation (SD)). The population limits of agreement (95%LOA) were calculated as a function of the average difference between the two tests, the average within-study variation, and variation in bias across studies. A random effects model was used. The allowable reference standard for hemoglobin measurement defined by the Institute of Quality Management in Healthcare (IQMH) is 4.0g/L.

Results: Out of 2,377 identified studies, 32 were included (n=2,591 patients, 8,476 hemoglobin paired measurements). Several devices were compared to the central laboratory (pulse co-oximetry 24 studies, HemoCue 9 studies, iSTAT 6 studies, blood gas analyzers 9 studies, and hematology analyzer 1 study). The median sample size was 40 paired measurements, 10/32 studies were funded by device manufacturers, and 15/32 studies were at a low risk of bias. The pooled MD (95%LOA) for pulse co-oximeters was 2.5 g/L (-28.2 to 33.1), -0.6 g/L for HemoCue (-10.6 to 9.3), -0.3 g/L for iSTAT (-8.4 to 7.8), and -2.0 g/L for blood gas analyzers (-16.5 to 12.5).

Conclusions: The pooled intervals for POCT-Hb devices were all larger than the allowable reference standard defined by IQMH. Hemoglobin values measured by POCT devices cannot be considered interchangeable with central laboratory values and abundant caution is necessary when using these devices to guide transfusions in the operative setting.

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Abstract ID :

Evaluation of growth, motility, and biofilm formation of Paenibacillus larvae isolated from a contaminated buffy coat platelet pool

Type of abstract : Scientific

Abstract Summary :

Introduction/Objectives: Platelet components (PC) are screened for microbial contamination using BACT/ALERT cultures. In 2021, a Gram-variable bacillus presenting pink colonies on agar plates, identified as *Paenibacillus larvae,* was isolated from initial BACT/ALERT cultures of a pooled PC. Confirmatory cultures were negative. *P. larvae* is an environmental bacterium often associated with diseased honeybees. We further investigated the *P. larvae* isolate, as environmental bacteria have gained attention for causing septic transfusion reactions (STR) with PC contaminated via pinhole breaches in storage containers. This study aimed at studying growth, motility, and biofilm formation of *P. larvae.*

Design/Methods: *P. larvae* was inoculated in two PC units at target concentrations of 30 (PC1) and 3000 (PC2) colony forming units (CFU)/bag and incubated for 7d. Growth in BACT/ALERT bottles (duplicate) and bacterial concentration by colony counts were determined on days 3 and 7. Motility in Motility Test Medium (MTM), swarming motility on brain heart infusion (BHI) agar, and biofilm formation (aggregates/pellicle) in BHI broth and trypticase soy broth (TSB) supplemented with glucose (TSBg) were evaluated. Duplicate PC bag coupons (1cmx0.5cm) were inoculated with 2ul of suspensions containing 10^2 or 10^4CFU/ml of *P. larvae.* Coupons were first left at room temperature for 3d, then placed on Chocolate agar plates at 37℃ for 5d, and finally transferred into TSB and incubated at 37℃ for additional 3d.

Results: In PC1, *P. larvae* reached concentrations of 5.0CFU/ml and 6.3x10^5CFU/ml after 3 and 7 days of storage, respectively. In PC2, it grew to 1.6x10^3 CFU/ml and 2.1x10^8 CFU/ml on days 3 and 7, respectively. BACT/ALERT cultures for PC1 were only positive in both bottles on day 7. However, for PC2, both bottles were positive on all testing days. Motility in MTM and swarming motility were positive. In contrast, biofilms were not formed in TSBg and *P. larvae* did not grow in BHI broth. Importantly, the bacterium did not survive on PC coupons.

Conclusion: *P. larvae* grows very slowly in PC and if present at low concentrations, it could be missed during routine screening. Despite its ability for swarming motility, the bacterium did not survive on PC bag coupons and therefore the origin of this organism is unknown. Vigilance about environmental contamination of PC to prevent STR in vulnerable patients is vital.

Acknowledgements: National Microbiology Laboratory for *P. larvae* identification. Funding was provided by Canadian Blood Services and Health Canada; the views expressed herein do not necessarily represent those of the Canadian Federal government.

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Abstract ID :

Misidentification of Cutibacterium acnes as Atopobium vaginae: relevance for bacterial screening of platelet components

Type of abstract : Scientific

Abstract Summary :

Introduction/Objectives: Canadian Blood Services isolates and identifies organisms as part of follow-up testing of positive BACT/ALERT cultures obtained during screening of platelet components (PC). Skin flora *Cutibacterium acnes* is the predominant bacterium isolated from contaminated PC. Since implementation of microbial identification with the automated Vitek 2 Compact system in 2019, there have been instances where the vaginal flora bacterium *Atopobium vaginae* has been isolated. Since this organism is not usually associated with PC contamination, and because some of these isolates were re-identified as *C. acnes,* a thorough investigation was initiated aimed at accurately confirming the identity of bacteria initially speciated as *A. vaginae.*

Design/Methods: Twenty-one isolates were selected for this study. All isolates and *A. vaginae* ATCC BAA-55 were assessed for morphological characteristics and identified using the Vitek system. Eight out of the 21 isolates were also identified using MALDI-ToF, and four of these eight isolates were analyzed using rapid ID 32A or API 20A strips and via PCR-amplification of a region of the *C. acnes* 16S rRNA gene.

Results: All isolates initially identified as *A. vaginae* were confirmed to be *C. acnes* by either repeat Vitek testing, MALDI-ToF or manual identification. PCR for *C. acnes* 16S rRNA was negative for the four isolates tested. Importantly, *A. vaginae* is a strict anaerobe while *C. acnes* is an aerotolerant anaerobe, and while *A. vaginae* is catalase negative, *C. acnes* is catalase positive. There are also marked differences in microscopic and colony morphologies between the two species.

Conclusion: We demonstrated that *C. acnes* can be misidentified as *A. vaginae* by the Vitek system, which monitors biochemical reactions every 15 minutes. Once these reactions match a profile in the database, no further readings occur, and an identification report is generated. We speculate that slow growing organisms (e.g., *C. acnes)*, may not produce positive reactions quickly enough, resulting in a mismatch in the Vitek profile. Our results also indicated genomic diversity between *C. acnes* isolates since four of them were not identified with MALDI-ToF or PCR. We recommend that PC isolates identified as *A. vaginae* are assessed for morphological and growth characteristics, and if applicable, be identified using manual methods.

Acknowledgements: MALDI-ToF identification was performed at The Ottawa Hospital reference clinical microbiology laboratory. Funding was provided by Canadian Blood Services and Health Canada; the views expressed herein do not necessarily represent those of the Canadian Federal government.

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Abstract ID :

Metabolomics and flow cytometry analyses of platelet concentrates contaminated with Staphylococcus aureus reveal significant modulations in platelet functionality

Type of abstract : Scientific

Abstract Summary :

Background: Platelet components (PCs) occasionally get contaminated with *Staphylococcus aureus,* which can escape detection during PC screening and cause septic transfusion reactions. This study aimed to determine the impact of *S. aureus* contamination on platelet metabolism and platelet functionality during PC storage.

Study design and methods: Targeted metabolomics was performed on non-spiked PCs (control) and PCs inoculated with ~1E+06 colony forming units (CFU)/unit or 10-20 CFU/unit of *S. aureus* CBS2016-05, a strain involved in a septic transfusion event. PC units were incubated under PC standard storage conditions for 144h. Metabolites were quantified in triplicate from control and spiked PCs at 0 and 24h of storage for units inoculated with 1E+06 CFU/bag and at 48h and 144h for units inoculated with 10-20 CFU/bag by high performance mass spectrometry (MS). In parallel, non-spiked and spiked PCs (0.01 CFU/bag) were stored for 144h and samples were taken every 24h for flow cytometry analyses to evaluate the expression of CD62P, phosphatidylserine, and fibrinogen receptor GPIIb.

Results: In PCs inoculated with ~1E+06 CFU/unit, *S. aureus* reached concentrations of ~6.3E+08 CFU/mL after 24h of storage while PCs spiked with 10-20 CFU/unit showed concentrations of 1.7E+07 and 2.5E+10 CFU/mL after 48 and 144h of storage, respectively. MS analysis revealed 8 metabolites with significantly different quantities in spiked PCs compared to control at all sampling time points. Xanthine, Uridine, Serine, Glutamine, and Threonine were downregulated whereas Orotic acid, Dihydroorotic acid, and Aspartic acid were upregulated (log2fold-change ≤ or ≥ ±1). Flow cytometry analyses showed a 3.5-fold and 27.3-fold increase in the percentage of CD62P+ and phosphatidylserine+ platelets in spiked PCs at 72h of storage, respectively, when bacteria had reached ~6E+08 CFU/mL. Additionally, percentage expression of GPIIb in spiked PCs decreased by 1.8-fold after 144h of PC storage when *S. aureus* had grown to 9E+09 CFU/mL.

Conclusion: Targeted metabolomics unveiled metabolomic changes in PCs contaminated with *S. aureus* later during PC storage when present at high concentrations. Notably, high levels of *S. aureus* induced a significant increase in platelet activation and loss of GPIIb expression, which is essential for platelet function. We propose to further explore the use of metabolomic changes of contaminated PC as an indicator of clinically significant levels of bacterial contamination to prevent septic transfusion events.

Acknowledgements: Canadian Blood Services and Health Canada. SR-A holds an intramural grant from Medical Affairs and Innovation, Canadian Blood Services.

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Abstract ID :

Cold-stored whole blood: extending holding time prior to leukoreduction may not increase bacterial contamination safety risk to transfusion patients

Type of abstract : Scientific

Abstract Summary :

Introduction / Objectives: Cold-stored whole blood (WB) transfusion has regained attention for treatment of trauma patients. We recently reported no significant changes in *in vitro* quality through 21 days of cold storage for leukoreduced WB (LCWB) when time to filtration was extended from 8h to 24h from collection. The present study aimed to evaluate the impact of extended WB-hold at room temperature (RT) prior to leukoreduction on proliferation of transfusion-relevant bacteria.

Design and Methods: WB units were spiked with suspensions of *Klebsiella pneumoniae*, *Streptococcus pyogenes*, *Staphylococcus aureus*, and *Listeria monocytogenes* prepared in saline solution (SS) or trypticase soy broth (TSB) to a concentration of ~0.2 colony forming units (CFU)/mL (N=6). Spiked units were held at RT for 20-24h before leukoreduction and cold-stored for 21 days. Bacterial growth was determined on days 2, 7, 14, and 21. *In vitro* quality of WB inoculated with unspiked SS or TSB was assessed.

Results: *K. pneumoniae* and *S. pyogenes* proliferated in WB prior to leukoreduction reaching concentrations ≤10^2 CFU/mL. These bacteria, however, did not proliferate during the subsequent cold storage. *S. aureus* did not survive in WB while the psychrotrophic (i.e., grows in refrigeration) bacterium *L. monocytogenes* reached a concentration of ~10^2 CFU/mL by day 21. LCWB *in vitro* quality was not affected by SS or TSB.

Conclusion: Extended WB-hold prior to leukoreduction for up to 24h allowed proliferation of *K. pneumoniae* and *S. pyogenes*, two bacteria able to resist immune clearance. However, they did not grow to clinically significant levels (i.e., >10^5 CFU/mL). While *L. monocytogenes* proliferated in LCWB, its concentration by day 21 of storage was not clinically relevant. These data suggest that transfusing LCWB, even when held at RT for up to 24h prior to leukoreduction, may not pose a significant bacterial contamination safety risk to transfusion patients.

Acknowledgements: The authors thank volunteer blood donors and staff at netCAD Blood4Research Facility in Vancouver (British Columbia) for WB collection and *in vitro* quality testing. We are also grateful with Dr. Q-L Yi (senior biostatistician, Canadian Blood Services) for assistance with statistical analyses. The study was funded by Canadian Blood Services and Health Canada. However, the views expressed herein do not necessarily represent those of the Canadian Federal government.

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Abstract ID :

Planning for elevated transmissible diseases serology repeat reactive rates following implementation of a new serology test platform.

Type of abstract : Scientific

Abstract Summary :

Background: In April 2021, Canadian Blood Services (CBS) moved to the cobas8000 system which utilized Elecsys test kits (Roche Diagnostics, Laval, QC) for the detection of transmissible disease (TD) markers including human immunodeficiency virus (HIV-1/2) antibodies and HIV-1 p24 antigen (Ag), anti-hepatitis C virus (HCV), hepatitis B virus (HBV) surface antigen (HBSAg), anti-HBV core total (anti-HBc), and anti-human lymphotropic virus (anti-HTLV-1/2). During the implementation process we were made aware of a phenomenon where assay repeat reactive (RR) rates might be temporarily elevated above RR rates as identified in the Elecsys assay package inserts. This was concerning as CBS has no donor re-entry process for unconfirmed HBc and anti-HTLV-1/2 results. This study identified TD RR for the period April-December 2021 and compared them against package insert RR rates.

Methods: TD RR rates were obtained (April-December 2021) after testing on the cobas8000 system with Elecsys test kits: HIV-1/2, anti-HCV, HBSAg, anti-HBc, and anti-HTLV-1/2. Acceptable cobas8000 RR rates were obtained from Elecsys test kit package inserts (PI).

Results:

Select RR rates for Roche Elecsys TD assays

Assay	RR Rate (%) cobas 8000 April 2021 (69,330 donations)	RR Rate (%) cobas 8000 July 2021 (75,647 donations)	RR Rate (%) cobas 8000 Dec 2021 (72,399 donations)	cobas 8000 PI Rate (%)
HBsAg	0.03	0.02	0.02	0.02
Anti-HCV	0.16	0.12	0.08	0.15
HIV 1&2	0.06	0.04	0.04	0.13
Anti-HBcore	0.17	0.2	0.19	0.07
Anti-HTLV I/II	0.09	0.05	0.04	0.049

By July 2021, TD marker RR rates remained elevated against expected RR rates for anti-HBc and anti-HTLV-1/2. By December 2021, except for anti-HBc, TD marker RR rates had normalized.

Discussion: The exact mechanisms driving elevated RR rates in our study were not identified. In the absence of donor-re-entry processes for specific targets (in this case anti-HTLV-1/2 and anti-HBc) blood operators may encounter a higher than normal rate of permanent donor deferral. Blood operators should consider reviewing and modifying donor re-entry processes when changing serological assays for TD markers.

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Abstract ID :

Increases in unconfirmed syphilis repeat reactive serology results during influenza and COVID-19 vaccination campaigns: September 2017-January 2022.

Type of abstract : Scientific

Abstract Summary :

Background: Canadian Blood Services (CBS) screens all donations for syphilis using a serology testing algorithm. Currently, syphilis repeat reactive (RR) results lead to the indefinite deferral of CBS donors regardless of confirmatory results. We have previously described a temporal association of RR results with seasonal public health influenza vaccination campaigns that start in September and end in January. There has also been an intensive COVID-19 public health vaccination campaign in Canada since December 2020. The purpose of this study was to determine if this association between unconfirmed syphilis RR results continued for both influenza and COVID-19 vaccination campaigns.

Methods: Syphilis RR results were obtained from CBS donations (September 2017-January 2022), after testing on the PK 7300 instrument (Beckman Coulter; Brea, CA, USA) with the PK TP system test kit. 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. Respiratory virus data were acquired from the Public Health Agency of Canada Respiratory Virus Detection Surveillance System.

Results:

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

Peak	Peak RR time range	Peak month	Interval from start of influenza vaccination campaign (months) to peak month	Other associations
1	October 2017-March 2018	November 2017	1	Influenza season
2	October 2018-February 2019	November 2018	1	Influenza season
3	May-August 2019	June 2019	8	Respiratory virus circulation
4	October 2019-February 2020	January 2020	3	Influenza season
5	October 2020-March 2021	January 2021	3	Other respiratory viruses limited
6	July 2021-January 2022	September 2021	10	COVID-19 vaccination, seasonal respiratory viruses, Influenza vaccine

Discussion: Historically, the number of RR syphilis specimens that do not confirm has been elevated for several years. This study does not identify a direct causation for periodic increases in syphilis RR rates over a four-year period. However there does appear to be a temporal association between syphilis RR results in Canadian blood donors with influenza and COVID-19 vaccination campaigns as well as circulation of other respiratory viruses. Syphilis assays such as the PK TP test kit that detect IgM may be prone to false positive results that do not confirm either after influenza vaccine, COVID-19 vaccination or during a respiratory virus season.

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Abstract ID :

Optimizing the Supply of Apheresis Platelets: A 3 year Post-Implementation Follow-up

Type of abstract : Scientific

Abstract Summary :

Introduction: In 2016, we modified our procedure for collecting apheresis platelets. Specifically, the donor qualification and platelet collection parameters were optimized. Furthermore, the maximum collection time of double platelet donations (dTh) has been extended, and their processing steps have been simplified. The impacts of these changes on donor safety and product quality were monitored over 3 years of follow-up.

Methods: We used the Trima Accel (Terumo BCT, Lakewood, USA) technology for platelet apheresis. For repeat donors, a major change was the use of donors' historical platelet concentration (hPC) in the collection setting, which is the rolling average obtained in complete blood counts (CBCs) carried out on the three previous donations. In addition, CBCs are now performed using the same instrument (ACT 5diff AL analyzer [Beckman Coulter, Brea, USA]) at the quality control laboratory, instead of being performed using various instruments located at the collection center. In new donors (for whom hPC cannot be calculated), a sex-specific, reference platelet concentration (rPC) – calculated based on all donations collected in the previous year – was used to set up collections. New donor donations were limited to simple patelet donations (sTh).

Results: The process changes and the extension of the collection time have increased the dTh/sTh rate and the number of products generated per collection. Furthermore, process reliability was improved, as shown by the rate of compliance with CSA quality criteria for platelet concentration, platelet dose, white blood cell count/unit, and pH. For repeat donors, the correlation between the observed PC and the hPC was excellent (R^2 = 0.9). For new donors, the average difference between the observed PC and the rPC approached zero, which demonstrates the absence of a significant bias for donations from new donors. The annual number of post-collection adverse events did not significantly increase following the process changes.

Conclusions: The reliability and stability of apheresis platelet collection improved after setting collection parameters according to an hPC (for repeat donors) or an rPC (for new donors) and after centralizing CBCs to a single QC laboratory. Ultimately, the process changes brought greater control over operations without compromising product quality and donor safety.

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Abstract ID :

CEC enrichment is dependent on blood donor- specific density profile: Correlation with mononuclear cell population

Type of abstract : Scientific

Abstract Summary :

Introduction and Objectives:

Subpopulations of immature red blood cells (RBCs) named CD71+ erythroid cells (CECs) can be isolated using density-gradient separation (ρ= 1.077 ± 0.001 g/mL) and potentially used to investigate their immunomodulatory properties in RBC transfusions. However, unlike peripheral blood mononuclear cells, CEC density may vary among donors. This study aimed to explore the optimal Percoll density to enrich CECs and their relationship with the portion of mononuclear cells in whole blood (WB).

Material and *Methods:*

WB samples (ACD, n=5) were separated into subpopulations using a panel of different Percoll densities (1.077-1.088 g/mL). The quantity of CECs in the low-density populations was determined by a validated flow cytometry method using CD235a-PE-Cy7, CD71-BV711, and CD45-APC antibodies. The proportion of RBC and white blood cells (WBCs) in the low-density populations was analyzed with a 5-part differential hematology analyzer.

Results:

The peak of CECs (%) for donor 1 was 8.8% (ρ= 1.084 g/mL). Donors 2-5 reached a plateau (1.6%, 1.8%, 1.8%, 3.6%) at a density of 1.085 g/mL, 1.084 g/mL,1.087 g/mL, and 1.087 g/mL, respectively. The lymphocytes (%) in WBCs started to decrease while neutrophils (%) increased at the optimal Percoll density. There was a negative correlation between CEC (%) and lymphocytes (%) in the low-density subpopulations.

Conclusions:

The optimal density to isolate CECs is donor-dependent, and there appears to be a relationship between the optimal density for CEC enrichment and the subpopulation distribution of mononuclear cells. This study will facilitate future work examining the immunomodulatory activity of CECs in RBC transfusions.

Acknowledgment

We are grateful to Canadian Blood Services' blood donors who made this research possible. This research received funding support from Canadian Blood Services (Intramural Grant Program), funded by the federal government (Health Canada) and the provincial and territorial ministries of health. Wenhui Li received financial support from the China Scholarship Committee. The views herein do not necessarily reflect these institutions' views.

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Abstract ID :

Doxorubicin-Associated Thrombotic Risk and Thrombocytopenia Relieved by Salvianolic Acid Compounds

Type of abstract : Scientific

Abstract Summary :

Intro/objectives

Doxorubicin (Dox), a multi-purpose chemotherapeutic, is efficaciously limited due to accumulated side effects including cardiotoxicity, drug-induced immune thrombocytopenia (DITP), and increased risk of venous thromboembolism (VTE). It is reported that Dox affects platelets and thus requires combined anti-platelet drug with treatment. Salvianolic Acid C (SAC) is a water-soluble compound derived from Danshen root traditionally used in treatment of cardiovascular diseases and more recently explored for its anti-platelet properties. However, whether SAC can inhibit Dox-induced platelet activation and the more profound, unforeseen repercussions for Dox-induced platelet-cancer cell interaction has not been explored.

Design/Methods

Platelets isolated from healthy donors were pre-treated with or without SAC prior to incubation with Dox. P-Selectin, PAC-1 (indicative of activated aIIbb3 complex) and binding of soluble fluorescence-labeled Fibrinogen (Fg) were measured by flow cytometry to evaluate platelet activation. In Vitro Platelet Phagocytic Assay were performed by co-culturing CMFDA labeled platelets with differentiated THP-1 cells to evaluate clearance of activated platelets. Cancer cell-platelet interaction was measured by detecting fluorescently labelled platelets adhered to murine B16 melanoma cells. Whole platelet protein lysate was resolved for Western blot and probed for critical signaling pathways involved in platelet activation.

Results

Dox elevated P-selectin surface expression, PAC1 binding, soluble Fg binding and platelet adhesion on immobilized Fg, and macrophage phagocytosis of platelets. In contrast, SAC pretreatment suppressed the effects of Dox in a dose-dependent manner. Interestingly, Dox also led to increased platelet-cancer cell interaction, which SAC treatment abrogated. SAC was further able to reduce Dox uptake by platelets. Further experiments involving SYK and PLC inhibitors revealed similar results to SAC, reversing platelet activation and repealing the phosphorylation increases resultant from Dox.

Conclusions

SAC significantly relieves Dox-induced platelet activation and macrophage phagocytosis, possibly through targeting intracellular SYK-PLCγ2 and integrin outside-in signaling, as well as Dox uptake by platelets. Additionally, SAC drastically suppresses platelet-cancer interaction mediated by Dox. Our study suggests SAC as a promising combinational reagent with Dox to reduce the risk of DITP, VTE and the repercussions of inducing pro-cancer platelet physiology at the tumor microenvironment.

Acknowledgements.

This work was supported by CIHR Foundation Grant (H.N.).

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Abstract ID :

Activated Protein C levels correlate with attenuation of bleeding and coagulopathy by plasma transfusion or anti-APC aptamer infusion in a mouse model of hemorrhagic shock

Type of abstract : Scientific

Abstract Summary :

Introduction: Bleeding trauma victims with impaired coagulation (i.e. acute traumatic coagulopathy (ATC)) have a poor prognosis. The etiology ATC is uncertain. Coagulation factor depletion, hyperfibrinolysis, endothelial injury, and increased Activated Protein C (APC) may contribute. Clinical trial evidence suggests early plasma transfusion reduces ATC mortality. We investigated plasma transfusion and anti-APC aptamer treatment in a mouse model of hemorrhagic shock (HS).

Objective: To compare APC, tissue plasminogen activator (tPA), plasminogen activator-1 (PAI-1) levels, prothrombin times (PT), and blood losses in HS mice resuscitated with saline, plasma, control oligonucleotide AS C53A, or anti-APC aptamer HS02-52G.

Design and Methods: Blood was removed from anesthetized mice via a cannulated carotid artery to a mean arterial pressure of 35 ± 5 mM Hg. Shock was maintained for 60 minutes, then resuscitation fluid equal in volume to withdrawn blood was infused intravenously. A liver lobe was then lacerated via scalpel injury. Shed blood was collected for 15 minutes and then weighed. All values are means of 6-9 determinations ± SD. Plasma sampled before HS (Pre-Tx) or after resuscitation and liver laceration (Post-Tx) was tested for APC, tPA, and PA1-1 using microtiter plate assays.

Results: Sham-treated mice lost 90 ± 40 mg of blood versus 240 ± 40 mg (saline) or 0.063 mg/kg AS C53A (230 ± 70) ($p < 0.001$). Plasma or 0.063 mg/kg HS02-52G reduced bleeding to sham levels ($p > 0.05$, 140 ± 30 and 95 ± 50, respectively). APC levels in saline-treated mice increased 8.5-fold after HS and resuscitation (from 900 ± 200 to 8000 ± 2000 pg/ml, $p < 0.001$) while levels in mice treated with plasma or HS02-52G did not differ from sham (900 ± 300 pg/ml) Pre- or Post-Tx. PAI-1 and tPA levels did not differ from sham levels in any group Pre- or Post-Tx. PTs for saline or AS C53A groups increased from Pre-Tx to Post-Tx, from 8.4 ± 0.6 to 12 ± 2 s and 9.3 ± 0.3 to 13 ± 2 s ($p< 0.001$). Plasma or HS02-52G groups demonstrated no PT change.

Conclusions: Coagulopathy, bleeding, and APC increases were attenuated by plasma or anti-APC aptamer treatment. APC appears to drive ATC in a mouse HS model. Plasma transfusion could attenuate ATC by providing APC inhibitors. Anti-APC aptamer treatment could provide an alternative to early plasma transfusion in trauma.

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Abstract ID :

Factors able to induce macrophage phagocytosis of platelets are present in half of immune thrombocytopenia patient sera

Type of abstract : Scientific

Abstract Summary :

Introduction: Immune thrombocytopenia (ITP) is an autoimmune bleeding disorder with accelerated platelet clearance. Anti-platelet autoantibodies are presumed to mediate platelet clearance in most ITP patients through Fc gamma receptors (FcγRs) on splenic macrophages. The Harrington-Hollingsworth experiment previously demonstrated that a factor in 61.5% of ITP plasma caused thrombocytopenia when transfused into non-thrombocytopenic volunteers. However, only 10-20% of patients with ITP have detectable free autoantibodies in plasma. Thus, there appears to be a discordance between detectable autoantibodies in plasma and the ability of plasma to trigger thrombocytopenia in naïve recipients. This study explored the proportion of ITP patient sera that can mediate macrophage phagocytosis of platelets and characterized the phagocytic mechanisms including the presence of autoantibodies, comparing IgG positive to negative fractions, and the involvement of FcγRs for a single patient.

Design and Methods: Adult patients were recruited with a confirmed diagnosis of primary ITP. Sera from patients with ITP was used to opsonize third-party healthy donor platelets. Opsonized platelets were then fluorescently labelled and incubated with human THP-1 macrophages expressing all major activating FcγRs. The ability of macrophages to phagocytose platelets and the effects of blocking individual FcγRs was quantified by confocal microscopy. The presence of anti-platelet autoantibodies was detected using the monoclonal antibody specific immobilization of platelet antigens (MAIPA) assay.To characterize the sera components responsible for phagocytosis, protein G beads were used to isolate the IgG from ITP serum. IgG and IgG-depleted sera were used to opsonize donor platelets and reassessed for phagocytic activity.

Results: Sera from twelve ITP patients were analyzed; 50% were able to trigger phagocytosis compared with normal human serum (n=3-6 independent experiments per each patient). Six out of the twelve ITP sera had detectable free anti-platelet autoantibodies as detected by MAIPA. However, three of these patients did not trigger phagocytosis. A serum demonstrating high phagocytosis was used to study the effects of FcγRs by blocking individual receptors. Inhibiting either FcγRI or FcγRIII reduced phagocytosis as compared to IgG controls. The IgG positive fraction of the sera retained phagocytic activity of the whole serum.

Conclusion: These findings show the ability of ITP sera to mediate platelet destruction. This work highlights the role of FcγRI and FcγRIII as major phagocytic receptors. Future studies will analyze patient sera for the involvement of serum factors that may augment phagocytosis.

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Abstract ID :

Fibrinogen Concentrate vs. Cryoprecipitate for Treating Acquired Hypofibrinogenemia in Bleeding Adult Cardiac Surgical Patients: A within-trial economic evaluation of the FIBRES randomized controlled trial

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective: Excessive bleeding is a common complication of cardiac surgery and is associated with significant in-hospital and transfusion costs. Fibrinogen supplementation with fibrinogen concentrate (FC) or cryoprecipitate can restore hemostasis, however real-world economic studies comparing these products are lacking. Our aim was to determine the cost-effectiveness of FC compared with cryoprecipitate in bleeding adult cardiac surgical patients with acquired hypofibrinogenemia.

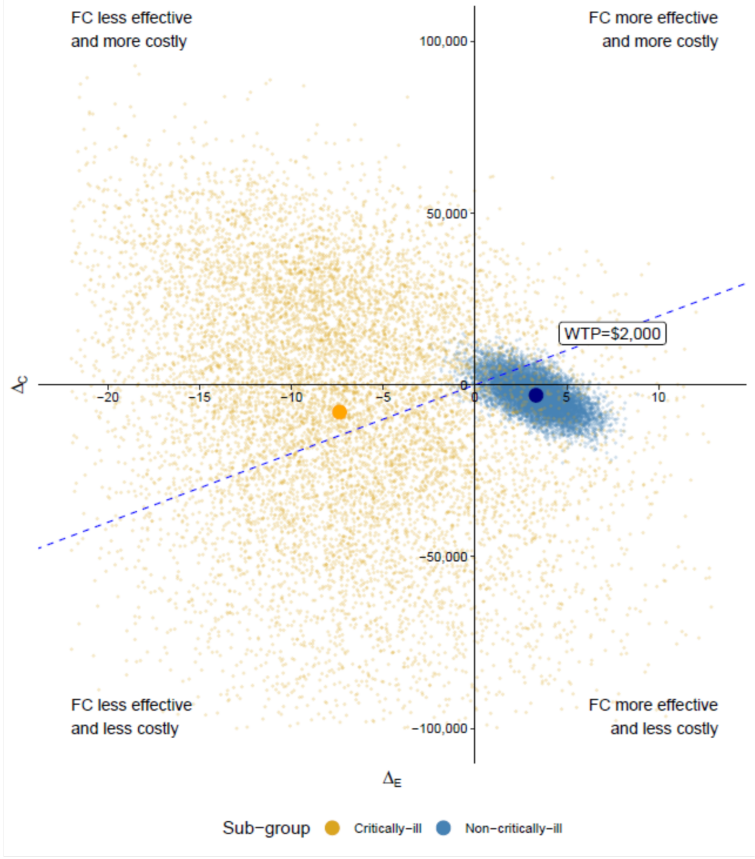
Design/Methods: This within-trial economic evaluation examined cost data from FIBRES, a large, prospective, multi-center, randomized, controlled, non-inferiority Phase 3 trial (NCT03037424). Bleeding adult cardiac surgical patients were given FC (4 g) or cryoprecipitate (10 units) within 24 hours of cardiopulmonary bypass (CPB). Effectiveness outcomes included the number of allogeneic blood product (ABP) transfusions (24-hour and 7-day) post-CPB. In-hospital resource utilization costs (28-day) and ABP transfusion costs (7-day) were evaluated from first admission. Cost-effectiveness was determined using incremental net monetary benefit (INB) at a defined willingness-to-pay (monetary value to reduce additional ABP usage), and net benefit regression to assess the impact of covariables including site, and critical illness status.

Results: Patient level costs for 495 patients from four Ontario hospitals were evaluated. Mean (SD) age was 59.2 (15.4) and 69.3% were male. The number of ABP transfusions for patients given FC *vs.* cryoprecipitate were comparable. The mean total 7-day ABP costs were comparable across both groups (~$3,870 Canadian dollar [CAD]), as were median (interquartile range) total 28-day costs at $37,830 ($26,200–64,980) CAD for FC and $38,660 ($26,010–70,380) CAD for cryoprecipitate. For non-critically ill patients (89% of the study population), FC was more cost-effective than cryoprecipitate with a mean incremental cost of −$3,060 CAD, a mean incremental effectiveness of 3.3 units and a positive incremental net benefit with a probability of being cost-effective 75% at zero willingness-to-pay. (**Figure 1**). Small sample size and substantially higher variation in costs made estimation of net benefit imprecise for the critically-ill patients.

Conclusions: FC was shown to be cost-effective relative to cryoprecipitate in non-critically ill bleeding adult cardiac surgical patients. This should be taken into consideration in future guideline recommendations for the management of these patients.

Acknowledgements: FIBRES was sponsored and funded by the Canadian Institutes of Health Research and Octapharma AG. This *post-hoc* analysis was funded by Octapharma AG.

Figure 1. Cost-effectiveness Plane, FC *vs.* Cryoprecipitate, by Critical Illness Status



Mean incremental cost was −$3,060 CAD (blue dot) and mean incremental effectiveness (3.3 unit) for FC vs. cryoprecipitate for non-critically-ill patients. Mean incremental cost was −$7,950 CAD (orange dot) and mean incremental effectiveness (−7.4 ABP) for FC vs. cryoprecipitate for critically-ill patients.

Abbreviations: ABP = allogeneic blood products; CAD = Canadian dollar;

FC = fibrinogen concentrate; WTP = willingness-to-pay

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Abstract ID :

RESPONSE OF LYMPHOPENIC PLATELETPHERESIS DONORS TO COVID-19 VACCINATION

Type of abstract : Scientific

Abstract Summary :

Introduction: Recent studies have shown that several frequent plateletpheresis donors (more than 20 donations/year) have CD4+ T cell counts below the normal limit while the levels of other blood cell types remain normal. This lymphopenia does not appear to be associated with an increased susceptibility to infections and cancers, suggesting that it does not affect immune function of platelet donors with low CD4+ T cell counts. The aim of the study was to assess the immune capacity of plateletpheresis donors with lymphopenia by taking advantage of the recent SARS-CoV-2 vaccination campaign.

Methods: Forty-three plateletpheresis donors were recruited for the study. Their baseline CD4+ T cell count was determined by flow cytometry. The levels of antibodies targeting the SARS-CoV-2 Spike receptor binding domain (RBD) or native full-length Spike were measured before and after vaccination. The avidity of RBD antibodies produced after the first and second dose of vaccine was determined using a modified ELISA (addition of urea 8M). The functional properties of vaccine-elicited SARS-CoV-2 antibodies were measured using ADCC and neutralization assays.

Results: Of the 43 participants, 27 had pre-vaccination CD4+ T cell counts below 400 cells/µl (*low CD4*) and 16 participants had counts in the normal range (*normal CD4*). The levels of RBD-binding antibodies did not significantly differ between the low and normal CD4 groups after the first and second doses of vaccine. As expected given the maturation of immune response, the avidity of RBD-binding antibodies increased after the second dose of vaccine, but the increase was of similar magnitude in both CD4 groups. Recognition of three Spike variants (D614G, Delta, Omicron) by vaccine elicited antibodies did not differ significantly between the low and normal CD4 groups. Finally, the antibody(Fc)-mediated effector function and neutralization of the three variants of concern tested were comparable for the two groups, after receiving two vaccine doses.

Summary/conclusions: Low CD4+ T cell counts in plateletpheresis donors do not impair their response to antigenic challenge such as COVID-19 vaccination. Work remains to be done to understand the physiological mechanism behind the low number of CD4+ T cells in the peripheral blood of several plateletpheresis donors.

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Abstract ID :

Examining Medication Use in Canadian Blood Donors

Type of abstract : Scientific

Abstract Summary :

Introduction: For every blood donation, Canadian Blood Services asks donors if they have taken medications in the last 3 days, excluding birth control and vitamins. Each medication name is entered manually by the screener on each donation attempt. This results in a plethora of input errors, due to the complexity of medication names. Examining these data more closely will provide insight into efficiencies in donor screening.
Design and Methods: Between January 2021 and September 2022, data on medication use from successful blood donations were analyzed (1,364,038 donations from 678,893 donors). Using the statistical software 'R', this data was organized and extensively cleaned (90% accuracy) primarily using regular expressions to analyze medication use. The classes of medications most commonly reported were identified. In addition, 200 randomly selected donors were assessed for changes in medications on subsequent donations.
Results: Overall, 465,096 donations (34%) came from donors who were taking at least one medication (37% of female and 32% of male donors). Of these, 119,064 (26%) were taking two medications, 61,984 (13%) were taking three, and 59,470 (13%) were taking more than three. Among males reporting medication, the most frequently reported classes were antilipemic agents (31%), analgesics (26%), ACE inhibitors (16%), antidepressants (15%) and angiotensin II receptor blockers (14%) . Among females reporting medications, the most frequently common classes of medications were antidepressants (33%), analgesics (31%), thyroid hormones (13%), antilipemic agents (11%) and antihistamines (7%). From a random sample of 200 donors, 47.5% remained on the exact same medications for all their donations in the time considered. Another 15% remained the same other than the addition or loss of an analgesic or antihistamine.
Conclusions: There are frequently reported medications, which supports the creation of a drop-down menu for selection of medications from when donating. Stability in medication use also demonstrates the potential for carrying over medication data from one donation to the next. Implementation of such menus and carry over would help avoid errors from manual entry and perhaps speed up the administrative aspect of donating blood.

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Abstract ID :

Expansion of the IVIg Neuromuscular Screening Program to include Central Nervous System Conditions

Type of abstract : Administrative

Abstract Summary :

Introduction/Objective

The British Columbia Provincial Blood Coordinating Office (PBCO) plays a key role in provincial blood component and blood product utilization management. In collaboration with provincial stakeholders, PBCO facilitates the advancement of transfusion medicine practices through unique initiatives that support the effective and appropriate use of blood components and blood products across the province.

Since 2000 PBCO has focused its efforts on strategies to manage appropriate utilization of Intravenous Immune Globulin (IVIg).

In 2012 a Neuromuscular Taskforce was convened to identify strategies to optimize use of IVIg for neuromuscular patients. The Taskforce developed standardized diagnostic and treatment algorithms for neuromuscular disorders and established the Neuromuscular Review Panel to optimize the use of Ig. While neuromuscular conditions account for the majority of Ig use in neurology, there is a small, but growing, use of Ig for central nervous system (CNS) conditions.

To address this a new working group was established in 2020, with the goal of creating a succinct, yet comprehensive neurology program.

Design and Methods

The Neuromuscular Review Panel, together with Transfusion Medicine support, sought the expertise of experts on autoimmune conditions of the central nervous system. A working group was established to develop treatment recommendations for IVIg use for CNS conditions. These recommendations are intended to support clinicians in diagnosing and managing these difficult conditions.

Results

A comprehensive set of neurologic screening resources have been created, whereby each condition was classified into one of the following indication categories:

- Approved – conditions approved by Health Canada
- Conditionally Approved – conditions whereby treatment is proven to be effective
- Only in Exceptional Circumstances – conditions to which IVIg treatment is not typically beneficial, however a trial treatment will deem appropriateness
- Not Indicated – conditions to which there is no clinical evidence for the use of IVIg

To align with this, specific outcome measures are monitored every 6 months, along with a reassessment by a neurologist to continue on IVIg treatment.

Conclusions

While this program has not yet been implemented, all stakeholders are eagerly anticipating the program launch to create a harmonized and comprehensive neurology program.

Acknowledgements

- Dr. Katie Beadon, Dr. Kristine Chapman and Dr. Nadim Jiwa and the CNS Working Group
- Provincial stakeholders including technologists, utilization management coordinators, and physicians

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Abstract ID :

"Building a more inclusive blood system in Canada": A mixed-methods evaluation of a workshop to guide medical students to develop as health advocates through advancing health equity in blood product donation for gay, bisexual, and other men who have sex with men (gbMSM)

Type of abstract : Administrative

Abstract Summary :

Introduction: Health advocacy is an essential skill for medical students but is challenging to teach.

Methods: We developed a workshop, "Building a more inclusive blood system in Canada", to support students to develop as health advocates through advancing health equity in blood product donation for gay, bisexual, and other men who have sex with men (gbMSM). The workshop included an online module (available at stemcellclub.ca/training.html) on blood and stem cell donation in Canada for gbMSM, outlining the historical policies and the context in which they were put in place, to today's policies and where future policies may lie. The module also presented content from a national campaign to engage gbMSM as stem cell donors (stemcellclub.ca/savingliveswithpride). A facilitated virtual discussion group supported participants to reflect on gbMSM donation policies and their consequences, and discuss how to concurrently advocate for gbMSM and blood product recipients. Quantitative and qualitative analyses were employed to evaluate participants' perspectives on the impact of the workshop on their development as health advocates.

Results: From 10/2020-7/2021, workshops were hosted for 104 medical students from 8 medical schools. 65 students completed post- workshop surveys (63% response rate; 40% male, 34% LGBTQ+ [10 gay, 9 bisexual, 3 other], 52% non-White; 93% pre-clerkship). Most felt the workshop prepared them to discuss gbMSM donation (88%) and supported their development as health advocates (98%) including the ability to: advocate for patients beyond the clinical environment (83%); work with patients (88%) or communities/populations (74%) to address determinants of health that affect access to care; advocate for system-level change (83%); apply continuous quality improvement to health promotion activities (79%); and contribute to improving the health of a community/population they will serve (90%). Qualitative analysis of focus groups in a subset of these students (n=39; 42% male, 37% LGBTQ+, 76% non-White) identified rich examples demonstrating their development as health advocates, including through recognizing bias/discrimination in health policy, the need for inclusivity, and barriers to policy change, and applying health advocacy learnings to future practice.

Conclusion: A national cohort of medical students felt that participating in a workshop on advancing health equity in blood product donation for gbMSM contributed to their development as health advocates. This workshop can be adopted by medical educators seeking to build health advocacy teaching into medical curricula.

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

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Abstract ID :

Satisfaction survey of Quebec hospitals blood banks: implementation of routine CcEe and K automated phenotypes at Hema-Quebec

Type of abstract : Administrative

Abstract Summary :

Introduction: In December 2020, Hema-Quebec introduced the automated routine analysis of the Kell (K) phenotype on all unknown donors to increase its inventory of negative K red blood cell (RBC) units, in order to facilitate the implementation of clause 10.7.4 of the CSA-Z902:20 standards in hospitals. This clause states that females 45 years and under with child bearing potential should be transfused with K negative RBC units unless known with a K positive. Additionally, since the demand from hospitals for CcEe phenotyped units had increased significantly in recent years, these phenotypes were tested along with the K assay, unless the donor's K phenotype had been previously tested.

Objective: The primary objective of this study was to measure hospital satisfaction with automated routine CcEe and K phenotypes and to assess its impact on hospital blood bank procedures.

Design and methods: In March 2022, a 37-question Google Forms Survey was sent to 94 Quebec hospitals to gather feedback post implementation. The survey assessed 4 dimensions: demographic information, patient population, satisfaction level and operational impacts.

Results: To date, complete responses were received from 56 hospitals (60%). The vast majority of hospitals were either satisfied or very satisfied with K (98%) and CcEe (95%) phenotype additions. Few questions were raised by either the blood bank personnel or nursing staff regarding the addition of CcEe and K phenotypes on the RBC unit label. As of March 2022, 46 out of 56 hospitals (82%) had implemented a K- policy for females with child bearing potential and of these, 8 had it in place before the CSA-Z902:20 standard was published in March 2020. In addition, 17 hospitals (30%) reported changing their policy for re-typing units after December 2020. For example, when prophylactic antigen matching for CcEe or K was required, some hospitals stopped re-typing units that had been already phenotyped by the blood center. Finally, 40 hospitals (71%) observed a reduction in the number of phenotype assays performed manually in their transfusion medicine laboratory (from 10% to 95% reduction).

Conclusions: Survey respondents reported a high level of satisfaction with the implementation of routine CcEe and K phenotype automated assays by Hema-Quebec. The increased availability of phenotyped units was an impetus to modify local procedures and practices.

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Abstract ID :

Evaluating the current state of Canadian undergraduate medical school training in transfusion medicine

Type of abstract : Administrative

Abstract Summary :

INTRODUCTION/OBJECTIVE

Considering that around 10% of hospitalized patients get transfused, postgraduate trainees across disciplines are commonly involved in transfusion medicine (TM) practice. However, multiple studies of this group have shown important knowledge deficiencies in this area.

The gap in TM education for postgraduate residents is addressed in part by Transfusion Camp, a centralized postgraduate TM education curriculum now available at 15 of 17 Canadian medical schools. However, not all residents attend Transfusion Camp; thus, it is important to identify and address deficits in TM training during medical school. The aim of this study is to investigate the current status of TM education in undergraduate medical schools in Canada.

DESIGN AND METHODS

TM leads at all 17 medical schools were contacted by email and asked to complete a web-based survey using SurveyMonkey. Only completed answers were included for analysis. Survey participants were asked to describe the TM curriculum at each medical school between 2016-2020 including the number of hours dedicated to TM teaching, the format of teaching, and the topics that were covered. A total of 19 topics in TM were selected based on what is covered in Transfusion Camp.

RESULTS

The majority of medical schools (16/17) agreed to participate and completed the survey, of which 93% (15/16) responded that their medical school curriculum has formal/intended TM teaching, with (6/16) stating it was integrated into other specialty teaching. The average number of hours (h) devoted to TM teaching during first, second, third, and fourth year were 2.8h (0-10h), 1.3h (0-4h), 1h (0-3h), and 0.7h (0-3h), respectively, with 25% (4/16) devoted 4h to TM teaching throughout the 4 years (1-14h). Teaching was mainly in the format of lectures or seminars; additionally, 5 centers used e-modules and 3 centers used simulations. Eleven of 19 topics were covered in over 50% of the centers. The most and least commonly covered topics were: "Appropriately prescribe components" and "Know when to screen patients for platelet alloimmunization", respectively.

CONCLUSION

Although most Transfusion Camp topics are covered in Canadian medical school curricula, there is variability in the quantity and content across the sites. Further investigation is underway to evaluate the impact of this variation on knowledge retained by residents as they enter postgraduate training.

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Abstract ID :

Expanded eligibility criteria for source plasma donation by gay, bisexual, and other men who have sex with men: A research-informed approach to interactive staff preparedness training

Type of abstract : Administrative

Abstract Summary :

Introduction - Canadian Blood Services is committed to making donation as inclusive as possible while maintaining blood safety. As part of this commitment, in September 2021, alternative eligibility criteria were put in place that mean that some sexually active gay, bisexual, and other men who have sex with men (gbMSM) can donate source plasma at two donation centres in London and Calgary. This abstract describes the development of research-informed interactive staff preparedness training that supported the implementation of these criteria.

Methods – Canadian Blood Services, with funding from Health Canada and in partnership with Héma-Québec, has been supporting research to inform more inclusive eligibility criteria for blood and plasma donation. Research findings from relevant projects were synthesized to help guide development of training to support the implementation of source plasma collection for sexually active gbMSM. Instructors at Canadian Blood Services worked closely with external researchers who contributed critical findings both from Canadian Blood Services Staff perspectives and from the perspectives of gbMSM. Both agreed that interactive staff preparedness training was essential for successful implementation of this new program. A summary of questions and concerns from staff and potential donors was developed to inform the training. These research-informed recommendations guided the development of training content and delivery.

Results - Training was delivered to over 200 staff in London, Calgary, and at our National Contact Center. Based on the research-informed recommendations, training competencies included diversity, equity, and inclusion training, providing clear evidence-based rationales about the new criteria, training about navigating difficult discussions, and sex-positive sexual health training. Training materials developed included a 90-minute didactic session that highlighted evidence to support the change, gender and sexual orientation basics, sex-positive principles to address donor questions, and principles about maintaining psychological safety for donors. 2.5 additional hours were spent in small groups role-playing practice scenarios applying the new criteria and answering questions from donors while applying principles learned in the didactic session. Staff were engaged in the sessions and positively described the benefit of this training in preparing them for this change.

Conclusions – A dedicated research funding program, collaboration between internal and external experts, researchers, and community members helped to apply a "knowledge to action" approach in developing this training. This training, identified as an essential component of program rollout, had a positive impact. Future efforts for more inclusive donation policies should involve interactive staff preparedness training.

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Abstract ID :

Assessment of hemoglobin-oxygen affinity of RBCs of different senescence levels during hypothermic storage in old senior and teenage donors

Type of abstract : Clinical

Abstract Summary :

Introduction/ Objective: Hemoglobin-oxygen(Hb-O_2)affinity of RBCs changes as they age and undergo morphological and metabolic changes. Moreover, donor factors – like age – influence the transfusion efficiency of RBC-products. Therefore, this study aims to characterize changes in Hb-O_2 affinity of RBC-products from donors of different ages, as well as investigate differences between subpopulations of RBCs within each product over the course of standard 42-day storage.

Design and Methods: Units from healthy teenagers(<20 years old; n=30) and seniors(>74 years old; n=30) were Percoll-density separated into portions of less dense/recently matured/young RBCs(Y-RBCs) and dense/senescent/old RBCs(O-RBCs). The Hb-O2 affinity of Y-RBCs, O-RBCs, and unseparated (U-RBCs)samples were assessed on days 5(baseline),14,21,28 and 42 post-collection. A Hemox analyzer observed the dissociation rate of an oxygen-saturated sample to determine the pressure of oxygen at which 50% of the hemoglobin is bound to oxygen(p50).

Results: Comparison of Hb-O_2 affinity between the U-RBCs and each subpopulation(Y-RBCs, O-RBCs)for all RCCs, regardless of age, did not show any significant differences throughout the storage period. However, significant differences were observed when comparing Hb-O_2 affinity between senior (21.02±3.01 mmHg)and teenage(19.36±2.78 mmHg) donors for U-RBCs prior to day 14 of storage (p=0.0323), at which point p50 values for all donors were decreased and differences no longer significant. Unexpectedly, a significant decrease of Hb-O_2 affinity was observed for teenage donors for U-RBCs (p=0.0005)and both RBC subpopulations at day 42 of the hypothermic storage(Y-RBCs:p=0.0025; O-RBCs:p=0.0037)in comparison to the senior donors, which requires further investigation.

Conclusions: RBCs of senior donors have lower Hb-O_2 affinity suggesting more efficient oxygen release post-donation at the baseline timepoint, compared to RBCs of teenage donors. RBCs of different senescence levels isolated on the same day from the same RCC unit, have comparable Hb-O_2 affinities throughout storage.

Acknowledgements: We are grateful to Canadian Blood Services' blood donors who made this research possible. This work received funding support from Canadian Blood Services, funded by the federal government(Health Canada)and the provincial and territorial ministries of health. The views herein do not necessarily reflect the views of the federal, provincial, or territorial governments of Canada. This work is supported by a Canadian Blood Services Intramural Grant(2018IG-JA).

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Abstract ID :

Donors with medical conditions: Canadian vs US policies. The BEST Collaborative study

Type of abstract : Clinical

Abstract Summary :

Introduction: Donor eligibility for medical conditions vary between blood centres, suggesting that they are based on regulatory requirements and experience, rather than data. These criteria are designed to protect the donor's health and/or to prevent theoretical risk of transmission by transfusion. We participated in a 2019 Biomedical Excellence for Safer Transfusion (BEST) Collaborative survey of BEST members regarding donor eligibility policies. Since European regulations (2004 European Directive) are highly restrictive, we focus on results of US respondents vs our current policies to identify areas where criteria could be reassessed.

Methods: A REDCap survey containing questions about 20 medical conditions of greatest interest to the BEST Donor Studies Team was send to BEST blood centre participants.

Results: Responses were received from six stand alone US blood centres, most collecting over 400,000 units annually, and three small hospital-based US centres (81% overall response rate). Policies at CBS and Héma-Québec were similar to the US for coronary artery disease, coagulopathies, epilepsy, allergies, benign tumors and (except Héma-Québec) diabetes. For most cancers (colon, breast, prostate, including *in situ* breast and *in situ* prostate cancer), Canadian centres defer donors for 5 years after curative treatment, while US centres accept donors immediately after curative treatment for *in situ* breast and prostate cancer and defer for 1-2 years for most cancers. Canadian centres have a permanent deferral for melanoma, while US centres accept donors 1-2 years after curative treatment. For autoimmune disorders such as multiple sclerosis, SLE, and Crohn's disease, Canadian centres defer all donors, while US centres accept donors depending on a variety of factors, including recent symptoms, immunosuppressant use, and how the donor is feeling on the day of donation.

Conclusions: Over the last 5 years, Canadian blood centres have liberalized criteria for medical conditions such as diabetes, coronary artery disease, and epilepsy, which are now very similar to the US. However, criteria for cancer and autoimmune disorders are considerably more restrictive. Database linkage studies have convincingly shown a lack of transfusion transmission of cancers. Autoimmune diseases have a huge range of severity, and with the advent of novel therapies, many patients have well controlled symptoms and large periods of remission. Canadian policies in these two areas are likely unnecessarily restrictive and should be reassessed.

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Abstract ID :

Asking donors about their ethnicity/racial group: why and how?

Type of abstract : Clinical

Abstract Summary :

Introduction: Rare red cell units, found in less than 1 in 1,000 donors, include unusual phenotype combinations, or less commonly, the absence of a high prevalence antigen. Since blood groups are inherited, the probability of finding a matched unit for a patient requiring a particular antigen combination is considerably greater in donors of the same ethnic/racial group. Identifying these donors permits the donor testing laboratory to perform targeted phenotyping and/or genotyping on donor blood samples.

Design and methods: When an electronic donor questionnaire was introduced at Canadian Blood Services in 2016, an optional question about ethnicity/race asked only once on first donation, was included. Because of technical limitations, a short list of choices, based on the Statistics Canada census was used and initially the question was only asked on permanent collection sites. Increased IT functionality (Connected clinic) permitted roll-out to mobile blood drives, completed in Sept, 2020. Laboratory staff evaluate donor ethnic group reports from each clinic and select samples for phenotype and/or genotype testing according to a pre established plan. We assessed donor participation rates and the number of rare donors identified by this additional testing.

Results: 96% of donors agree to answer the voluntary question. In 2021, 72.4% identified as White, 7.8% South Asian, 7.6% Asian, 2.2% Latin-American, 1.7% Indigenous, 1.7% Arabic, 1.0% Black, and 5.2% "Other". Non-white ethnicity was more common in first-time donors, 29.5% compared with repeat donors, 17.4%. Seventeen donors with rare phenotypes or phenotype combinations were identified. The rare phenotypes included Di(b-), D --, Jk(a-b-), U-, and rare combinations of antigens. Difficulties noted included insufficient precision in the categorization of certain groups, such as Asians, and lack of harmonization with ethnicity/racial categorization used in the stem cell registries.

Conclusions: The vast majority of donors were comfortable providing information about their race/ethnicity. Ethnicity data is important to monitor recruitment and retention of a diverse and inclusive donor base and to understand differences in deferrals rates in different groups. Additional testing resulted in the identification of 17 rare donors. Plans include modifying the ethnicity/race question to provide more information and align with stem cells, analyzing donor deferral rates in different groups, and following the proportion of donations from various groups over time.

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Abstract ID :

Unravelling an unusual case of anti-Vel in a perinatal patient with genotype-phenotype discrepancy

Type of abstract : Clinical

Abstract Summary :

Background:

Anti-Vel is recognized as a "dangerous" antibody to a high frequency antigen capable of causing severe hemolytic transfusion reactions and hemolytic disease of the fetus/newborn (HDFN). The genetic basis of the Vel-negative phenotype is linked to a 17bp deletion in the *SMIM1* gene. A perinatal patient with unusual anti-Vel activity in a monocyte monolayer assay (MMA) with genotyping unable to explain the Vel-negative phenotype was encountered.

Methods:

Maternal plasma and serum were tested serologically and using MMA (autologous and allogeneic monocytes) against Vel- and Vel+ RBCs including a panel of genomically and flow cytometrically characterized Vel+ RBC. SIAT antibody titration (+/-DTT treated plasma) and IgG subclass analysis were performed. Vel antigen typing was performed using a variety of polyclonal antisera. Testing on the neonatal cord RBCs included: DAT, eluate, Vel antigen typing and MMA (cord RBCs opsonized with maternal plasma using maternal monocytes). *SMIM1* gene sequencing was performed on maternal and cord samples by the Nordic Reference lab (Lund, Sweden) along with Western blot analysis of red cell proteins using rabbit anti-SMIM1.

Results:

Anti-Vel specificity was confirmed by lack of reactivity with Vel- red cells (serologically and molecularly confirmed Vel status). SIAT antibody titre was 16 with IgG3 predominance (stable through pregnancy). In MMA studies, random group O donor RBCs opsonized with serum induced remarkable monocyte rosetting while plasma opsonization induced phagocytosis that mirrored the level of Vel antigen expression on a panel of 5 flow-cytometrically/genomically characterized Vel+ subsets. Polyclonal antisera consistently confirmed patient RBCs were Vel-, but unexpectedly, gene sequencing revealed heterozygosity for the 17bp *SMIM1* deletion with an intact *SMIM1* gene on one allele. Western blotting confirmed absence of SMIM1 protein in maternal red blood cells. Neonatal cord red cells showed negative DAT/eluate and were compatible with maternal plasma both serologically and by MMA. Baby's RBCs were serologically Vel- despite homozygosity for wild type *SMIM1* and detectable SMIM1 by Western blotting. Control cord RBCs were uniformly weakly Vel+. There was no clinical evidence of HDFN.

Conclusion: The unusual serologic features of this anti-Vel (as highlighted by MMA studies) and absence of maternal RBC Vel antigen/SMIM1 protein despite an apparently intact *SMIM1* gene require further study. These findings suggest an alternate novel molecular mechanism for Vel negative antigen status.

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Abstract ID :

The Self-reported Impact of Transfusion Camp on Postgraduate Trainee Transfusion Behaviour: A Retrospective Study

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective: The optimal method of postgraduate transfusion medicine (TM) education remains understudied. One novel approach is Transfusion Camp, a longitudinal 5-day program that delivers TM education to Canadian and international trainees. The purpose of this study was to determine the self-reported impact of Transfusion Camp on trainee clinical practice.

Design and Methods: A retrospective analysis of anonymous survey evaluations from Transfusion Camp trainees over three academic years (2018-2021) was conducted. Trainees were asked, "Have you applied any of your learning from transfusion camp into your clinical practice?". Trainees answering "yes" were asked to provide free-text examples. Through an iterative process, responses were categorized according to program learning objectives. The primary outcome was to describe the self-reported impact of Transfusion camp on clinical practice, including the most frequently applied topics. Secondary outcomes were to determine the association between specialty and postgraduate year (PGY), with impact. Descriptive statistics were used. A multivariable analysis was performed using generalized linear regression with binomial distribution and logit link function.

Results: Of 757 survey responses, 68% of trainees indicated that Transfusion Camp had an impact on their practice; this increased progressively each day (OR 1.58; 95% CI 1.37-1.84) with 83% of trainees reporting impact on day 5. No difference was seen over the years despite a transition to virtual teaching due to COVID-19 (p=0.63). The most frequent areas of impact included transfusion indications (45%) and transfusion risk management (27%), while blood bank testing was the least reported (1%). Hematology-based specialties reported the most frequent impact compared with lab-based specialties (81% vs. 39%; p< 0.0001). Trainees reporting impact increased as PGY increased (OR=1.44; p=0.0009), with 75% of PGY-4+ trainees reporting impact. In multivariable analysis, the impact of specialty and PGY varied depending on the topic.

Conclusions: The majority of trainees report applying learnings from Transfusion Camp to their clinical practice with variations in the translation of knowledge to practice based on PGY and specialty. Virtual curriculum delivery did not negatively affect these outcomes. These findings will enable the Transfusion Camp curriculum to identify high-yield areas and gaps in knowledge transfer and further support Transfusion Camp as an effective means of targeting the TM education gap and improving patient outcomes.

Acknowledgments: Thanks to Liying Zhang for statistical support and the Canadian Blood Services Program Support Award (University of Toronto QUEST Research Program).

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Abstract ID :

A 12-month audit of AB plasma use at a level 1 trauma centre

Type of abstract : Clinical

Abstract Summary :

Introduction/Objective: Despite overall declining plasma transfusion rates, the relative use of AB plasma has increased from 13.3% to 17.0% over the last decade. Since group AB donors represent only 4% of the donor population, this trend is unsustainable. Our hospital is a Level 1 trauma centre serving the greater Toronto area and maintains thawed AB plasma on-hand for urgent and emergent bleeding scenarios. We performed a 12-month audit at our centre to characterize the use of AB plasma.

Design and Methods: Using the electronic blood banking system we determined the disposition of all AB plasma units at St. Michael's Hospital (Toronto, Ontario) between November 1, 2020 and October 31, 2021. AB plasma use was categorized as "appropriate" or "inappropriate" using patient blood group, the availability of ABO typing at the time of plasma release, and the clinical context surrounding transfusion. We defined appropriate use of AB plasma as either transfusion to a group AB recipient, or transfusion to a group A, B or O recipient for an urgent/emergent indication with either a) no available blood group, b) <30 minutes from blood group result or c) a discrepant blood group result.

Results: 642 units of AB plasma were thawed at our institution during the 12-month audit period. 69 (11%) units were discarded due to outdating. Of the 573 transfused units, 101 (18%) were transfused to AB patients, and 204 (36%) were transfused to A, B or O recipients for urgent/emergent indications meeting our acceptable criteria. 4 (0.7%) units were transfused non-urgently/emergently to a recipient with discrepant blood group post-allogeneic bone marrow transplant. In total, 309 (54%) transfused units were categorized as appropriate use of AB plasma. The remaining 264 (46%) transfused units represented inappropriate use of AB plasma by our definition.

Conclusions: AB plasma is a valuable and limited resource that must be conserved through best transfusion practices. At our institution, over half (52%) of all AB plasma units were either discarded or transfused to patients who could have safely received non-AB plasma. This highlights the importance of assessing alternative plasma transfusion strategies including low-titer group A plasma, group O whole blood, elimination of on-hand liquid AB plasma units or plasma alternatives such as PCC.

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Abstract ID :

SARS-CoV-2 seroprevalence in the vaccine era: The Canadian Blood Services Serosurvey January to November 2021

Type of abstract : Scientific

Abstract Summary :

OBJECTIVES: Seroprevalence studies bridge the gap left from case detection and vaccination records. Using residual blood from healthy blood donors SARS-CoV-2 seroprevalence was evaluated Canada-wide over vaccine deployment.

METHODS: Between January and November 2021 serial cross-sectional samples from blood donors at all Canadian Blood Services locations were included. The Roche Elecsys anti-SARS-CoV-2 antibody assays detect total antibodies to spike (S) and nucleocapsid (N) proteins. Anti-S was analyzed neat and 1:10 dilution from January until August; from September onward, the dilution changed to 1:400. Seroprevalence was standardized to population-level demographics and assay characteristics adjusted using the Rogan-Gladen equation.

RESULTS: Of 149,522 samples, the percentage anti-S positive increased from 2.78% (95%CI 2.6,3.0) to 97.0% (95%CI 96.6,97.4) and anti-N from 2.24% (95%CI 2.2,2.4) to 5.1% (95%CI 4.6,5.5). The percentage anti-N positive peaked highest in Alberta (9.3%; 95% CI 7.7,10.8) and the Prairies (8.6%; 95% CI 6.6,10.6); lowest in Atlantic region (1.0%; 95% CI 0.2,1.8); was higher in 17-24-year old's (8.1%; 95% CI 7.2,9.0) and racialized donors (8.9%; 95% CI 7.5,10.4). The percentage anti-S positive increased in donors over 60 first; all peaked by July. Beginning in September, the median anti-S concentration (IQ range) was: September 3652 U/mL (2041,6245), October 2807 U/mL (1616,4855), November 2460 U/mL (1253,4388). In a linear regression model of September to November data, with anti-S concentrations as the dependent variable, there was a negative slope with older age group and later month ($P < 0.001$).

CONCLUSIONS: SARS-CoV-2 seroprevalence due to natural infection was below or around 5% from January to November 2021, but cumulative seroprevalence was likely higher as waning antibody was not considered. Anti-S seroprevalence was largely due to vaccination. The early increase in older donors that is gradually met by younger age groups is consistent with vaccine roll-out policies prioritized by age. Lower and decreasing anti-S concentrations in older individuals are likely related to waning antibody with longer time since their second vaccine dose, although a muted response with older age has not been ruled out. Ongoing monitoring of seroprevalence continues to be important for public health policies including potential third dose of vaccine.

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Abstract ID :

Adverse inflammatory effects of anti-erythrocyte antibody therapy in murine ITP is driven by platelet-activating factor (PAF)

Type of abstract : Scientific

Abstract Summary :

Introduction

Anti-D is a donor-derived anti-erythrocyte polyclonal antibody used to treat immune thrombocytopenia (ITP). Though effective, it has adverse inflammatory properties which limit its use. TER119 is a monoclonal anti-erythrocyte antibody with anti-D-like activity that is therapeutic in murine ITP, although it likewise possesses a highly inflammatory profile. Therefore, deducing the mechanism of these adverse effects and identifying replacement therapies is highly desirable. We hypothesize that inflammation caused by TER119 (and perhaps anti-D) is due to the production of platelet-activating factor (PAF), and TER119-induced inflammation could be mitigated with a PAF-receptor antagonist.

Methods

Murine ITP was induced by injection of an anti-platelet antibody (MwReg30). Body temperature was measured in 15-minute intervals post-treatment with TER119 as an inflammatory metric. To determine the therapeutic activity of TER119, platelets were enumerated 24 hours post-treatment. Serum PAF concentration was assessed post-TER119 treatment by ELISA and *in vivo* PAF neutralization was achieved by injecting mice with a prophylaxis of ABT-491, a PAF-receptor antagonist, 15 minutes prior to receiving TER119.

Results

Our data show that TER119 significantly increased platelet counts in murine ITP. However, we observed upregulation in serum PAF concentrations 5 minutes post-TER119 treatment and an inflammatory decrease in body temperature by 15 minutes post-treatment. Interestingly, this temperature drop was ameliorated by a PAF-receptor antagonist prophylaxis, without interreference to the therapeutic efficacy of TER119 nor to the ability of TER119-opsonized erythrocytes to undergo phagocytosis. Our work supports molecular insight into TER119-induced inflammation and provides a strategy to potentially mitigate it.

Conclusions

Adverse inflammatory effects of ITP therapies highlight the importance of identifying replacement products. With TER119, an anti-erythrocyte antibody with anti-D-like activity, we show that inflammatory changes in body temperature is suggested to be driven by PAF, which can be mitigated with a PAF-receptor antagonist. By advancing our understanding of anti-erythrocyte antibodies, we aim to identify safer and more accessible treatments for ITP patients.

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Abstract ID :

Staphylococcal exotoxins exhibit biomarker potential for detection of Staphylococcus aureus in contaminated platelet components

Type of abstract : Scientific

Abstract Summary :

Introduction / Objective: Platelet components (PCs) are transfused to treat thrombocytopenic patients. PC storage conditions in gas-permeable bags at 20-24^{O}C, under agitation, are important to maintain platelet function. However, these conditions can promote proliferation of contaminant bacteria. *Staphylococcus aureus* is the major cause of false-negative transfusion sepsis involving PCs. *S. aureus* produces exotoxins including staphylococcal superantigen-like proteins (SSLs); host immunity inhibitors, and staphylococcal enterotoxins (SEs) that cause septic shock symptoms in PC recipients. Here, we investigated exotoxins as plausible biomarkers to detect PC contamination with *S. aureus*.

Design and Methods: We performed high-throughput genome and transcriptome sequencing of four *S. aureus* strains isolated from contaminated PCs in Canada and England. Encoded exotoxin genes were confirmed by PCR. Comparative RNAseq analyses were performed on the strains grown to stationary phase in Trypticase Soya Broth (TSB) and PCs, and results were validated with RT-qPCR. Western blotting was employed to verify production of SE-types G (SEG) and H (SEH) proteins in both TSB and PC cultures.

Results: The genomes of tested *S. aureus* strains encode multiple exotoxin genes. Comparative RNAseq results, validated by RT-qPCR, revealed differential expression of exotoxins with both SSL and SE genes significantly upregulated (>1 to 6.7 folds) in PCs compared to TSB. Production of SE-types G (SEG) and H (SEH) proteins in TSB and PC cultures were confirmed by Western blotting.

Conclusions: The presence of *S. aureus* exotoxins in contaminated PCs highlights safety risk to PC recipients. SSL proteins can interfere host immune defences promoting *S. aureus* evasion. We previously demonstrated that SEs contribute to septic shock symptoms in transfusion patients. Remarkably, *S. aureus* exotoxins exhibit biomarker characteristics: 1) SEs and SSL RNA transcripts were upregulated in PC; 2) exotoxins such as SEG and SEU were detected in PCs involved in septic transfusions; and 3) concentrations as low as 0.1pg/mL of SEs can induce septic shock in patients. We therefore propose using exotoxins as biomarkers of *S. aureus* contamination in PCs.

Acknowledgements: The authors thank volunteer blood donors and staff at netCAD Blood4Research Fascility in Vancouver (British Columbia) for PC production. Canadian Blood Services and Health Canada provided funds. SR-A holds an intramural grant from Medical Affairs and Innovation (MAI), and SCI is a recipient of post-doctoral fellowship from MAI, Canadian Blood Services.

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Abstract ID :

ANTIBODIES ABLE TO INDUCE ANTIBODY MEDIATED-IMMUNE SUPPRESSION PROMOTE IN VITRO ANTIGEN-LOSS BY MACROPHAGES

Type of abstract : Scientific

Abstract Summary :

Abstract

Introduction/Objective

Hemolytic disease of the fetus and newborn (HDFN) is an alloimmune condition provoked by IgG molecules produced by the mother that crosses the placenta and cause fetal red blood cells (RBC) destruction. Polyclonal anti-RhD antibodies (anti-D) is the only therapy available to prevent HDFN through a phenomenon called antibody-mediated immune suppression (AMIS). Unfortunately, anti-D is a human blood product vulnerable to shortages, and the mechanism of AMIS is unknown. Our laboratory has explored the mechanism of AMIS and we identified that AMIS is better linked with the ability of antibodies (Abs) to mediate antigen (Ag) loss than RBC clearance. However, there is no available mouse model to study AMIS ability of RhD-specific Abs. Then, *in vitro* Ag-loss evaluation can be an advantage to find a monoclonal antibody to replace anti-D. The aim of the present work was to determine the ability of AMIS-inducing antibodies to promote *in vitro* Ag-loss.

Design and Methods

Erythrocytes from transgenic HOD mice, which express an antigen composed of hen egg lysozyme (HEL), ovalbumin (OVA), and the human Duffy protein [HOD], were stained with the membrane fluorescent dye PKH67 and opsonized with HOD-specific AMIS-inducing Abs. Fluorescent HOD-RBCs opsonized vs non-opsonized were then incubated with or without macrophages for 30 min and 3 hours. HOD-RBCs were recovered, macrophages were washed, and remaining RBCs were lysed by hypotonic lysis. HOD-Ag detection on the recovered erythrocyte surface was performed incubating with anti-HOD antibody plus APC labeled anti-IgG antibody. The percentage of PKH67+ macrophages, as well as their PKH67 MFI, were evaluated. Both samples RBC and macrophages were analyzed by flow cytometry.

Results

We observed that HOD antigen loss occurred in both a macrophage- and antibody-dependent manner and reached maximal levels within 3h. HOD-RBC membrane was transferred to macrophages (as measured by PKH67 fluorescence) and was substantially increased by anti-HOD antibody opsonization. Critically, AMIS-inducing antibodies did not lead to detectable macrophage phagocytosis of HOD-RBCs.

Conclusions

This work demonstrates that AMIS-inducing antibodies mediate RBC antigen loss by macrophages *in vitro*. Ag-loss occurs by a trogocytosis-type mechanism where RBC membrane and antigen are transferred to the macrophage without phagocytosis.

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Abstract ID :

The Impact of Cardiopulmonary Bypass Pump Time on Blood Component Transfusion in Adult Cardiac Surgery Patients Receiving Fibrinogen Concentrate vs. Cryoprecipitate: A post-hoc analysis of the FIBRES randomized controlled trial

Type of abstract : Scientific

Abstract Summary :

Introduction/Objective: Coagulopathy is a common complication of cardiac surgery with cardiopulmonary bypass (CPB) and can lead to excessive bleeding. Hemostasis can be restored through fibrinogen replacement with purified fibrinogen concentrate (FC) or non-purified cryoprecipitate, the latter of which contains additional coagulation factors that may confer a hemostatic advantage after prolonged CPB. Our aim was to examine the interaction of CPB duration with FC and cryoprecipitate product efficacy.

Design/Methods: This *post-hoc* analysis reports data from FIBRES, a large, prospective, multi-center, randomized, controlled, non-inferiority Phase 3 trial (NCT03037424) comparing the efficacy of FC (4 g) *vs.* cryoprecipitate (10 units) in bleeding adult cardiac surgery patients with acquired hypofibrinogenemia requiring CPB. Patients were stratified by CPB duration (≤120, 121–180, >180 minutes). The primary outcome was the total number of allogeneic blood products (ABPs) transfused within 24 hours of CPB. Secondary outcomes included the total number of units of ABPs given within 7 days of CPB.

Results: A total of 735 patients (FC, n=372; cryoprecipitate, n=363) were stratified by CPB duration: ≤120 minutes (n=280; median [IQR] 89 [70–106]), 121–180 minutes (n=220; 146 [133–164]), and >180 minutes (n=235; 237 [209–275]).

Longer CPB duration was associated with differences in perioperative bleeding i.e., increased cumulative blood loss and cell salvaged blood collected. Patients with a longer CPB duration had significantly higher transfusion requirements.

There was no significant clinical interaction between CPB duration and the efficacy of FC or cryoprecipitate for the primary outcome; the total number of ABPs transfused within the first 24 hours post-CPB (P=0.77). Individual component transfusions within 24 hours of CPB also showed no interaction between CPB duration and treatment (red blood cells, P=0.59; platelets, P=0.63; plasma, P=0.94). Similar results were seen for the total number of ABPs transfused within 7 days of surgery (P=0.98).

Conclusion: FC and cryoprecipitate demonstrated similar efficacy irrespective of CPB duration, with prolonged CPB pump time associated with higher transfusion requirements for both groups. This *post-hoc* analysis provides further evidence of the non-inferiority of FC *vs*. cryoprecipitate for fibrinogen replacement in bleeding adult cardiac surgery patients.

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Abstract ID :

Transfusion of female blood is associated with RBC entrapment in organs in a rat transfusion model

Type of abstract : Scientific

Abstract Summary :

Introduction

Transfusion of female red blood cells (RBCs) to male recipients has been associated with adverse outcomes. Mechanisms may include the amount of young RBCs circulating in donors. Using a rat biotinylated transfusion model, this study aimed to assess the impact of donor sex and the amount of young RBCs on post-transfusion recovery (PTR) and organ entrapment of donor RBCs.

Methods

Some donors groups underwent bloodletting to stimulate production of new young RBCs, as assessed by expression of the transferrin receptor (CD71). Male rats received biotinylated RBCs from 4 donor groups: male, female, male following bloodletting, and female following bloodletting. Controls received saline. PTR at 24 hours and the presence of transfused cells in organs was assessed by quantifying the amount of biotinylated cells. Markers of endothelial activation and hemolysis were evaluated in recipient blood.

Results

Bloodletting resulted in increased circulating CD71-positive red cells in both male and female donors. Receipt of blood from females was associated with entrapment of donor RBCs in the lung, liver, and spleen compared to receiving blood from male donors. Entrapment was not dependent on the quantity of of CD71 cells in the donor. PTR did not differ significantly between groups, but blood from females following bloodletting did not reach a PTR of 75%. Concentrations of soluble ICAM-1 and markers of hemolysis were also higher in recipients of female blood compared to the control group.

Conclusion

Transfusing RBCs from females, but not from males, is associated with entrapment of transfused RBCs in recipient's organs, with a concomitant increase in ICAM-1 and hemolysis. These findings are not explained by a higher amount of circulating young red cells.

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